

**Bond University**

## **DOCTORAL THESIS**

### **Voluntary Disclosure of GHG Emission Information by Australian Companies**

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*Award date:*  
2012

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**Voluntary disclosure of GHG emission information by  
Australian Companies**

Presented By

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Submitted in total fulfilment of the requirements of the degree of

Doctor of Philosophy

June 2012

School of Business

Bond University

Australia

## **ABSTRACT**

This research determines the quality of Australian public companies' disclosure of greenhouse gas emission information in annual reports and stand-alone sustainability reports for the years 2007 and 2009. Factors that have influenced these disclosures are also examined along with changes in disclosure between 2007 and 2009. Some 1,776 companies are studied for 2007 and 1,853 for 2009. These companies represent the population of ASX-listed companies in those years.

An index is used to measure the quality of those disclosures by reference to their being soft, unverifiable statements, or hard disclosures, where supporting evidence is possible. Influential factors considered for the incidence of these disclosures come from information asymmetry, agency, political cost and proprietary cost theories. Examining the disclosures from points of time on either side of the enforcement of the NGER Act 2007 (Cth) establishes how these voluntary disclosures have progressed over this time.

Ascertaining the content, motivations and progression of voluntary disclosures of greenhouse gas emission information reveals corporate commitment to the climate change agenda. It also reveals corporate attitude to society's climate change concerns. Establishing the population of ASX-listed companies' 2007 and 2009 voluntary greenhouse gas emission disclosure practices permits a firm benchmark from which future cross-sectional and temporal comparisons may be made.

Results determine that while the quality of voluntary greenhouse gas emission disclosures improves for some companies over the duration of the study, this cannot be generalised to the population. Results also suggest that greenhouse gas emission disclosures are motivated by companies that are seeking new debt finance, are more highly leveraged, participate in less competitive product-markets, are large, are currently underperforming financially but are held in good esteem in the stock market, have older assets and hold additional listing status on securities exchanges outside of Australia. Companies in the GICS sector - materials are likely to disclose more than those in other GICS sectors.

## **DECLARATION**

This thesis is submitted to Bond University in fulfilment of the requirements of the degree of Doctor of Philosophy. This thesis represents my own original work towards this research degree and contains no material which has been previously submitted for a degree or diploma at the University or any other institution, except where the acknowledgement is made.

Janice Hollindale

June 2012

## Acknowledgements

I can never fully express my thanks and appreciation to my supervisor, Pam Kent, for her guidance in my pursuit of the degree of Doctor of Philosophy. I am indebted to her, and to my secondary supervisor, Carolyn Windsor, for their commitment to my successful completion of this thesis.

I am privileged in having wonderful academic colleagues, too numerous to mention individually, who have given me their unqualified support and encouragement. Their encouragement has kept me focussed. Their answers to my (often dumb) questions have been given unstintingly and I am deeply grateful for their help. Gulasekaran Rajaguru, otherwise known as Sekar, is a PhD student's godsend and I cannot thank him enough for obliging me with his statistical expertise. Applause also goes to James Routledge for his readiness to provide advice, and to Keith Duncan for his encouraging pep talks. My very special thanks go to my dear friend, Jacqueline Christensen for a million different reasons, but especially for her wisdom, generosity, and moral support.

Other thanks go to my fellow PhD candidate colleagues - my cheer squad, my sounding board, and my support system – thank you for putting up with me (Kim Kercher, for one, has gone above and beyond in this capacity!). Thanks are also extended to visiting academic gurus, Professor Jere Francis, Professor Ken Trotman and Professor Tom Smith, for reading early drafts and for their wise counsel. Also, thank you to my anonymous examiners for their constructive reviews of the final product.

I was fortunate to receive a grant from AFAANZ back in the early days of my candidature and I am grateful for that financial assistance. I also wish to acknowledge and thank Bond University for providing me with the opportunity, resources and assistance with which to earn this degree. I hope you consider that this investment was worthwhile. Also, thank you to the HDR administrative staff (Doreen Taylor and Janet Price, in particular) and faculty Deans of Research who have always been willing to help and to encourage. Thanks are also extended to Adrienne Ellul for her enthusiasm and professionalism in her RA inter-rater role.

A final thank you goes to the men in my life and the loves of my life, my husband Kevin, and my sons, Brett and Craig, for their sacrifices, their support in this journey of mine, and their pride in my accomplishments.

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# Chapter 1 Problem Identification

## 1.1 Introduction to the Problem

This research determines the nature of Australian public companies' disclosure of greenhouse gas emission information in annual reports and stand-alone sustainability reports for the years 2007 and 2009, and factors that have influenced such disclosures, and identifies the progress of those disclosures. Some researchers believe that climate change is among the great issues of our time (for example, Elkington, 2006) and that, globally, it is a major concern for governments, communities, businesses and individuals. Climate change is influenced by naturally-occurring physical, chemical and biological processes and the activities of human inhabitants (Bureau of Meteorology, 2008). Anthropogenic (i.e., human) activities have increased concentrations of gases such as carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), sulphur hexafluoride (SF<sub>6</sub>), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and others (i.e., greenhouse gases (GHG)) within the atmosphere, a phenomenon which has been termed the "greenhouse effect" by scientists.

International cooperation to constrain GHG emissions led to the establishment of The Kyoto Protocol, which came into force in February 2005 and has 182 signatories as of May 2008 (United Nations Framework Convention on Climate Change, 2008). Under this protocol, signatory countries are committed to achieving binding targets of greenhouse gas emission reductions by 2012 (United Nations Framework Convention on Climate Change, 1998). Australia became a party to the Kyoto Protocol in December 2007 (Department of Climate Change, 2007).

Australia's ratification of the Kyoto Protocol followed the enactment of the National Greenhouse and Energy Reporting Act 2007 (Cth) (NGER). The National Greenhouse and Energy Reporting Act 2007 (Cth) provides a single national reporting framework with multiple objectives. The objectives are the collection and dissemination of information relating to greenhouse gas emissions, energy production and energy consumption to underpin a "cap-and-trade" scheme (otherwise known as an

emissions trading scheme or ETS) intended to reduce carbon emissions. Australia's *Carbon Pricing Mechanism*, part of the Government's *Clean Energy Plan*, released on 10 July 2011 (Australian Government, 2012b) announced the legislated introduction of Australia's emissions trading scheme. Commencing on 1 July 2012, carbon prices are fixed by the government until 30 June 2015 (Australian Securities Exchange, 2012). After that date, the mechanism allows for a fully flexible cap-and-trade scheme (Australian Government, 2012a).

Possession of this data allows the Australian government to meet its international reporting obligations, formulate government policies at the State, Territory and Commonwealth levels, and inform the Australian public. An important intention of the NGER legislation is to streamline corporations' reporting obligations and to avoid the duplication of similar reporting requirements in the States and Territories ("National Greenhouse and Energy Reporting Act 2007," 2007, s3). This legislation requires corporations with *operational control over facilities* to report to the Australian Federal Government all of their Scope 1 and Scope 2<sup>1</sup> GHG emissions, reductions, removals and offsets, and all their energy consumption and production from 1 July 2008 if either a corporate threshold or a facility level threshold is reached for specified levels. At the corporate group level the threshold is 125 kilotonnes of CO<sub>2</sub>-equivalent (CO<sub>2</sub>-e), or 500 terajoules of energy production, or 500 terajoules of energy consumption. The facility level thresholds are 25 kilotonnes of CO<sub>2</sub>-e, or 100 terajoules of energy production, or 100 terajoules of energy consumption (Australian Government Department of Climate Change, 2008).

The concepts of operational control and facilities are key components of the Act. Operational control<sup>2</sup> exists if corporations (including their subsidiaries, joint ventures or partnerships) have the authority to introduce and implement operating, health and

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<sup>1</sup> Scope 1 emissions are releases of GHG as a result of an activity or series of activities that constitute the facility; Scope 2 emissions are releases of GHG that result from one or more activities that generate electricity, heating, cooling or steam that is consumed by the facility but that do not form part of the facility (National Greenhouse and Energy Reporting Regulations 2008, s.223); a third type of emissions, Scope 3, is not covered under the Act and is generated in the wider economy because of a facility's activities but are produced by another facility (Australian Government Department of Climate Change, 2008).

<sup>2</sup> National Greenhouse and Energy Reporting Act 2007, s. 11.

safety, or environmental policies for their facilities. A facility is defined under the Act<sup>3</sup> as an activity or series of activities that involve the production of greenhouse gas emissions, the production of energy or the consumption of energy that form a single undertaking or enterprise.

Operational control or the declaration of the existence of a facility may also be determined by the administrator of the NGER Scheme. This administrator was originally the Greenhouse and Energy Data Officer; however the Clean Energy Regulator, a government body, assumed that role on 1<sup>st</sup> April 2012 (Australian Government, 2012d). The administrator's functions encompass the management of the National Greenhouse and Energy Register including the registration and deregistration of reporting corporations, monitoring compliance and enforcing the legislation, arranging external auditing, and the provision of communications and resources to assist with compliance (Australian Government Department of Climate Change, 2008).

Reporting is to be made via a government web portal (OSCAR<sup>4</sup>) by 31 October, 2009. Publication of the obtained data is available from 28 February in 2010, on the Department of Climate Change website. Under the National Greenhouse and Energy Reporting Act 2007, lower annual thresholds for reporting corporate GHG levels are progressively phased in, finalising at 50 kilotonnes of CO<sub>2</sub>-e, or 200 terajoules of energy production, or 200 terajoules of energy consumption by the 2010-11 financial year<sup>5</sup>. This captures a greater number of corporations than the initial 700 medium and large companies expected to mandatorily report by 31 October 2009 (Australian Government Department of Climate Change, 2009). The threshold level for facility CO<sub>2</sub>-e emissions remains at 25 kilotonnes.

There are few mandatory corporate reporting requirements for sustainability or environmental issues in Australia at present under the Corporations Act 2001 (Cth) or applicable to the Australian Stock Exchange Limited (ASX) listing. The key mandatory annual report disclosure of environmental matters for Australian companies is under the

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<sup>3</sup> National Greenhouse and Energy Reporting Act 2007, s. 9.

<sup>4</sup> Online System for Comprehensive Activity Reporting, <http://www.climatechange.gov.au/oscar/index.html>

<sup>5</sup> National Greenhouse Energy and Reporting Act 2007, s13(iii).

Corporations Act 2001<sup>6</sup>, which requires directors to report the entity's performance in relation to any *particular and significant* environmental regulation under which they operate. This requirement commenced on 1 July 1998 (Frost & English, 2002; Hanson & White, 2003) and is associated with an increase in the number of companies reporting about their level of environmental performance, although there is considerable variation in the content reported (Frost, 2007). Since 1 January, 2005, companies operating in the extractive industries must comply with AASB 6 for measuring, recognising, and disclosure of exploration and evaluation assets. Superannuation and certain managed investment funds must set out information detailing their consideration, or otherwise, of labour standards, environmental, social or ethical issues when making investment decisions to demonstrate their ethical investment credentials in their product disclosure statements<sup>7</sup>.

It has been observed that Australian firms have voluntarily made environmental disclosures as early as the 1950s (Guthrie & Parker, 1989), and have disclosed details of their operational performance in relation to the environment within their annual reports (Deegan & Gordon, 1996; Kent & Chan, 2009). GHG disclosures are a specific form of environmental reporting given that they address issues that have been identified as influencing climate change. Although the NGER Act was enacted on 29 September 2007 (Australian Government Department of Climate Change, 2009), there is evidence of Australian firms reporting information about their greenhouse gas emissions in their 2007 annual reports and stand-alone sustainability reports.

## 1.2 General Problem

Determining a manager's incentive to disclose or withhold information when it is not mandated is an important accounting problem (Verrecchia, 1990). Imperfect information, termed *information asymmetry*, is a characteristic of the capital market, and exists because managers are frequently better informed than investors. Voluntary disclosures are attempts to remove this asymmetry (Brammer & Pavelin, 2006) and

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<sup>6</sup>s299(1)(f) "The directors' report for a financial year must if the entity's operations are subject to any particular and significant environmental regulation under a law of the Commonwealth or of a State or Territory--give details of the entity's performance in relation to environmental regulation."

<sup>7</sup>Corporations Act 2001, s1013D, effective from 11 March 2002.

signalling theory suggests that managers attempt to reduce uncertainty resulting from information differences by making disclosures (Watts & Zimmerman, 1986). This theory suggests that companies that believe they are *better* than others signal this through their voluntary disclosures, seeking to attract investment and to enhance their reputation (Campbell, Shrivies & Bohmbach-Saager, 2001).

The belief that *no news is bad news* is a rational assumption in capital markets (Lundholm & Van Winkle, 2006) and underpins the phenomenon of adverse selection (see Akerlof, 1970, for an example). The adverse selection phenomenon induces firms to fully disclose information that outside investors know they possess, otherwise liquidity levels for firm shares are reduced (Leuz & Verrecchia, 2000), and undervaluation of the company results. In the absence of disclosure, the market assumes that this information is unfavourable to the company; otherwise it would have been reported. The firm, therefore, has an incentive to fully disclose both good and bad information and avoid a negative response from the markets (Grossman, 1981; Milgrom, 1981). The failure of firms to make full disclosure implies that frictions exist that influence management's disclosure decisions (Verrecchia, 1983). These frictions relate to the costs of making discretionary disclosure.

Parties external to the firm are aware of the existence of private information, but not its content (Verrecchia, 1983), and a corporate manager decides to release private information based on the information's potential effect on the market (Verrecchia, 1983). Knowledge of this information influences decisions made by actors within the capital, labour and corporate control markets (Foster, 1986), and those in the consumer market, regulatory bodies, and the general public (Meek, Roberts & Gray, 1995).

Several forms of disclosure costs exist, including those that affect a firm's position in product markets (Nagar, 1999) and those that impose political costs that reduce profits (Wagenhofer, 1990). Product market disclosure costs are endogenous costs (Dye, 2001), identified as those that give rise to competitive concerns including the threat of new entrants to the market, if the disclosing firm is one that earns high profits (Berger & Hann, 2007; Bhattacharya & Ritter, 1983; Darrough & Stoughton, 1990; Dye, 2001; Gigler, 1994; Hayes & Lundholm, 1996; Verrecchia, 1990;

Wagenhofer, 1990). Political costs associated with disclosure arise from regulation, union demands or adverse media reports (Wagenhofer, 1990).

### **1.3 Voluntary Disclosures**

Statutes, professional regulations and stock exchange listing requirements mandate certain corporate disclosures (Marston & Shrives, 1991). Voluntary disclosures are unregulated, and represent the excess over the minimum of required disclosures (Marston & Shrives, 1991). Voluntary disclosures, therefore, are made with free choice, or at the discretion of the reporting entity and, consequently, vary in terms of subject matter, amount of information provided, and degree of detail.

### **1.4 Benefits of Voluntary Disclosures**

Possible benefits of voluntary disclosures include improving the marketability of shares, and thus positively influencing the firm's market valuation, and easing financing considerations, and thus reducing firms' cost of debt (Cerf, 1961). Additional information reduces uncertainty about the quality of the firm as a means of investment and corporate voluntary disclosures provide reassurance about a firm's ability to pay dividends and to meet debt obligations. Thus, enhanced disclosure influences reductions in a firm's cost of capital (Bushee & Leuz, 2005; Clarkson, Li, Richardson & Vasvari, 2008; Diamond & Verrecchia, 1991; Huang & Zhang, 2008). The provision of additional information lowers information asymmetries between the firm's management and investors (Hayes & Lundholm, 1996) and financiers (Clarkson *et al.*, 2008). Increased disclosure influences analysts, credit rating outlets, media outlets, and other third party information providers (Arya & Mittendorf, 2005; Banghoj & Plenborg, 2008). It also lowers their information gathering and reporting costs, and enhances external monitoring (Huang & Zhang, 2008). Additional disclosure reduces agency problems (Deumes & Knechel, 2008; Jensen & Meckling, 1976; Whittred, Zimmer, Taylor & Wells, 2004), and political costs (Jantadej & Kent, 1999). Litigation risk has also been attributed to influencing the decision to make voluntary disclosures (Healy & Palepu, 2001). For example, firms have been found to volunteer information seeking to pre-empt potential lawsuits in the presence of large negative earnings surprises (Field, Lowry & Shu, 2005; Skinner, 1994).

Further disclosure also reduces the incentive to acquire private information and reduces the information acquisition costs of individual investors (Diamond, 1985; Verrecchia, 1982), improving the liquidity of the shares (Diamond & Verrecchia, 1991). Miller (2002) found that investors respond positively to increased discretionary disclosure. Less directly-observable, but nevertheless potentially influential to a firm's cash flows, are the reputational effects stemming from additional disclosure (Campbell *et al.*, 2001; Einhorn & Ziv, 2008).

Internal benefits derived from the making of voluntary environmental disclosures include potential improvements in organisational practices and the management of environmental impacts. These opportunities arise through the process of gathering environmental information to enable reporting. Other beneficial prospects are the potential to gain additional general and investment community support as a consequence of good environmental performance (Deegan & Rankin, 1999).

### **1.5 Costs of Voluntary Disclosures**

Direct and indirect costs are involved in making voluntary disclosures (Niskanen & Nieminen, 2001). Direct costs are those pertaining to the preparation and dissemination of the information (Field *et al.*, 2005; Lev, 1992) and include data collection, processing, production and auditing costs (Gray, Radebaugh & Roberts, 1990). Other costs are litigation, political, competitive disadvantage costs and constraints on managerial behaviour (Foster, 1986). Indirect costs result from the revelation of proprietary information to competitors (Dye, 1986) or to other market participants (Darrough, 1993), the loss of bargaining power to unions or suppliers (Foster, 1986, p. 38), or the implicit agreement to provide future voluntary disclosures to the capital market (Einhorn & Ziv, 2008). Financial executives from the United Kingdom and United States agree that the indirect cost of competitive disadvantage is the most important cost constraint of making voluntary disclosures (Gray *et al.*, 1990).

#### **Proprietary Costs**

A manager's endowment of private information contains proprietary information and non-proprietary information (Dye, 1986) and is acquired through management

planning and controlling activities. Unlike proprietary information, disclosed non-proprietary information has little influence on the present value of a firm's cash flows. Its classification (as non-proprietary information) is dependent on the other information privately held by the firm's manager (Dye, 1986) as, in combination, disclosure could improve the ability of competitors to make inferences about a firm's cost structure or future plans, and reduce cash flows to the firm. The reduction of cash flows to the firm results in proprietary costs (Dye, 1986).

The existence of proprietary costs produces management-tension regarding the decision to voluntarily disclose private information. The manager's conundrum is that while the disclosed information could be useful in more accurate firm-valuation in financial markets (Bhojraj, Blacconiere & D'Souza, 2004), it could also alert other parties to the firm's business strategy, technical innovations and other firm-specifics (Elliott & Jacobson, 1994). Disclosing private information could lead to favourable financial market results, in that the firm's cost of capital reduces or the liquidity of its shares increases, but those disclosures could bring about significant competitive disadvantages in the product market (Elliott & Jacobson, 1994). Managers must trade off the benefits from additional disclosure against the costs of revealing potentially harmful information (Aerts, Cormier & Magnan, 2008; Cormier & Magnan, 2007; Cormier, Magnan & Van Velthoven, 2005; Darrrough, 1993; Depoers, 2000; Healy & Palepu, 2001; Wagenhofer, 1990) and either do not otherwise disclose (Cho & Patten, 2007), or a partial disclosure occurs (Dye, 1986; Verrecchia, 1983).

## **1.6 Targets of Voluntary Disclosures**

Voluntary disclosures are targeted towards multiple audiences (Einhorn, 2007). Aside from capital markets and financing considerations, managers' communication of voluntary information is directed to a broader group of stakeholders. Additional audiences include competitors in the product market, consumers, suppliers, employees, labour unions, creditors, and regulatory authorities (Einhorn, 2007). Mission statements, a form of voluntary disclosure, have been found to be directed to customers, shareholders, business partners, employees, community, and those concerned about the environment (Campbell *et al.*, 2001). A survey of Australian sustainability reporting practices found eight target audiences: employees, shareholders, customers, local

community, institutional investors, suppliers, analysts and other (Australian Government Department of the Environment and Heritage, 2005).

## **1.7 Social Responsibility**

The consideration of these *relevant audiences* (Suchman, 1995) is often an attempt to promote the firm's stance or performance in areas denoting social responsibility. In general terms, corporate social responsibility is concerned with a firm's behaviour and its economic, social and environmental performance. Corporate social responsibility reporting is a relatively recent, continually evolving and generally unregulated concept (Deegan, 2006, p. 381). Given the diverse audiences, interest in one aspect of social responsibility, i.e., a firm's specific environmental performance, is unlikely to abate in the near future. Public disclosures of GHG emission data in annual reports, the major corporate social and environmental communication medium (Brown & Deegan, 1998; O'Donovan, 2002), and stand-alone sustainability reports are likely to help satisfy some of the current information requirements of those audiences.

## **1.8 Objectives of This Research**

This research examines the economic implications of voluntary reporting of GHG emission information by Australian publicly-listed companies as early as 2007. It relies on corporate disclosures made in annual reports and stand-alone sustainability or environmental reports. It investigates management decisions to disclose that information within the context of positive accounting theory. The pursuit of positive accounting theory (Watts & Zimmerman, 1986) is to explain and predict management's motives for their financial reporting choices. Within this framework, research on a firm's decision to make voluntary disclosures is undertaken within a capital markets setting (Birt, Bilson, Smith & Whaley, 2006).

This research has three objectives. The first is to determine the nature of GHG emissions data reported by Australian publicly-listed companies in their annual reports or stand-alone sustainability<sup>8</sup> reports for the years 2007 and 2009. A 2005 Australian government inquiry did not endorse legislative intervention concerning corporate social

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<sup>8</sup> For the remainder of this thesis, reference to "sustainability reports" includes environmental reports.

responsibility and its accompanied reporting (Parliamentary Joint Committee on Corporations and Financial Services, 2006). The inquiry committee concluded that mandatory corporate responsibility reporting would lead to a meaningless compliance tick-a-box culture, defeating the purpose behind corporate responsibility concepts (Parliamentary Joint Committee on Corporations and Financial Services, 2006). The unregulated nature of voluntary disclosures suggests their content varies across firms and across time. Establishing the content of voluntary disclosures of GHG emission information reveals corporate commitment to the corporate responsibility agenda.

The second objective is to determine why these discretionary disclosures have been made when firms meeting NGER Act reporting thresholds are only required to report via a government portal commencing in 2009. Firms operate within an environment of numerous stakeholder and constituent groups, for example, capital markets, labour markets, suppliers, product markets, competitors, potential entrants, employees, communities, and corporate control. Therefore, the provision of additional disclosure often has simultaneous and contradictory effects (Lev, 1992).

The third objective is to determine disclosures before and after implementation of the NGER legislation by comparing GHG emissions data reported voluntarily in 2007 to those disclosed in 2009. As societal attitudes and expectations concerning environmental issues change, and governmental environmental regulations become more prolific, it is necessary for businesses to re-examine their environmental performance and practices and to make adjustments accordingly. It is beneficial to determine whether the National Greenhouse and Energy Reporting Act 2007 (Cth) stimulates additional annual report and sustainability report disclosures, and to reveal companies' disclosures in these media before and after the Act.

## **1.9 Research questions**

The thesis provides answers to the following research questions:

What is the nature of greenhouse gas disclosures in annual reports and stand-alone sustainability reports of Australian companies listed on the Australian Stock Exchange for 2007 and 2009?

Why do these companies voluntarily supply greenhouse gas information in these reports?

How did the disclosures change from 2007, two years' prior to the requirement for any disclosure, to 2009, when it became mandatory for corporations meeting emission thresholds to report to the government body responsible for clean energy and carbon emissions reduction?

### **1.10 Contribution of the Research**

The introduction of the NGER legislation emphasises the importance the Australian Government places on the issue of GHG reporting. Australian corporations' GHG disclosure information in annual reports and sustainability reports is currently unknown as most research has focused on environmental voluntary disclosures in general. The contribution of this research is that it examines a specific type of environmental disclosure, GHG emissions, and focuses on the period prior to and immediately following the new NGER legislation. This establishes the pre-legislative characteristics of GHG reporting and its post-legislative development. It includes a sample of all companies listed on the ASX in 2007 and 2009. Therefore, this research covers small, medium and large companies.

Previous Australian studies have been completed before the NGER legislation, while others focus on the Top 300 companies. Simnett and Nugent (2007) found that less than 10 per cent of Australian listed companies made GHG disclosures in their annual reports in 2005 and recommended that external verification of disclosures lends credibility to the information. Wahyuni, Rankin and Windsor (2009) took a legitimacy viewpoint in their analysis of 2007 voluntary disclosures of ASX300 firms in annual reports, stand-alone environment or sustainability reports, and corporate websites, connecting them to the existence of the firms' environmental management systems.

Perera and Jubb (2011) provide the first investigation concerning the NGER Act. They studied the voluntary environmental disclosures made by NGER Act-affected companies' annual reports and sustainability reports. The sample studied constituted approximately 4 per cent of listed companies. The disclosures targeted in these reports

were the number of references to the NGER Act or GHG volumes in the financial years ending 30 June 2007 and 2009.

Overseas, evidence of companies' emissions performance and disclosures is also limited. Gamble *et al.* (1996) studied international trends in environmental disclosure practices, which included emissions targets and performance, during the period 1989 to 1991. Cerin (2002) found that fewer than 10 per cent of OM Stockholm-listed companies provided documented environmental reports on the internet and that CO<sub>2</sub> emission data was lacking in 60 per cent of companies that did provide these reports. Clarkson *et al.* (2008) examined the relationship between environmental performance, including performance indicators of GHG emissions, and environmental disclosure for firms in high polluting industries in the United States. Boasson (2009) compared two oil companies' approaches to climate change and reported their management of CO<sub>2</sub> emissions and reductions in gas flaring and venting. The Canadian Voluntary Climate Challenge and Registry served as the basis for Brouhle and Harrington's (2009) research into how Canadian firms addressed GHG emissions, mitigation targets, and performance.

Given the growing interest in reducing individuals' and organisations' environmental footprints and the concept of environmental sustainability, the significance of this research lies in its establishment of the characteristics of greenhouse gas emission data reported by Australian publicly-listed companies at a time period when it is not mandated. This knowledge forms a benchmark against which cross-functional and temporal comparisons can be made, and is useful for stakeholders at all levels of society in their decision-making.

Understanding the characteristics of greenhouse gas information being reported is of use to standard-setters and policy-makers, especially given the global context in which companies list their securities. These bodies are able to determine the adequacy of the information currently provided and mandate improvements or extensions in the form and content of reports to serve their general objectives. Investors, suppliers, creditors, and lobby groups have a deeper insight into the ecological credentials of these companies, a knowledge which is likely to influence their future dealings with those firms, given the institutional changes emerging within society.

Academics and the professional community also desire to know the characteristics of the information voluntarily released within the annual report and stand-alone sustainability report, i.e., what type of GHG information is reported, how much information is reported, whether the reported information is qualitative or quantitative, whether the information is retrospective or future-oriented, and whether performance is measured against targets. This information enables a better understanding of corporate voluntary reporting behaviour. Similarly, knowledge of how that information changes over time is beneficial in extending that understanding.

Establishing reasons for the early disclosure practices allows interested parties to anticipate corporate reactions to future legislative mandates and permits conjectures about their consequent behaviour.

### **1.11 Limitations of the Research**

As this research is limited to Australian-listed public companies, differences in business, regulatory and capital markets environments detracts from the generalisability of the results to corporations in other parts of the world. This study investigates GHG disclosures in annual reports and stand-alone sustainability reports only. The variety of alternative reporting media used by companies is increasing (Adams, Hill & Roberts, 1998), and disclosures in other media, e.g., a company's webpage, a corporate brochure, a conference call, or a press release<sup>9</sup>, may contain different information. Appendix A provides more comprehensive details of the various types of media studied in recent research.

This research seeks to explain the nature and motivations of voluntary reporting of greenhouse gas emissions and relies on agency and information asymmetry theories. Because other theories, such as legitimacy, stakeholder, contingency, and transaction cost economics are beyond the scope of this study, the ultimate explanations for corporate motivations and behaviour in reporting their greenhouse gas emissions at this point in time and in these particular media may not have been fully exposed.

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<sup>9</sup> This not an exhaustive list of all sources of corporate voluntary disclosures.

## **1.12 Structure of the Thesis**

This thesis is structured as follows. This chapter describes the problem being researched and prior related studies. It provides a summary of the significance of its contribution to theory, research, practice and education. A review of relevant literature, from which theories are developed and hypotheses are produced, is presented in Chapter Two. Chapter Three describes the methods and techniques used to test the hypotheses developed in the previous chapter. Chapter Four presents descriptive statistics. Chapter Five depicts the results and provides an analysis of the data. The findings of the research are summarised in Chapter Six and the limitations and implications concerning this research are also discussed therein.

## Chapter 2 Theoretical Foundation and Hypothesis Development

### 2.1 Introduction

This chapter documents key research carried out in the field of voluntary greenhouse gas (GHG) emission disclosures by business corporations. In providing a summary of research significant in this field, it ultimately draws on existing theories from capital market and agency perspectives. From these perspectives, it sets the theoretical framework and develops testable hypotheses about voluntary GHG emission disclosures.

The focal point of voluntary accounting disclosure literature<sup>10</sup> is on management disclosure decisions, which are associated with capital market, contracting, and political cost considerations (Healy & Palepu, 2001). The importance of managers' disclosures relates to the prevention of inefficient resource allocations that result from information and incentive problems within a capital market economy (Healy & Palepu, 2001). While research on voluntary environmental disclosures is well-established, voluntary greenhouse gas emission disclosures is under-researched.

Signatories to the Kyoto Protocol accept obligations to reduce GHG emissions via market-based mechanisms (United Nations Framework Convention on Climate Change, 1998) and mandatory national emission reduction targets apply under the Kyoto Protocol. Australia became a signatory to the Kyoto Protocol in 2007 but is yet to implement emission limiting mechanisms. As a result, corporate proactivity to reduce GHG emissions currently varies considerably. Nevertheless, the National Greenhouse and Energy Reporting Act 2007 (Cth) (NGER Act) has brought corporate attention to their GHG emission performance, with some listed companies voluntarily disclosing GHG information. Business corporations' GHG emission performance is of interest to government policy-makers, industry, investors and the general public.

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<sup>10</sup> Various literature seeking to determine motivational factors for, and the significance of, the practice of making voluntary disclosures has preceded this research. This literature has included accounting, finance and economics disciplines (Verrecchia, 2001), although there is yet to be one unifying theoretical framework to explain these disclosures.

The chapter continues in the following manner. Section 2.2 discusses key research in the area of voluntary disclosure of greenhouse gas emission information. Section 2.3 leads into the development of hypotheses and precedes a discussion on the implications of voluntary disclosures on capital markets, presented in Section 2.4. This is expanded further in Section 2.5 where the information problems inherent in capital markets and the acquisition of capital funding are explained. A discourse on the principal/agent problem and voluntary disclosure comes next in Section 2.6. The chapter continues to Sections 2.7 and 2.8 where proprietary costs and political costs surrounding the reporting of voluntary GHG disclosures are considered. Other factors are discussed in Section 2.9 where control variables are introduced. A chapter summary is presented in Section 2.10.

## **2.2 Voluntary Greenhouse Emission Disclosures**

Voluntary disclosure is a persistent and important feature of corporate reporting (Cotter, Lokman & Najah, 2011). Voluntary disclosures can offer a superior means of communicating a company's economic, environmental, and social opportunities and performances rather than simply responding to requests for information from stakeholders (Global Reporting Initiative, 2002). Increased environmental disclosure in Australia has been linked to an increase in society's concern for environmental issues (Deegan & Gordon, 1996). Worldwide, businesses are increasingly considering their corporate environmental performance as environmental issues grow in prominence in society.

The body of work concerning the voluntary reporting of greenhouse gas emission information is in its early stages and, currently, research is limited. A study of the first reporters under the National Greenhouse and Energy Reporting Act 2007 (Cth) found no link between Australian corporate large GHG-emitters and voluntary disclosures in their annual and sustainability reports (Perera & Jubb, 2011). Prado-Lorenzo *et al.* (2009) sought to identify the factors relating to the 2005 corporate GHG website disclosures of 101 corporations from USA, Canada, Europe and Australia. The credibility of ASX 300 companies' voluntary GHG disclosures in annual reports and stand-alone sustainability reports for 2007 were analysed from an institutional

governance theoretical perspective by Rankin, Windsor and Wayhuni (2011). Matsumura, Prakash and Vera-Muñoz (2010) undertook to determine the relationship between carbon emission performance, firm market value and cost of capital. Freedman and Jaggi (2005) compared pollution and GHG disclosures made during 2000 to 2002 by the world's largest public corporations<sup>11</sup> from Kyoto Protocol-adopting and non-Kyoto Protocol-adopting countries. They found superior disclosures by corporations from adopting countries. Similar findings were made in a more recent study of 510 international corporations<sup>12</sup> (Freedman & Jaggi, 2011). Research on voluntary GHG emissions reporting is expected to increase as governments around the world ratify the Kyoto Protocol, introduce regulatory mechanisms to reduce GHGs and/or when emissions trading schemes become part of the business environment.

Several voluntary reporting initiatives have been established to collect and disseminate organisational performance concerning climate change activities. Their aims are to document and report, globally, accurate information about corporate environmental and social behaviour to make positive changes and to enhance the information set available to investors. These initiatives aim to satisfy institutional investors' demands for corporate carbon performance reporting and to allow investors to evaluate their future investment prospects (Carbon Disclosure Project, 2009). The Carbon Disclosure Project has 551 financial institutional signatories with assets of over US\$71 trillion at 1 February, 2011 (Carbon Disclosure Project, 2011) indicating the significance placed on this type of information for investment decision-making.

A study of voluntary reports<sup>13</sup> of GHG emission disclosures found that knowledge of this type of climate change information has a valuation effect for investors in S&P 500 and large Canadian companies (Griffin *et al.*, 2010).

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<sup>11</sup> Freedman and Jaggi (2005) studied the annual reports, environmental reports, and websites of 120 of the world's largest public companies in the chemical, oil and gas, energy, and motor vehicle and casualty insurance industries.

<sup>12</sup> The sample of corporations for this later study comprised 148 firms from the European Union, 106 firms from Japan, 28 firms from Canada, 16 firms from India, and 212 United States corporations (Freedman & Jaggi, 2011).

<sup>13</sup> Griffin, Lont and Sun (2010) sourced their disclosures from Carbon Disclosure Project reports for the years 2006 to 2009.

### **2.3 Hypotheses Development**

Systems-oriented theories such as legitimacy, stakeholder and institutional provide accepted alternate perceptions of behaviour and have been the focus of various researchers (Deegan, 2006). These are recognised increasingly as being valid concepts with which to explain corporate voluntary disclosure decisions. Reporting beyond financial performance on matters of the firm's social and environmental prominence is directly linked to the concept and goal of sustainable development, a phenomenon becoming widely embraced by organisations around the world (Deegan, 2005; Robins, 2006) as being fundamental to their future survival. Sustainable development is concerned with not compromising the ability of future generations to meet their needs while meeting the needs of the present (United Nations World Commission on Environment and Development, 1987). While the numbers of companies voluntarily producing sustainability reports have increased significantly since the early 1990s, the quality of the reports, being both unregulated and largely unverified, is questionable (Milne & Gray, 2008). However, third-party verification or commentary on sustainability information is increasing as firms seek to improve the quality and credibility of the reported information (KPMG, 2008). Ullmann (1985) is a critic of the piecemeal approach to social responsibility research, declaring the findings to be inconsistent and ambiguous. This research provides an alternative theoretical perspective.

The following sections discuss motivating factors likely to influence managers' decisions to voluntarily communicate greenhouse gas emission information in annual reports and stand-alone sustainability reports. These factors consider the information problem inherent in capital markets and agency relationships, and implications for voluntary GHG information in relation to proprietary costs and political costs. Testable hypotheses are developed from these discussions.

### **2.4 Capital Markets**

Two obstacles impeding the efficient allocation of resources in capital markets relate to problems with information and incentives (Healy & Palepu, 2001). Firms seek financial resources from investors or lenders to fund business investments. Firm

management has a motive to misstate the value of potential business opportunities because they possess superior information, leaving investors and lenders with an information problem (Healy & Palepu, 2001). Subsequent to gaining financial resources, conflicts of interest occur because managers have an incentive to make self-opportunistic decisions, resulting in an agency problem (Healy & Palepu, 2001).

In the next section the information problem is discussed. A discussion of the agency problem follows in Section 2.6.

## **2.5 Information Problem**

Signalling literature centres on the consequences of asymmetric costs of information (Jensen & Smith Jr., 2002). Although signalling theory originated in the labour market, it is generally applicable in any market where information asymmetry exists (Morris, 1987). In a capital markets setting, information asymmetry, the information problem, surrounds various parties who have differential knowledge of firm-specific information. Corporate managers possess information about the value of the corporation that is superior to that of outside investors (Jensen & Meckling, 1976; Myers & Majluf, 1984; Watts & Zimmerman, 1986), and imbalances frequently exist in the possession of private information about the firm's value between investors (Brown & Hillegeist, 2007) or between different agents (Chae, 2005). Public revelation of corporate private information can reduce information asymmetries between managers and investors, and among investors (Botosan, 2000). Disclosing corporate information can alleviate problems associated with differing managerial/owner incentives, competitive standing, new funding requirements, and relationships with regulatory bodies (Alvarez, Sanchez & Dominguez, 2008).

Signalling is a means of indirectly conveying information to the capital markets (Ang & Cheng, 2011). By publicly communicating corporate private information, managers are signalling the superior quality of the corporation over others that do not communicate private information (Akerlof, 1970). Corporate disclosure reduces information asymmetries by permitting the company to disseminate value-relevant information and, therefore, to potentially influence the perceptions of various interested stakeholders (Brammer & Pavelin, 2008) about the future financial prospects of the firm

(Brammer & Pavelin, 2006). Stakeholders interested in corporate disclosure are generally external parties such as stock analysts, capital markets and institutional investors (Brammer & Pavelin, 2006).

Voluntarily disclosing GHG performance and management initiatives may be a means of distinguishing the firm from a competitor firm and a device that signals firm-superiority in GHG mitigation. Providing this private information could lead to a more efficient valuation of the company's future prospects by the capital market and result in a higher share price (Alvarez *et al.*, 2008).

Investors make their stock pricing decisions based on past and estimated future returns. They use all available information to estimate the extent to which the returns of future investments are likely to exceed the cost of capital (Botosan, 2000; Clarkson, Guedes & Thompson, 1996). Lack of sufficient information results in uncertainty about their estimates and a perception of higher riskiness and, unless the risk can be diversified away, investors demand a higher cost of capital in compensation (Botosan, 1997, 2000). Investors who possess information about a firm's GHG performance and management may be able to infer possible unrecorded assets and liabilities, and future economic performance, and therefore future returns, and thus lessen perceptions of risk.

Managers have advance knowledge in their managerial capacity about profits, future sales contracts, research and development prospects, expansion or divestiture plans, decisions concerning acquisition or disposal of key assets, hiring plans for key personnel and other business and operational strategies. These factors are associated with firm value. Information asymmetry (Banghoj & Plenborg, 2008; Lev, 1992) is the lack of knowledge of this information in the stock market and therefore is a source of firm misvaluations or mispricing (Birt *et al.*, 2006; Lev, 1992). Information gaps also impede the efficient allocation of resources and can result in higher transaction costs and lower liquidity (Birt *et al.*, 2006; Diamond & Verrecchia, 1991).

Managers are motivated to provide information that signals the quality of their firms' future prospects to investors and potential investors when share prices are undervalued, although to be effective, the signal must not be easily copied (Morris, 1987). Clarkson *et al.* (2008) proposed that environmentally proactive corporations

with superior environmental performance have incentives to inform their investors and stakeholders of their accomplishments because poor-environmentally performing firms simply cannot make the same declarations. As a consequence, they suggest there is a potential for an increase in firm valuation by credible disclosures of environmental performance. This is possible because informed investors infer that good environmental performers are likely to have lower environmental risks and liabilities than poorer environmental performers.

### **Capital Funding**

Corporations obtain capital funding from equity investors and debt holders. Linkages between voluntary disclosure and capital markets benefits have been established by theoretical and empirical research (Botosan & Harris, 2000). Prior empirical research has supported higher levels of disclosures being associated with lower costs of equity capital (Botosan, 1997, 2000; Botosan & Plumlee, 2002; Hail, 2002), although this research is without consistent results (Abad, Bravo & Trombetta, 2008; Fields, Lys & Vincent, 2001; Francis, Nanda & Olsson, 2008; Holm & Rikhardsson, 2006; Joos, 2000). Sengupta (1998) found that disclosure can lower the cost of issuing debt, while the same result was not obtained by Collett and Hraskey (2005) when they investigated voluntary corporate governance disclosures. Francis, Khurana and Pereira (2005) found that, globally, cost of equity and debt capital were lower in the presence of expanded disclosures.

#### **2.5.1 Acquisition of Capital: Hypotheses 1 & 2**

Lang and Lundholm (2000) propose that minimising information asymmetry when issuing equity securities can increase their proceeds. Frankel, McNichols, and Wilson (1995) suggest that market forces provide some incentives for increased disclosure when access to external finance is intended. In an international study of non-United States companies, Francis, Khurana and Pereira (2005) found a positive link between voluntary disclosure levels of financial information and external financing requirements.

Additional information reduces uncertainty about the returns to the investor and improves the liquidity of the stock. By reporting about their company's GHG emissions, managers improve the information set available to capital market participants to make their investment and lending decisions.

In this research, seeking new debt or additional share capital is assumed to influence a firm's decision to adopt a GHG reporting regime and to voluntarily report thereon. Hence the following hypotheses are tested:

**H1: Companies provide higher quality GHG disclosures when they seek additional debt finance.**

**H2: Companies provide higher quality GHG disclosures when they seek additional equity finance.**

## **2.6 Agency Theory**

A characteristic of publicly-listed companies is the separation of ownership and control (Fama, 1980). For various reasons, including personal wealth limitations and listing rules, no publicly traded corporation is totally owned by management (Ang, Cole & Lin, 2000). As shareholders (principals) are distant from the firm's management, managers (agents) are prone to making decisions that are incongruent with investors' wishes because they reduce shareholder wealth. Agency costs result from those incongruent managerial decisions. These costs occur through managerial extravagance or incompetence, poor asset management, and inferior investment choices (Chen & Yur-Austin, 2007). Ang *et al.* (2000) found that, in small businesses, agency costs relating to excessive perquisite consumption and lost revenue due to managerial shirking vary inversely with the manager's equity stake. Their research confirmed Jensen and Meckling's (1976) conjecture that agency costs are higher for firms where managers have no equity claims and increase as non-manager shareholders increase.

Jensen and Meckling (1976) contend that the agency relationship raises conflicts of interest problems because of utility-maximising propensities of owners or debt-providers (principals) and managers (agents). Consequently, agency costs of monitoring, bonding and residual costs are unavoidable. Agency costs to the principals

include contracting costs, transaction costs, moral-hazard costs, and information costs (Jensen & Smith Jr., 2002). On the agents' side, agency costs are financial and non-financial, with non-financial costs involving additional effort in searching for new profitable undertakings, understanding new technologies, or due to anxiety concerning the implementation of innovative undertakings (Wright, Mukherji & Kroll, 2001). Principals and agents contract to minimise agency costs, although it is impossible for all possible decision-situations to be addressed ex-ante (Nagar, 1999).

According to agency theorists, it is assumed that agents possess hidden knowledge or information relative to their principals that may be used opportunistically (Saam, 2007). Providing information to principals is a mechanism to reduce the consequential agency costs (Watts & Zimmerman, 1986) of this differential knowledge. A precept underpinning agency theory is that the provision of more corporate information is a means of controlling managers' actions and aligning managerial incentives to those of owners (Alvarez *et al.*, 2008). Making disclosures is a channel for managers to signal that their actions are made in the owners' best interest (Broberg, Tagesson & Collin, 2009). The intuition is that voluntary disclosures are measures taken by managers to reduce agency costs, thereby avoiding wealth transfers away from themselves.

This current research suggests that managers make voluntary GHG disclosures to thwart possible adverse performance evaluations that result from unexpected corporate costs and capital outlays to meet future legislative requirements. Costs that must be recognised (operating expenses and those that are unable to be capitalised) reduce profits and potential dividends, and expenditures affect cash flows. The assumption underpinning the instance of voluntary disclosures of GHG information is that managers are exercising prudence. Voluntary GHG disclosures in annual reports and stand-alone sustainability reports may be made to warn shareholders and loan providers that this type of expenditure is pending and that consequential cash and profit effects are expected.

Several recent empirical capital market studies have pursued agency theory to explain corporate voluntary disclosure practice. Berger and Hann (2007) found that

concern with agency costs motivates managers to conceal negative segment information in their application of changes to segment reporting rules under SFAS 131<sup>14</sup>. This study found that managers have incentives to withhold disaggregated information in circumstances of segmental underperformance. They wish to avoid unresolved agency costs that ultimately lead to increased external monitoring. Berger and Hann (2007) suggest that managerial reluctance to disclose information relating to segment performance was due to the *diversification discount* phenomenon. The diversification phenomenon is used to describe situations where multi-segment firms trade at a discount relative to non-diversified firms.

The costs arising from agency problems are a function of firm-specific attributes (Dey, 2008). Company features such as its size, complexity, ownership structure (Ang *et al.*, 2000; Deumes & Knechel, 2008; Eng & Mak, 2003), growth, operating risk, and free cash flows have been used in prior research as indicators of the existence of agency conflicts. Other internal attributes studied in agency-related research are leverage (Deumes & Knechel, 2008), assets in place, type of auditor, and foreign listing status (Hossain, Perera & Rahman, 1995).

### **2.6.1 Debt and Leverage: Hypothesis 3**

Francis, Khurana and Pereira (2005) found that in the 34 countries they studied, firms that practice expanded disclosure experienced a lower cost of debt capital. Hossain *et al.* (1995) determined that high leverage firms are inclined to disclose more voluntary information to reduce the cost of debt. Sengupta (1998) found that financial analysts' high disclosure quality ratings lower a firm's effective debt interest, and argued that detailed disclosures reduce lenders' perceptions of default risk and therefore cost of debt.

Financial leverage raises agency problems between providers of equity capital and debt capital when their risk outlooks differ (Deumes & Knechel, 2008). As leverage increases, so does the potential for wealth transfers from debt-providers

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<sup>14</sup>SFAS 131, effective for financial statements for periods beginning after December 15, 1997, is *Disclosures about Segments of an Enterprise and Related Information* (Financial Accounting Standards Board, 1997).

(Ahmed & Courtis, 1999; Jensen & Meckling, 1976; Prado-Lorenzo *et al.*, 2009; Watts, 1977) to residual claimants (Depoers, 2000; Watts, 1977), and debt-providers take action to price-protect themselves (Hossain *et al.*, 1995). Agency theory proposes that the extent of voluntary disclosures is positively associated with increased leverage (Hossain *et al.*, 1995; Leftwich, Watts & Zimmerman, 1981). The ability of managers to transfer resources away from debt-providers consequently requires more monitoring and disclosure (Francis *et al.*, 2005; Jensen & Meckling, 1976) and thus higher agency costs (Jensen, 1986). Monitoring costs are likely to be high for firms with high levels of debt (Cerbioni & Parbonetti, 2007; Jensen & Meckling, 1976) and disclosing more information is a way of reducing those costs (Ahmed & Courtis, 1999).

The amount of leverage in a firm's capital structure influences agency costs of management incentive systems (Kocchar, 1996). Debt has a disciplining effect on managers' extravagances through the requirement to service the interest and principal payments, which lowers free cash flow. This restricts opportunistic managerial behaviour as managers seek to avoid scrutiny and interference by debt-holders in case of default (Kocchar, 1996), and leads to a better alignment with the perspective of equity providers. Leverage was found to explain voluntary annual report disclosures of New Zealand companies (Hossain *et al.*, 1995). In contrast, Chow and Wong-Boren (1987) found no relationship between leverage and extent of disclosure in Mexican Stock-Exchange-listed firms. It has been established that protection of debt roll-over facilities motivates debt-heavy companies to provide more information (Ahmed & Courtis, 1999).

Investor uncertainty compels companies to disclose more information (Ahmed & Courtis, 1999). Provision of more information decreases uncertainty (risk) and as a consequence, agency costs (Prencipe, 2004) attributable to debt-holders protecting against default risk by demanding higher yields (i.e., exercising price-protection) (Hossain *et al.*, 1995). The NGER Act 2007 (Cth) is the precursor of future legislation to control environment-destroying consequences of business. The subsequent limiting measures, however, have not been determined by the Australian government. Thus, while organisations' GHG reporting requirements are clear under the NGER legislation, managers are unable to select optimum operating and investing strategies to mitigate

their future greenhouse gas emissions. Because debt financiers stand to lose their principal and interest should the business fail, they require reassurance of the riskiness of their investment. Firms are likely to provide more information to apprise lenders of their actions in relation to environmental issues. This suggests the following hypothesis:

**H3: Companies with higher debt levels provide higher quality voluntary GHG emission disclosures.**

#### **2.6.2 Ownership Structure: Hypothesis 4**

Agency problems are exacerbated for firms with diffuse outside ownership (Jensen & Meckling, 1976). Conflicting interests and management opportunism are more likely to occur in firms with dispersed ownership and low management ownership (Adrem, 1999). These factors affect agency problems because of the need for increased external monitoring (Eng & Mak, 2003). The level of monitoring and, consequently, disclosure is a function of managerial ownership (Jensen & Meckling, 1976) and blockholder ownership (Kaplan & Minton, 1994).

The readiness and capacity of large shareholders to actively monitor the corporation to protect firm value lowers agency problems (Milgrom & Roberts, 1992) by mitigating conflicts of interests between management and owners (Chen & Yur-Austin, 2007). When outside ownership is more highly concentrated, managers disclose less voluntary information in their external reports. Broberg *et al.* (2009) found that dispersed share ownership has a positive relationship on the amount of information disclosed and that firms with high management ownership supply less information. A similar result was found by Prencipe (2004). Higher ownership levels by external shareholders increases management performance monitoring as these investors seek to maximise the value of their shareholding (Henry, 2010).

Chen and Yur-Austin (2007) suggest that value-decreasing actions by managers are reduced with concentrated ownership, due to large shareholders' ability to influence managerial decisions. They found that agency problems can be constrained by large shareholders through a reduction in managerial extravagance, better asset utilisation and

easing problems with underinvestment. This influence stems from blockholders' capacity to control the corporate board composition and selection of top management. Similarly, institutional investors are seen as effective monitors that reduce agency costs (Henry, 2010).

This implies that the need for management to provide additional information is not as important for companies with high concentrated ownership. Less separation of ownership and control exists when ownership is highly concentrated and blockholders can readily obtain corporate information. This reduces information asymmetry and lowers the agency problem. Hence the following hypothesis is tested:

**H4: Firms with higher concentrated ownership disclose lower quality voluntary GHG emission disclosures.**

## **2.7 Proprietary Costs and Competition: Hypothesis 5**

If adverse selection causes firms to disclose fully all private information except the worst possible news, then rational managers with no extreme bad news should be making complete disclosure. The friction that prevents such full disclosure is influenced by the existence of proprietary costs. Managers possess private information that, if released, could damage the firm's future earnings prospects. Revelation of information that competitors could exploit could affect their competitive position in product markets (Darrough, 1993; Dye, 1986; Gigler, 1994; Verrecchia, 1983). Managers have incentives to withhold this information to protect their strategic interests from market competitors (Bhojraj *et al.*, 2004).

Mixed empirical evidence has been found regarding the relation between the level of disclosure and competition (Birt *et al.*, 2006). Verrecchia (1983) and Wagenhofer (1990) proposed that less information is provided by firms in more competitive industries, and firms in less competitive industries disclose more because of lower proprietary costs. Conversely, there exists a greater incentive for a firm to disclose in highly competitive industries because it is less risky to their competitive position (Birt *et al.*, 2006). Darrough (1993) put forward that in some situations, firms

are better off sharing information with their competitors as they can coordinate their actions to their mutual advantage.

Firms that disclose their GHG data risk revealing their operational strategy for GHG management. These details could alert their competitors to the processes, technology or equipment currently possessed by the disclosing firm. If these resources are superior, competitors could acquire similar ones and reduce the competitive advantage held by the disclosing firm. Likewise, if these resources are deficient, competitors could inform the consumer market by making unfavourable comparisons in their marketing activities. This leads to the following hypothesis:

**H5: Companies in highly competitive product markets disclose less information relating to GHG emissions than those in less competitive product markets.**

## **2.8 Political Costs: Hypothesis 6**

Accounting systems have developed to include environmental performance perspectives. This is a result of the business-response to global concern over climate change, global action to reduce GHG emissions (e.g., Kyoto Protocol), and to comply or to prepare to comply with mandatory GHG reduction schemes and emissions trading schemes. These systems incorporate procedures that include life cycle analysis, environmental auditing, corporate environmental reporting, and scrutiny of suppliers' environmental practices. The inclusion of these practices follows a trend towards incorporating environmental quality into total quality management systems as firms acknowledge a competitive advantage for being environmentally responsible (Elkington, 1994).

Researchers have variously classified a firm's operations as pertaining to environmentally-sensitive industries, although noting that not all sectors are equally environmentally sensitive. A summary of environmentally-sensitive industries classifications follows in Table 2-1.

**Table 2-1 Environmentally-sensitive Industry Classifications**

<b>Industry sector</b>	<b>Researchers</b>
Chemicals/ drugs / pharmaceutical	Aerts and Cormier (2009); Cho and Patten (2007); Cormier and Magnan (2007); Fekrat, Inclan and Petroni (1996); Holland and Foo (2003); Murray <i>et al.</i> (2006); Niskala and Pretes (1995); Toms (2002)
Construction	Holland and Foo (2003); Wilmshurst and Frost (2000)
Consumer goods	Cormier and Magnan (2007)
Food and beverage/ household	Cormier and Magnan (2007); Niskala and Pretes (1995); Toms (2002); Wilmshurst and Frost (2000)
Forestry	Esrock and Leighty (1998); Fekrat, Inclan and Petroni (1996); Niskala and Pretes (1995)
Infrastructure	Aerts and Cormier (2009); Burritt (2002); Cho and Patten (2007)
Iron and steel	Ingram and Frazier (1980)
Manufacturing	Wilmshurst and Frost (2000)
Metals	Cho and Patten (2007); Cormier and Magnan (2007); Fekrat, Inclan and Petroni (1996); Niskala and Pretes (1995); Toms (2002)
Minerals processing	Toms (2002)
Motor	Fekrat, Inclan and Petroni (1996)
Natural resources/ mining/ gold	Aerts and Cormier (2009); Bertels and Peloza (2008); Burritt (2002); Cho and Patten (2007); Cormier and Magnan (2007); Deegan and Gordon (1996); Holland and Foo (2003)
Nuclear	Clarke and Gibson-Sweet (1999)
Oil and gas/ oil and gas exploration	Aerts and Cormier (2009); Bertels and Peloza (2008); Burritt (2002); Cho and Patten (2007); Clarke and Gibson-Sweet (1999); Cormier and Magnan (2007); Deegan and Gordon (1996); Esrock and Leighty (1998); Holland and Foo (2003); Murray <i>et al.</i> (2006); Niskala and Pretes (1995)
Paper/ pulp/ paper packaging/ forest products	Aerts and Cormier (2009); Burritt (2002); Cho and Patten (2007); Cormier and Magnan (2007); Deegan and Gordon (1996); Hanson and White (2003); Ingram and Frazier (1980); Niskala and Pretes (1995); Toms (2002); Wilmshurst and Frost (2000)
Petroleum refining/ petrol producers/ petrochemical	Cho and Patten (2007); Deegan and Gordon (1996); Fekrat, Inclan and Petroni (1996); Ingram and Frazier (1980); Mobus (2005)
Pipelines	Aerts and Cormier (2009); Bertels and Peloza (2008); Burritt (2002); Cho and Patten (2007)
Plastics / rubber manufacturing	Deegan and Gordon (1996); Toms (2002)
Transport/ tourism	Deegan and Gordon (1996); Wilmshurst and Frost (2000); Niskala and Pretes (1995)
Utilities/ power generation/ gas distributors/ energy	Aerts and Cormier (2009); Bertels and Peloza (2008); Burritt (2002); Cho and Patten (2007); Deegan and Gordon (1996); Holland and Foo (2003); Ingram and Frazier (1980); Niskala and Pretes (1995); Toms (2002)

A relationship to industry membership has been found to influence environmental disclosures (Adams *et al.*, 1998). Reid and Toffel (2009) found that public disclosures of a company’s climate change strategies and GHG emissions were influenced by shareholder activism on a related issue made towards the company itself, or made towards other firms in their industry.

While the above industries are presented as being “environmentally sensitive”, this study is concerned with the issue of disclosures of greenhouse gases, a specific environmental problem linked to climate change. Industries likely to be immediately affected by climate change laws are those involved in electricity generation, coal or other mining activities, natural gas retailing, industrial processing, fossil fuel intensive industries and waste disposal (Australian Government, 2012c). These industries align with the following broad GICS sector classifications<sup>15</sup>: energy (electricity generation industries and coal or other mining activities); utilities (natural gas retailing industries); materials (industrial processing industries) and industrials (industrial processing industries, waste disposal industries).

The undesired attention of governments and other external parties, for example unions, suppliers and environmental activists, may be diverted by the firm taking various actions, including voluntarily disclosing their GHG performance. The attention stemming from political visibility causes costs that transfer wealth away from the company.

Deegan and Gordon (1996) found a positive association between increasing social pressure and concern from lobby groups, and increased environmental disclosures in their review of Australian corporate environmental reporting behaviour from 1980 to 1991. It is proposed that a firm’s membership in a climate change-sensitive GICS sector attracts increased attention and generates higher stakeholder expectations. Firms respond to these expectations by implementing GHG management programs and reporting their GHG performance. From this, the following hypothesis results:

**H6: Companies in climate change-sensitive GICS sectors voluntarily disclose more GHG emission information than those in other GICS sectors.**

## **2.9 Control Variables**

It is likely that other company characteristics influence the voluntary disclosure of GHG emission information. The true relationship between the independent variables

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<sup>15</sup> Since August 2008, the Global Industry Classification Standard consists of ten sectors aggregated from 24 industry groups, 68 industry sectors and 154 sub-industry sectors (Standard & Poors, 2008).

and voluntary GHG disclosure are concealed if these other characteristics are ignored. Accordingly, five categories of control variables are included for testing the model. These are financial performance, audit quality, age of fixed assets, foreign listing status and size.

### **2.9.1 Financial Performance**

A corporation's financial performance is likely to influence whether or not voluntary greenhouse disclosures are made. Financial performance can be measured from an accounting or a market perspective. Each type of measure has its shortcomings. Accounting measures are indicative of the firm's historical performance and are open to management manipulation (Christie & Zimmerman, 1994; Holthausen, 1990). Market measures represent investors' perceptions of the firm's future earnings ability (Kent & Chan, 2009).

In keeping with numerous prior research (for example, Cormier, Aerts, Ledoux & Magnan, 2009; Dhaliwal, Li, Tsang & Yang, 2009; Magness, 2006; Matsumura *et al.*, 2010; McGuire, Sundgren & Schneeweis, 1988; Van der Laan, Van Ees & Van, 2007) this study uses return on assets (ROA) as the accounting measure of financial performance. Lang and Lundholm (1993) note that companies want to reveal their good news to the financial markets, and so disclose more when they expect better earnings forecasts. Including ROA in this study is consistent with more recent research on voluntary environmental disclosures (for example, Aerts & Cormier, 2009; Chapple, Clarkson & Gold, 2011; Clarkson *et al.*, 2008; Moroney, Windsor & Aw, 2011; Rankin *et al.*, 2011). This study assumes a positive relationship between financial performance, as measured by return on assets, and voluntary greenhouse gas emission disclosures.

Tobin's Q is also used widely to represent financial performance. Tobin's Q is a financial market-based measure of the future performance potential of an investment (Bharadwaj, Bharadwaj & Konsynski, 1999). It represents the market's opinion of a firm's cash flows per dollar invested in assets and should be higher if greater cash flows are expected or if cash flows are considered less risky (King & Lenox, 2001). Thus, Tobin's Q indicates the profitability of investment opportunities, or growth

opportunities (Min & Prather, 2001) anticipated by the market, based on investors' information-set specific to the firm. It has featured in voluntary environmental disclosure studies (for example, Chapple *et al.*, 2011; Clarkson *et al.*, 2008; Moroney *et al.*, 2011; Stanny & Ely, 2008), and agency theory studies (for example, Ertugrul & Hegde, 2008; Harvey, Lins & Roper, 2004; Henry, 2010; Min & Prather, 2001). In this thesis, it is proposed that firm performance, measured by Tobin's Q, has a positive influence on the provision of greenhouse gas emission information.

### **2.9.2 Audit Quality**

Accounting literature has long held the view that information asymmetry and agency problems influence the demand for audit quality (Healy & Palepu, 2001; Watts & Zimmerman, 1983, 1986). Audit quality was found to influence the voluntary disclosure of forward-looking information of Australian companies in 2000 (O'Sullivan, Percy & Stewart, 2008). Gray and Ratzinger (2010) conducted focus group studies of chief financial officers (financial statement preparers), bankers and analysts (financial statement users) and financial statement auditors. Participants believed that Big 4 auditors possess a depth of resources not held by smaller firms. The general belief was that a Big 4 audit provides superior audit quality for large, complex and/or multinational firms. Gray and Ratzinger (2010) linked this perception to Simunic's (1980) argument that Big 4 auditors are perceived to be more credible than others.

Big 4 firms have been found to be associated with higher quality financial reporting (Cohen, Krishnamoorthy & Wright, 2004). Participants in the Gray and Ratzinger (2010) study believe that a Big 4 audit provides value to the client firm in the form of reduced loan interest rates, higher stock prices, and easier issuance of IPOs. Barton (2005) suggests that firms that are more prominent in the capital markets engage highly reputable auditors to enhance their financial reporting credibility.

In prior research Big 4 auditors (or their predecessors, Big 5, Big 6 or Big 8 depending on the timing of the research) are used as an indication of high audit quality (see, for example Bushman, Piotroski & Smith, 2004; O'Sullivan *et al.*, 2008; Yatim, Kent & Clarkson, 2006). The audit quality provided by larger audit firms is increased because they value their reputation and, to financial statement users, auditor size is a

surrogate measure for audit quality (DeAngelo, 1981). Deumes and Knechel (2008) suggest that a high quality external auditor's independent review of unaudited parts of the annual report may increase the perceived credibility of voluntary reporting. This thesis takes the same view and assumes a positive relationship between a Big 4 auditor and the making of voluntary greenhouse emissions disclosures.

### **2.9.3 Age of Fixed Assets**

A corporation's asset structure influences the extent of external monitoring required and in consequence, its agency costs (Huang & Zhang, 2008; Leftwich *et al.*, 1981). Chow and Wong-Boren (1987) proposed that agency costs are lower for firms with large proportions of fixed assets in place. Their research followed Myers (1977) who found an inverse relationship between voluntary financial disclosure and a firm's proportion of assets in place. While Chow and Wong-Boren (1987) also proposed that managers in control of already acquired assets would disclose less, they did not find a significant relationship in the Mexican context of their study. For New Zealand studies, Bradbury's (1992) results were similarly unsuccessful, as were those of Hossain, Perera and Rahman (1995). Leftwich, Watts and Zimmerman's (1981) agency theory test of assets in place and the frequency of voluntary corporate reporting among United States firms also did not establish the expected inverse relationship. However, Indian banking corporations that provide more voluntary information, and thus have lower agency costs, have been found to have more assets in place (for example, Hossain & Reaz, 2007). Harvey, Lins and Roper (2004) found that leverage is instrumental in alleviating agency problems in emerging-market-firms with a high proportion of assets in place. Thus the proposition that the extent of voluntary disclosure is inversely related to a firm's proportion of assets in place is unresolved.

In this research it is considered that it is the age of fixed assets, rather than the proportion of fixed assets held, that influences GHG disclosures. Fixed asset age has featured in models representing several theoretical perspectives. It has been included in legitimacy theory studies (for example, Cormier, Gordon & Magnan, 2004), stakeholder theory studies (for example, McGuire *et al.*, 1988), value relevance studies (for example, Moneva & Cuellar, 2009) and political cost studies (Uchida & Ferraro, 2007).

Fixed asset age has been found to be a determinant of the level of environmental disclosure by German firms (Cormier & Magnan, 2007; Cormier *et al.*, 2005) and Canadian firms (Cormier & Magnan, 2007). It has been included as a control variable in other studies (see, for example, Clarkson *et al.*, 2008; Cormier *et al.*, 2004; Cormier & Magnan, 2003), and as a measure of the environmental management of the company (Cormier *et al.*, 2005; Russo & Fouts, 1997).

Older assets are an indication of more-polluting technology (Cormier & Magnan, 1999) and of difficulties for the company in meeting environmental regulations (Cormier *et al.*, 2004). In contrast, newer assets are assumed to be more environmentally friendly and more focussed on pollution prevention (Chambers, 2011). The age of plant is related to environmental performance (Jaggi & Freedman, 1992) and thus increases exposure to political costs. This has led Cormier and Magnan (2007) to suggest that in the absence of further information, investors may use fixed asset age to assume the company's environmental performance. Investors are likely to believe that old assets are associated with lower environmental performance. This study assumes that additional disclosures are necessary to counteract these beliefs, and a positive relationship is predicted between voluntary greenhouse gas emission disclosures and the age of fixed assets.

#### **2.9.4 Foreign Listing Status**

Leuz and Verrecchia (2000) suggest that listing on a foreign exchange could motivate more communication to investors. A company's foreign listing status has been associated with the level of voluntary disclosure in New Zealand companies (Hossain *et al.*, 1995) and in the content of voluntary disclosures in Swedish companies (Broberg *et al.*, 2009). Similarly, Meek and Gray (1989) found that multinational European companies listed on the London Stock Exchange disclosed more than required by London Stock Exchange rules. An international listing association was found to influence the voluntary strategic information disclosures of United States and United Kingdom multinational corporations (Gray, Meek & Roberts, 1995).

Companies may make voluntary GHG disclosures when they are listed on a stock exchange in a jurisdiction where carbon mitigation mechanisms are in force or

where climate change issues are a significant part of the business environment. Accordingly, a foreign listing variable is included as a control variable and measured as a binary variable.

### **2.9.5 Size**

An additional test of political costs is provided by the size of companies. Prior research suggests that corporate voluntary disclosure of environmental information increases with firm size. In this thesis, size is included as a firm characteristic that influences the ability and propensity to make voluntary GHG disclosures. It is costly to accumulate and report detailed information and smaller firms may not consider that the expense is worthwhile (Cerf, 1961). In contrast, however, larger firms and those with diversified geographic regions or products require a higher level of internal reporting as a control mechanism and have already borne the costs of information collection (Cerf, 1961).

Larger firms are concerned with liquidity and its consequences on cost of capital, as illiquidity causes stocks to be priced lower (Diamond & Verrecchia, 1991). Larger firms place importance on attracting large holdings from institutional investors and their subsequent large trades, a factor influencing the price of the security. Accordingly, larger firms are the biggest recipients of benefits of reducing information asymmetry and disclose more information (Diamond & Verrecchia, 1991).

The magnitude of political costs is highly dependent on firm size (Watts & Zimmerman, 1978). Large firms are more visible and are thus subject to political pressures (Watts & Zimmerman, 1986) and public scrutiny. Álvarez, Sánchez and Domínguez (2008) found that more-visible Spanish firms volunteered a larger volume of unregulated corporate social responsibility information on their websites, and suggest that this is to reduce political costs. Various studies have found a significant relationship between the size of a company and its level of voluntary environmental reporting (for example, Adams *et al.*, 1998; Cormier & Gordon, 2001; Lang & Lundholm, 1993) and voluntary social reporting in general (for example, Belkaoui & Karpik, 1989; Patten, 1991; Trotman & Bradley, 1981). Thus a positive relationship is expected and size is included as a control variable.

## **2.10 Summary**

Some overlap occurs amongst three of the main theories (information asymmetry, agency, and political cost theories) underpinning this research into why firms voluntarily disclose their GHG performance. The most basic reason is that the corporation perceives that benefits exist from disclosing this information. Corporations should benefit from disclosing better information about their GHG emission performance in three key areas. Firstly, reducing information asymmetry allows stock market participants to better evaluate the future earnings potential of the company and, thus, influence the market's assessment of firm value, and promote the liquidity of the stock. Secondly, lessening the need for costly management monitoring by equity and debt providers should facilitate the acquisition of capital funding. Thirdly, reporting non-mandatory GHG performance information to a wide audience is indicative of greater transparency and accountability and should reduce political cost pressures in these times of carbon emission sensitivity.

This chapter detailed the conceptual and theoretical framework from which this research is based. Voluntary disclosure and its impact on capital market participants were discussed from an information asymmetry perspective. Following, agency and proprietary costs theories were presented as further crucial theoretical frameworks for this thesis. Lastly, political cost theory was raised. Six hypotheses were presented for analysis and control variables were introduced. The hypotheses describe the factors that influence a company's decision to make voluntary GHG emission disclosures. In the next chapter the research method for testing those hypotheses is reported.

## **Chapter 3 Research Design**

This section documents the data studied, the methodology adopted, and the variables of interest in this investigation into the voluntary GHG disclosures of Australian listed-companies in 2007 and 2009.

### **3.1 Sample Selection**

The National Greenhouse and Energy Reporting Act 2007 (Cth) (NGER Act 2007) requires large emitters to report their greenhouse gas emissions and energy use to the Australian Government, commencing from 2008. The objectives of this research are to determine the status of corporate voluntary greenhouse gas (GHG) emission disclosures in 2007 and 2009, their motivating factors, and their progression from 2007 to 2009. This research investigates the entire population of ASX listed companies for 2007, the year immediately prior to the commencement of the new reporting regime instituted under the legislation, and 2009, the year immediately following its commencement.

The sample includes 1,776 companies with a balance date falling in 2007 and 1,853 companies with a balance date in 2009. Companies whose annual reports and stand-alone sustainability reports specify information about greenhouse gas emissions, carbon emissions, and/or CO<sub>2</sub> emissions or with specific statements about the NGER Act 2007 (Cth) are targeted and their disclosures scrutinised.

### **3.2 Disclosure Medium**

Climate change challenges are global and their economic consequences have caused great and wide-ranging market failure (Stern, 2006). Major and perhaps irreversible economic and social disruptions are predicted unless effective global actions are taken immediately (Stern, 2006). Climate change is an issue appearing in political and business agendas worldwide (PricewaterhouseCoopers Australia, 2011; Santam, 2009; Starbuck & Singer, 2011) as parties deliberate on actions to mitigate greenhouse gas emissions and consequential risks.

Internal and external stakeholders demand information about the organisation's ability to manage key risks beyond those of a financial nature (Ballou, Heitger & Landes, 2006). Increasing social pressure on their management of societal, moral and environmental aspects of their activities has made firms accountable to a wider audience than solely shareholders (Branco & Rodrigues, 2006). Corporations seek to assure stakeholders that they are acting responsibly in relation to environmental laws and regulations and communicate their performance in various reporting media including annual reports, newsletters, bulletins, media releases, stand-alone environmental reports and internet homepages (Holland & Boon Foo, 2003).

Enhanced communication is a means of managing relationships among interested parties, and voluntary disclosures represent management's strategic posture towards social demands (Bowman & Haire, 1975; Kent & Chan, 2009; Ullmann, 1985). Stakeholder engagement is important to corporations, yet is complicated by the diversity of company stakeholders and the changing nature of issues relating to the organisation and its operating environment (Adams & Frost, 2006). A further complication stems from the varied interests of stakeholder groups (Ballou *et al.*, 2006). Corporate greenhouse gas performance is of interest to NGOs, investors, and other stakeholders (World Business Council for Sustainable Development & Institute, 2004).

Companies use a variety of formats when communicating environmental issues. They use questionnaire surveys, face-to-face meetings with persons of influence, briefings, conferences, hard copy reports, brochures and newsletters, and electronic media, although with varying frequency (Adams & Frost, 2006). Other communication media include news releases, speeches, "hot-links" to other web sites (Esrock & Leighty, 1998), conference calls (Burritt, 2002), and mass advertising (Zeghal & Ahmed, 1990). This study is based on disclosures of GHG information provided in annual reports and sustainability reports.

### **3.3 Annual Report**

The annual report is generally regarded as one of the most important sources of corporate information (Botosan, 1997). It is the main company disclosure vehicle (Marston & Shrivs, 1991) to outsiders and shareholders (Guthrie & Parker, 1989) and

for stakeholder communication (Adams & Frost, 2006). Annual reports are considered as the principal source of voluntary information (Ingram & Frazier, 1980) on issues concerning employees, customers, society, and the environment (Owen, 2008). They are the chief medium for Australian corporate environmental performance disclosures (Brown & Deegan, 1998) and are used strategically to signal desirable environmental behaviour (Aerts & Cormier, 2009). The annual report's breadth of coverage and availability makes it an influential source to the public (Hooks, Coy & Davey, 2002) and a vehicle for discharging public accountability (Boyne & Law, 1991).

Australian corporations now have alternative means of distributing their annual report. They may provide it in a hard copy or may make an electronic copy available on a website, or distribute it in an electronic format ("Corporations Act 2001 No. 50," 2001 s. 314). Notwithstanding the growing popularity of the internet as a means of dissemination of corporate information, there is evidence that the annual report's importance to corporate communications has not declined, although the quantity of information provided has decreased for some companies (Adams & Frost, 2006). A widely available, public communication device, the annual report provides a permanent record (Cormier *et al.*, 2004) in contrast to internet web content which, being a dynamic resource, can be changed or removed instantaneously and without notice.

### **3.4 Sustainability Report**

Sustainability reporting has become mainstream (Isenmann, Bey & Welter, 2007; KPMG & Group of 100, 2008) and is gaining in importance (Raar, 2006). It is another type of communication used by corporations to convey their environmental performance to interested stakeholders. These are voluntary corporate performance reports, often included as a separate section in the annual report, or as a separate report. Like annual reports, companies produce stand-alone sustainability reports in hard or electronic copies, and sometimes the page numbering of the sustainability report provides evidence of it being a direct extract from the corporate annual report.

According to Isenmann, Bey and Welter (2007), sustainability reporting appears to have become a daily component in a company's business operations. The intention of a sustainability report is to present an integrated view of the company's performance

as a whole (Adams & Frost, 2006), and to complement annual report disclosures of social and environmental information (Gibson & O'Donovan, 2007). It is seen as a useful source for appraising management's attitude to risk and the communications of governance (CPA Australia Ltd, 2009). These are attributes that may not be fully captured in financial reporting (CPA Australia Ltd, 2009). This study includes the sustainability reports of Australian publicly-listed companies, identified and sourced from their websites following an internet search.

### **3.5 Disclosure Medium Summarised**

To summarise, the medium for researching voluntary GHG emission disclosures consists of ASX-listed companies' 2007 and 2009 annual reports and stand-alone sustainability reports. The annual reports are obtained from Aspect Huntley FinAnalysis<sup>16</sup> electronic database or companies' websites. Sustainability reports (sometimes called Corporate Social Responsibility Reports or other similar nomenclature) in document format are acquired from the corporation's website. Webpage disclosures are not accessed for reasons stated at the end of Section 3.3.

### **3.6 Disclosure Metrics**

The importance of an issue to the reporting entity has been assumed to determine the volume of disclosure, according to Krippendorff (2004). Campbell *et al.* (2001) believe that only the most important matters are disclosed in annual reports because of space restrictions. However, this viewpoint might not hold in today's digital reporting age. The amount of disclosure in the written medium can be analysed in various ways, but it is observed that some research, for example corporate social responsibility, has tended to prefer the use of words, sentences and pages as units of analysis.

Gray, Kouhy and Lavers (1995) selected the average pages of disclosures in their study of United Kingdom firms over a thirteen year period. They found that the volume of pages of voluntary disclosure rose fourfold in that time. Guthrie and Parker

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<sup>16</sup>AspectHuntley FinAnalysis is owned by Morningstar, Inc (Huntleys' Investment Information Pty Limited, 2011).

(1989) made use of the page measurements (excluding photographs and graphics) of CSR disclosure made by BHP over a century. They measured the absolute number of quarter-pages, rather than the relative amount of space devoted to CSR as opposed to all other information types.

The number of lines of disclosure formed the basis of analysis in Bowman and Haire's (1975) study. They counted and compared the proportion of lines of narrative devoted to social responsibility in the annual reports of a sample of fourteen "outstandingly responsible"<sup>17</sup> (Bowman & Haire, 1975, p. 51) firms and a similar control group that had not been so identified.

Sentences were the unit of analysis used by Kent and Chan (2009) when they operationalized Ullmann's (1985) stakeholder theory to explain the quantity and quality of voluntary environmental disclosures of large Australian public companies. The sentence has been established as an acceptable unit of analysis in various research, for example Ingram and Frazier (1980), because it is easily identified and is subject to less inter-judge variation than phrases, clauses, or themes.

### **3.7 Disclosure Quality**

According to Singhvi and Desai (1971, p. 131), quality of disclosure has the three attributes of "completeness, accuracy and reliability". Disclosure quality, an "elusive" concept at the empirical level (Artiach & Clarkson, 2011, p. 4), has been defined and measured in various ways including the actual amount of disclosure. In his 2005 paper, Gray (2005) argued that it is essential to challenge corporate reports for their absence of quality. Wiseman (1982) determined that the length of environmental disclosures in the annual reports of United States' companies in three industries (steel, oil, and pulp and paper) was not indicative of quality of disclosure. Therefore, while the level of disclosure may provide some indication of the importance of information, some researchers (for example Clarkson *et al.*, 2008; Cormier *et al.*, 2009) are of the opinion that the attributes of disclosures are also worthy of research.

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<sup>17</sup> As identified by a leading New York Times editor in 1973.

Other researchers, (for example, Beattie, McInnes & Fearnley, 2004; Beretta & Bozzolan, 2008) also, take the view that the quantity of disclosure alone is an inadequate measure of the quality of disclosure. They examine disclosures under a multi-dimensional framework, including the various topics reported, the time orientation, financial versus non-financial aspects, and whether the disclosure is quantitative or qualitative.

Quality of disclosures of environmental information has been represented by various means. Brammer and Pavelin (2008) used five indicators of quality: the disclosure of environmental policies, the description of environmental initiatives, reporting on environmental improvements, setting of environmental targets, and the presence of an environmental audit or assessment. Their disclosures were sourced from a research agency and resulted from an analysis of the content of annual reports, accounts, and separate environmental reports, and used indicators of best practice determined by standard-setting bodies<sup>18</sup>.

The quality, rather than the quantity, of the disclosures concerning greenhouse gas emissions information is studied in this thesis. The measurement of quality of GHG emissions information is by way of the existence of a statement made in the annual report or stand-alone sustainability report that conforms to the subject matter of an indexed list of items.

### **3.8 Disclosure Indices**

Researcher-constructed disclosure indices, measuring the attributes of reported information, were pioneered in 1961 by Cerf (Marston & Shrives, 1991). The original researcher-constructed disclosure index was used to evaluate the quality of annual report disclosures by identifying the inclusion of items of information that were deemed as *important* to the investment decision. Cerf's (1961) study was a consequence of concern among members of the National Federation of Financial Analysts Societies, and others, over the deficiencies of corporate annual reporting in relation to the investment

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<sup>18</sup> The standard-setting bodies identified by these authors were: the Global Reporting Initiative, the Association of Chartered Certified Accountants, and Business in the Environment (Brammer & Pavelin, 2008).

decision. The content of Cerf's (1961) index reflected the suggested reporting improvements identified by the Corporate Information Committee of the National Federation of Financial Analysts Societies in various studies. Items were weighted differently to denote their relative importance as determined by various subcommittees of the Committee on Corporate Information. A percentage score was obtained by dividing the number of points awarded for included items by the number of possible points for the company. The validity of this index was achieved by having the importance of each item externally determined, although Cerf (1961) acknowledged that there would be differing opinions on the inclusion or exclusion of index items or weighting assignments. This index was updated and improved in a later study in which it was demonstrated that inadequate corporate disclosure in annual reports is likely to impact on the investment decision and result in wide fluctuations in a security's market price (Singhvi & Desai, 1971).

While the formation of disclosure indices is subjective, they have been found to be a valuable research tool (Marston & Shrivies, 1991). Subsequently, various disclosure indices have been used (see Beattie *et al.*, 2004, for a summary of their characteristics).

Small and medium companies' annual report information of a financial and non-financial nature was indexed by Buzby (1974) to identify possible deficiencies in the required accounting disclosures in the early 1970s. The index was constructed from the perspective of professional financial analysts seeking to evaluate the investment-worthiness of common equities of small and medium companies. Some 38 items of information were included in the index. The items were weighted by a factor of importance that had been determined following a survey of members of The Financial Analysts Federation. Surveying financial analysts for their importance ratings provided validation for the choice of index items (Artiach & Clarkson, 2011). Buzby (1974) concluded that deficiencies existed in the extent of annual report disclosure by small and medium size companies and that many items of information important to financial analysts were inadequately disclosed. More recently, Campbell *et al.* (2001) created an index to measure the comprehensiveness of the content of mission statements reported in the annual reports of FTSE 100 companies during 1998. Kent and Ung (2003) used a

rating scale to evaluate disclosure quality of forecast earnings performance in their study.

Environmental disclosures in annual reports were specifically targeted in Wiseman's (1982) study. She developed a four-category, eighteen-item index with which she compared the environmental disclosures of 26 of the largest companies in three United States industries<sup>19</sup> to their actual environmental performance ratings measured by the external body, the Council on Economic Priorities. The categories of her index were: economic factors, litigation, pollution abatement, and other environmentally related information. A three-point scoring system was applied, with scoring based on the presence or absence of a piece of information and the degree of specificity of the disclosure. Unlike Cerf (1961) and Buzby (1974), Wiseman (1982) did not obtain outside verification of the index items or their weightings. Wiseman (1982) observed a noticeable lack of specificity in disclosed environmental information. She found that the voluntary environmental disclosures were incomplete and did not reflect the firm's environmental performance. The Wiseman (1982) index has since featured in numerous research, in modified and unmodified forms (see, for example, the works of Choi, 1999; Cormier & Magnan, 1999; Fekrat *et al.*, 1996; Hughes, Anderson & Golden, 2001; Jantadej & Kent, 1999; Walden & Schwartz, 1997).

Aerts and Cormier (2009) measured the extent and quality of environmental disclosures in annual reports using a coding instrument they called a *grid*. They scored items on a three-point scale according to the specificity of the statement and the nature of the terms used<sup>20</sup>. They grouped 39 items into six categories of expenditures and risks, compliance with laws and regulations, pollution abatement, sustainable development, land remediation and contamination and environmental management. This same grid also formed the basis of a study into the relationship among corporate environmental disclosure, financial markets and public pressure of international corporations by Aerts, Cormier and Magnan (2008), and underpinned even earlier

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<sup>19</sup> The industries were: steel, oil, and pulp and paper.

<sup>20</sup> A score of 3 was given if the item was described in monetary or quantitative terms; 2 if the item was described specifically; 1 if only a general discussion was provided (Aerts & Cormier, 2009, p. 24).

studies (see Cormier *et al.*, 2004; Cormier & Magnan, 2007; Cormier *et al.*, 2005). It appears that this grid and rating scale had its origins with Cormier, Gordon and Magnan (2004).

In this study the measurement of disclosure quality is made using an index slightly modified from the one used by Clarkson, Li, Richardson and Vasvari (2008). A feature of their index is that each disclosure item is mapped to the Global Reporting Initiative guidelines. The Global Reporting Initiative provides a comprehensive sustainability reporting framework that is used voluntarily by organisations worldwide (Global Reporting Initiative, 2012). The principles underlying the Global Reporting Initiative Reporting guidelines are aimed at ensuring the quality of reported information (Global Reporting Initiative, 2011). KPMG (2011) recently measured quality of corporate responsibility communications with reference to whether or not corporations used Global Reporting Initiative standards in their responsibility reporting. They stated that the Global Reporting Initiative guidelines “best serve the needs of stakeholder” and provide “credibility” (KPMG, 2011, p. 5). According to KPMG (2011), eighty per cent of the top 250 companies belonging on the Fortune Global 500 list in 2010 and 69 per cent of the uppermost 100 companies in terms of revenues from each of thirty-four countries<sup>21</sup> follow the Global Reporting Initiative Sustainability Reporting Guidelines, considered as the de facto standard around the world.

Clarkson *et al.* (2008) grouped their index items into seven categories: governance structure and management systems, credibility, environmental performance indicators, environmental spending, claims about vision and strategy, environmental profile and environmental initiatives. The maximum score possible for Clarkson *et al.*'s (2008) index was 95.

Disclosure items for six out of the seven categories were of a binary nature (with one indicative of the presence of the disclosure item, and zero otherwise). A six-point scoring scale was applied for the environmental performance indicators category. The

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<sup>21</sup> These countries comprise: Australia, Brazil, Bulgaria, Canada, Chile, China, Denmark, Finland, France, Germany, Greece, India, Israel, Italy, Japan, Mexico, Netherlands, New Zealand, Nigeria, Portugal, Romania, Russia, Slovakia, South Africa, South Korea, Spain, Sweden, Switzerland, Taiwan, Ukraine, United Kingdom and United States (KPMG, 2011).

focus of this category was the presence of specific environmental performance data covering ten areas. A point was allocated if performance data was presented, if it was presented relative to peers/rivals or industry, if performance trend over previous periods was provided, if performance against targets was given, if performance data was presented in both absolute and normalised forms, and if it was disaggregated (Clarkson *et al.*, 2008).

Additionally, the Clarkson *et al.* (2008) index of environmental performance disclosures, of which GHG information is included, classes categories of items as either high quality *hard* disclosures, or lower quality *soft* disclosures. Disclosures regarded as *hard* are objective measures of environmental performance. The *hard* disclosures include items relating to governance structure and management systems, credibility, environmental performance indicators, and environmental spending. *Soft* disclosures lack credibility and substantiation (Clarkson *et al.*, 2008). These disclosures consist of claims about vision and strategy, environmental profile and environmental initiatives. Clarkson *et al.*'s (2008) index was validated by collaborating with an expert in environmental reporting.

### **3.9 GHG Disclosure Index**

The minor modifications made for this study are to the Clarkson *et al.* (2008) item descriptors to reflect an Australian context and to exclude references to web disclosures. The main modification is to the items included in the environmental performance indicators category. Only environmental performance indicator data on greenhouse gas emissions and energy use and/or energy efficiency are collected. These are the key reporting elements of the NGER Act 2007 (Cth). GHGs and energy are two of the ten items in the Clarkson *et al.* (2008) environmental performance indicators category. However, in this modified Clarkson *et al.* (2008) index the environmental performance indicator category relates to only GHG and/or energy performance data, and is labelled *GHG Performance Indicators*.

All index items are scored uniformly. This study's index involves seven categories and consists of a maximum score of 41.

In further keeping with the Clarkson *et al.*'s (2008) index design, the higher-level *hard* or *soft* classifications are maintained for the seven categories of disclosures. The index of disclosures is presented in Table 3-1.

A total score of 25 is possible for the hard disclosure items. This class of disclosures is split into four categories. Statements that fit into these categories are objective, able to be verified, and point to the company's organisation of its operations in regard to its GHG emission performance and management, and its commitment to the management of GHG emissions. These are statements of fact and are unable to be easily mimicked or to be flippantly made.

The first group concerns governance structure and management systems (disclosure category A1). Statements within this category indicate that environmental protection is an important issue to the company and is considered in short- and long-term planning and control decisions. This consideration extends to how the company is structured, the involvement of suppliers, customers and other stakeholders in their interactions with the firm, the implementation of an international standard of environmental management, and how its managers are rewarded. The six items in this group follow; each is worth a score of one. Item A1 refers to the *existence of a department for pollution control and/or management positions for environmental management*. Item A1.2 covers the *existence of an environmental and/or a public issues committee on the board*. Item A1.3 relates to the *existence of terms and conditions applicable to suppliers and/or customers regarding environmental practices*. Item A1.4 is for statements made about *stakeholder involvement in setting corporate environmental policies*. Item A1.5 is a statement about the *implementation of ISO 14001<sup>22</sup> at the plant and/or firm level*. Item A1.6 refers to statements that *executive compensation is linked to environmental performance*.

Disclosure category A2 comprises ten items that attest to the company's credibility of disclosures and claims. Statements in this category refer to the achievement of external standards of environmental performance. Item A2.1 refers to

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<sup>22</sup> *ISO 14001 Environmental Management Systems*. The founders of International Organization for Standardization have shortened its name to *ISO* to avoid having different acronyms in different languages (International Organization for Standardization, 2012).

the *adoption of GRI sustainability reporting guidelines*. Item A2.2 is scored when *independent verification/assurance about environmental information is disclosed in the annual report or sustainability report*. Item A2.3 is a statement indicating that *periodic independent verifications/audits are performed on environmental performance and/or systems*. Item A2.4 is a declaration about having *certification of environmental programs by independent agencies*. Item A2.5 refers to the company attaining *product certification with respect to its environmental impact*. Item A2.6 relates to the company achieving *external performance awards and/or inclusion in a sustainability index*. Item A2.7 is a statement of *stakeholder involvement in the environmental disclosure process*. Item A2.8 is about *participation in voluntary environmental initiatives that are endorsed by government*. Item A2.9 is for statements about the company's *participation in industry specific associations/initiatives to improve environmental practices*. Similarly, item A2.10 is concerned with statements attesting to *participation in other environmental organisations/associations to improve environmental practices*.

The section concerning GHG performance indicators (disclosure category A3) is where companies provide actual quantitative data about their GHG and energy performance and targets. Six types of data qualify for this category. Item A3.1 is scored when *performance data is presented*. Item A3.2 is where *performance data is presented relative to peers/rivals or industry*. Item A3.3 receives a score when *performance data is presented relative to previous periods (trend analysis)*. Item A3.4 refers to *performance data being presented relative to targets*. Item A3.5 is where the company presents *performance data in absolute and normalised form*. Item A3.6 is for statements providing *performance data at a disaggregate level (i.e., plant, business unit, geographic segment)*.

The final set of statements comprising the hard category is about a firm's environmental spending (disclosure category A4). Three items make up this set. Item A4.1 is when the company gives a *summary of dollar savings arising from environmental initiatives to the company*. Item A4.2 is the provision of the *amount spent on technologies, research and development and/or innovations to enhance environmental performance and/or efficiency*. Item A4.3 is used when the *amount spent on fines related to environmental issues* is provided.

Soft disclosure items generally lack hard proof or their subject matter can be easily altered depending on the firm's prospects and corresponding outlook, and/or positioning strategy. There are three soft disclosure categories. These comprise statements about the company's vision and strategy claims, environmental profile and environmental initiatives.

Vision and strategy claims (disclosure category A5) has six items. These are assertions in which environmental management and performance is espoused without providing objective proof. Item A5.1 is where a *CEO statement on environmental performance in a letter to shareholders and/or stakeholders* is reported. Item A5.2 is concerned with *a statement of corporate environmental policy, values and principles, environmental codes of conduct*. Item A5.3 refers to the reporting of *a statement about formal management systems regarding environmental risk and performance*. Item A5.4 is when *a statement is made that the firm undertakes periodic reviews and evaluations of its environmental performance*. Item A5.5 is when there is *a statement of measureable goals in terms of future environmental performance*. Item A5.6 is scored when there is *a statement about specific environmental innovations and/or new technologies*.

A company's environmental profile (disclosure category A6) has four items and covers statements about the firm's influences on the environment. Item A6.1 refers to *a statement about the firm's obligations regarding climate change regulation*. Item A6.2 applies when *an overview of the environmental impact of the industry* is given. Item A6.3 covers statements providing *an overview of how the business operations and/or products and services impact the environment*. Item A6.4 is for statements giving *an overview of corporate environmental performance relative to industry peers*.

The environmental initiatives category (disclosure category A7) is the last category and deals with the firm's resourcefulness and proactivity towards environmental improvements. Six items are included. Item A7.1 is awarded a score when *a substantive description of employee training in environmental management and operations* is provided. Item A7.2 is for statements concerning the *existence of response plans in case of environmental accidents*. Item A7.3 is for statements about

the existence of *internal environmental awards*. Item A7.4 applies when the company makes a statement about *internal environmental audits*. Item A7.5 covers statements about *internal certification of environmental programs*. Item A7.6 is for reports detailing *community involvement and/or donations related to the environment*.

Table 3-1 follows on page 50.

**Table 3-1 GHG Emissions Disclosure Index**

<b>Hard Disclosure Items</b>	
<b>A1</b>	<b>Governance structure and management systems (max score is 5)</b>
1	Existence of a department for pollution control and/or management positions for environmental management (0-1)
2	Existence of an environmental and/or public issues committee on the board (0-1)
3	Existence of terms and conditions applicable to suppliers and/or customers regarding environmental practices (0-1)
4	Stakeholder involvement in setting corporate environmental policies (0-1)
5	Implementation of ISO 14001 at the plant and/or firm level (0-1)
6	Executive compensation is linked to environmental performance (0-1)
<b>A2</b>	<b>Credibility (max score is 10)</b>
1	Adoption of GRI sustainability reporting guidelines or provision of a CERES report (0-1)
2	Independent verification/assurance about environmental information disclosed in the annual report or sustainability report (0-1)
3	Periodic independent verifications/audits on environmental performance and/or systems (0-1)
4	Certification of environmental programs by independent agencies (0-1)
5	Product certification with respect to environmental impact (0-1)
6	External environmental performance awards and/or inclusion in a sustainability index (0-1)
7	Stakeholder involvement in the environmental disclosure process (0-1)
8	Participation in voluntary environmental initiatives endorsed by EPA or Government Department (0-1)
9	Participation in industry specific associations/initiatives to improve environmental practices (0-1)
10	Participation in other environmental organisations/associations to improve environmental practices (0-1)
<b>A3</b>	<b>GHG Performance Indicators (max score is 6)</b>
1	Performance data is presented (0-1)
2	Performance data is presented relative to peers/rivals or industry (0-1)
3	Performance data is presented relative to previous periods (trend analysis) (0-1)
4	Performance data is presented relative to targets (0-1)
5	Performance data is presented in absolute and normalized form (0-1)
6	Performance data is presented at disaggregate level (i.e., plant, business unit geographic segment) (0-1)
<b>A4</b>	<b>Environmental spending (max score is 3)</b>
1	Summary of dollar savings arising from environmental initiatives to the company (0-1)
2	Amount spent on technologies, R&D and/or innovations to enhance environmental performance and/or efficiency (0-1)
3	Amount spent on fines related to environmental issues (0-1)
<b>Soft Disclosure Items</b>	
<b>A5</b>	<b>Vision and strategy claims (max score is 6)</b>
1	CEO statement on environmental performance in letter to shareholders and/or stakeholder (0-1)
2	A statement of corporate environmental policy, values and principles, environmental codes of conduct (0-1)
3	A statement about formal management systems regarding environmental risk and performance (0-1)
4	A statement that the firm undertakes periodic reviews and evaluations of its environmental performance (0-1)
5	A statement of measurable goals in terms of future environmental performance (if not awarded under A3) (0-1)
6	A statement about specific environmental innovations and/or new technologies (0-1)
<b>A6</b>	<b>Environmental profile (max score is 4)</b>
1	A statement about the firm's obligations regarding climate change regulations (0-1)
2	An overview of environmental impact of the industry (0-1)
3	An overview of how the business operations and/or products and services impact the environment

	(0-1)
4	An overview about specific environmental innovations and/or new technologies (0-1)
<b>A7</b>	<b>Environmental initiatives (max score is 6)</b>
1	A substantive description of employee training in environmental management and operations (0-1)
2	Existence of response plans in case of environmental accidents (0-1)
3	Internal environmental awards (0-1)
4	Internal environmental audits (0-1)
5	Internal certification of environmental programs (0-1)
6	Community involvement and/or donations related to environment (if not awarded under A1.4 or A2.7) (0-1)

### 3.10 Content Analysis

The annual reports and stand-alone sustainability reports for the entire population of ASX publicly-listed companies for the years 2007 and 2009 are examined. To minimise possible evaluation bias, a two-step process of content analysis is used. In the first instance, a research assistant<sup>23</sup> collected disclosures from the annual reports of companies listed on the Australian Securities Exchange in the years 2007 and 2009. During 2007, there are 1,940 corporations listed and 1,927 corporations during 2009<sup>24</sup>. An electronic search for the words: environment, carbon, sustain, emission, regulation, committee and their derivatives, is used to identify companies that made GHG disclosures, or referred specifically to the NGER Act 2007 (Cth), and to identify corporate approaches to key environmental aspects regarding their operations. These search words were selected because they appear to reflect an efficient and parsimonious process of capturing a broad set of company references to the information required to be reported under the NGER Act 2007 (Cth).

Errors in locating relevant text are virtually eliminated (Krippendorff, 2004) because computer-aided text analysis tools operate by searching for character strings. They are thus reliable to the extent that the exact search words are identified.

<sup>23</sup> The author was the grateful recipient of a grant from AFAANZ in 2008 which provided partial funding for research assistance.

<sup>24</sup> According to the Australian Securities Exchange (Australian Securities Exchange, 2008, 2010), there were 2,209 listed entities at 31 December, 2007, and 2,181 at the same date in 2009. However, included in these figures are trusts with quoted equities, entities that trade as stapled securities, and entities with debt securities only. These were beyond the scope of this study. Additionally, new listings and delistings occur during each year, and their annual reports are not necessarily available in those circumstances.

Relevant text segments were copied and pasted into two Excel files, one each for 2007 and 2009. A separate worksheet was devoted to each company. Next, the work was checked by the author for reproducibility. Reproducibility is concerned with the ability that a process can be replicated by different analysts and is a medium-strength indicator of reliability (Krippendorff, 2004). For PDF files that were not electronically-readable, careful reading was carried out and relevant disclosures were noted, along with the annual report page number. A similar procedure was performed on company sustainability reports. Some 218 companies make GHG disclosures in 2007 and 390 in 2009<sup>25</sup>. Coding of the disclosures was the next step of the analysis process.

In this research the coding procedure takes the unitised data and classifies it according to its fit with predefined recording units. These predefined recording units are the 41 items comprising the index, providing that the company's disclosures include GHG or energy information. Therefore, the second step involved the researcher, as principle investigator, reading each company's collected disclosures for each year to determine if they featured greenhouse gases<sup>26</sup> or energy<sup>27</sup>. If greenhouse gas or energy disclosures were identified, the entire compilation of disclosures collected as above for that company was coded according to whether or not they corresponded with an index item. The corresponding index item received a score of one for a disclosure matching the item, or a zero where a match was absent. An item was scored only once regardless of the frequency with which disclosures matched a given item. By following this process a disclosure index score was attributed to each company for 2007 and 2009.

A necessary condition in content analysis is to assess the reliability of the coding. This demonstrates that the obtained results do not represent the idiosyncratic results of one coders's subjective judgment (Tinsley & Weiss, 1975). Details of reliability testing follow in Section 3.11.

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<sup>25</sup> A list of all disclosing companies and their disclosure medium is included at Appendix B.

<sup>26</sup> "Greenhouse gases" include 24 gases specified in the National Greenhouse and Energy Reporting Regulations ("National Greenhouse and Energy Reporting Regulations," 2008).

<sup>27</sup> Listed companies that did not make reference to CO<sub>2</sub>, carbon, greenhouse gas, or energy in their reports were not included in the indexing process.

### 3.11 Tests of Reliability

The three forms of reliability applicable to content analysis are stability, reproducibility and accuracy (Krippendorff, 2004). Stability, the weakest form, refers to the same content being coded the same way more than once by the same coder (Weber, 1990), and is also known as intraobserver consistency (Krippendorff, 2004). Accuracy, while the highest form of reliability, is concerned with the extent by which classified text confirms to a standard (Krippendorff, 2004) or norm (Weber, 1990). The use of accuracy is seldom used in reliability assessment (Weber, 1990) and is limited to coder training and when objective standards are readily available (Krippendorff, 2004). Thus the most frequently reported measure is reproducibility (Weber, 1990), and it serves to validate the coding scheme<sup>28</sup> and is an imperative for human-coding content (Neuendorf, 2002).

Reproducibility refers to intercoder (Neuendorf, 2002; Weber, 1990) inter-rater (Beattie *et al.*, 2004), or inter-observer (Krippendorff, 2004) reliability. It signifies the extent to which independent judges make the same coding decisions (Lombard, Snyder-Duch & Bracken, 2002). It measures the consistency of shared understandings (Weber, 1990) and is of central importance to the trust placed in content analysis (Singletary, 1993). Without intercoder reliability the data and their interpretations can never be considered valid (Lombard *et al.*, 2002). At least two independent coders are necessary for reproducibility (Krippendorff, 2004). A numerical index of the extent of agreement between or among the coders is calculated from their categorisations of units (Lombard *et al.*, 2002).

Reliability is concerned with the confidence that the agreement level for the data produced by independent observers is not due to chance. Recall that a 41-item index was used in this research and that text segments were the units of analysis. Perfect reliability is difficult to achieve when complex coding tasks require elaborate cognitive process (Krippendorff, 2004).

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<sup>28</sup> The coding instructions for this study are located at Appendix C.

No set standard exists for the number of units to be used in reliability assessment, but generally a subsample between 50 and 300 is acceptable (Neuendorf, 2002). Reproducibility of the coding process was established for this study by having a subsample (n=266)<sup>29</sup> of the units of analysis (each company's text segments) independently coded by a second coder<sup>30</sup>. The coder training procedure involved the second coder indexing the disclosures of ten companies after verbal instruction and using the coding instructions. This resulted in the identification and rectification of inter-coder differences of understanding. Subsequent independent coding of the full subsample yielded a data reliability matrix comprising 10,906<sup>31</sup> pairs of observations.

Measuring coding agreement was done using Krippendorff's *alpha* (Krippendorff, 2004). Other frequently used measures of coefficients of agreement are Scott's *pi* (Scott, 1955) and Cohen's *kappa* (Cohen, 1960).

Krippendorff's *alpha* can be used with any number of coders, any sized sample, and for different measurement levels. It evaluates each variable individually, allows for missing categories or scale points and accounts for chance agreements (Krippendorff, 2004; Lombard *et al.*, 2002).

Levels for acceptability of reproducibility vary according to different researchers but it appears that a minimum coefficient of 70% is a basic requirement. Coefficients of 80% or higher are said to be acceptable in most situations, and greater than 90% are acceptable to all (Neuendorf, 2002). Krippendorff's agreement coefficient  $\alpha$ , used to

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<sup>29</sup> The selection of a subsample was achieved by using Excel's Data Analysis Sampling technique, which incorporates a "with replacement" rule to provide a simple random sample. In order for each unit of the population to have an equal chance of being chosen, it is replaced in the "draw" after selection and is available to be reselected. To account for duplications, some 330 randomly selected units were generated, aiming to achieve an acceptable sample size after disregarding repeated units. Running this technique resulted in 64 duplications which were ignored to produce the 266 discrete units for reliability assessment. The subsample is included at Appendix D.

<sup>30</sup> A research assistant was employed for this stage of the study. This assistant was selected from a pool of research assistants used by various researchers at Bond University and had no particular knowledge of the subject matter being coded. This fulfils a condition for generating reliability data: that any individual with specifiable qualifications, rather than an expert, could understand the coding instructions and carry out the coding process (Krippendorff, 2004).

<sup>31</sup> 266 randomly selected sets of disclosures applied to a 41-item index.

evaluate reliability in content analysis, was .84 (84 per cent) in this study. This is an acceptable reliability distribution, and thus the index data as a whole is reliable (Krippendorff, 2004).

### **3.12 Dependent Variables**

Two measures are used to reflect the quality of voluntary GHG emission disclosures. These are the index score achieved by each GHG disclosing company and the ratio of hard disclosures to total disclosures.

### **3.13 Independent Variables**

This study relies on the following explanatory factors for a company's decision to voluntarily disclose their greenhouse gas emission management and performance: obtaining additional debt or equity funding, leverage, concentration of stock ownership, competitiveness of product market, and industry membership. A number of control variables are also incorporated into the analysis, and these are discussed in Section 3.14.

The suitability of these variables has been established in prior studies. Data relating to all independent and control variables are obtained from archival sources, specifically, FinAnalysis, DatAnalysis and Capital IQ. Where required data are not present in these databases, they are collected directly from the companies' annual reports<sup>32</sup>.

#### **3.13.1 Additional debt or equity funding**

Support has been found for managers providing greater disclosure when they determine to raise capital (Choi, 1973; Frankel *et al.*, 1995).

It is pertinent to assume that the issuance of additional share capital or debt funding lags GHG disclosure. The measurement of a firm's obtainment of additional external financing is the incidence of new debt financing or new share issues in the year after the GHG disclosure. This information is disclosed in a company's Statement of

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<sup>32</sup> As an example, it was necessary to hand collect data from the notes to each company's annual reports in order to calculate the age of fixed assets variables for 2007 and 2009. This time-consuming effort (involving accessing almost 3,800 annual reports and calculating gross fixed assets and accumulated depreciation thereon) was required because of inaccuracies in available data bases.

Cash Flows<sup>33</sup> and accordingly, the firms' 2008 and 2010 financial statements provide this information. Borrowings next year and equity issued next year are measured as the natural log of the proceeds from borrowings and proceeds from share issues undertaken in the next financial year, respectively.

### **3.13.2 Leverage**

Disclosures are expected to increase as firm debt increases because of the monitoring demands of debt-holders (Leftwich *et al.*, 1981). Another reason is that higher quality disclosures have been found to have a favourable effect on the default risk premium charged by debt-providers (Sengupta, 1998). Leverage is measured as the ratio of total liabilities divided by total assets at the end of the year.

### **3.13.3 Ownership concentration**

Cormier & Magnan (1999) found an association between less environmental disclosure and concentrated ownership. It is expected that corporations with a high concentrated ownership have a lower need to provide greenhouse gas emission information. This is because monitoring costs are lower (Demsetz, 1983) and dominant owners normally have access to the information they require (Broberg *et al.*, 2009; Cormier *et al.*, 2005). Following prior research, for example Banghøj and Plenborg (2008), Deumes and Knechel (2008) Eljido-Ten (2007), Kent and Chan (2009) and Roberts (1992), ownership concentration is measured by the percentage of ownership of the firm held by shareholders who own 5 per cent or more of the total shareholding. Shareholding information was obtained from the Capital IQ database.

### **3.13.4 Competitiveness of product market**

The degree of product competition is likely to have an effect on a manager's decision to report GHG information. It is expected that firms operating in a highly competitive environment are hesitant to disclose information that can be used to reduce their future cash flows from the consumer market. Competition is measured in this

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<sup>33</sup> AASB 107 requires the cash flow statement to report cash flows from a firm's operating, investing and financing activities. Proceeds from issuing shares or other equity instruments, and proceeds from issuing debentures, loans, notes, mortgages, and other borrowings relate to financing activities.

research using a proxy for a market structure indicator, the Herfindahl index. This index has been used extensively in accounting research as a measure of industry concentration (see, for example, the research of Ajinkya, Bhojraj & Sengupta, 2005; Beattie *et al.*, 2004; Berger & Hann, 2007; Birt *et al.*, 2006; Christensen, 2011; Cuijpers & Buijink, 2005; Dhaliwal, Khurana & Pereira, 2011; Dhaliwal *et al.*, 2009; Harris, 1998; Heitzman, Wasley & Zimmerman, 2009).

The Herfindahl Index is computed as the sum of squares of revenue of all companies in each of the Global Industry Classification (GICS)<sup>34</sup> sub-industry sectors divided by the total revenue of that sector. A score of one indicates a monopoly, and zero indicates a purely competitive market, with a higher score indicating increasing market power and a decrease in competition. As in Birt *et al.* (2006), the product of the Herfindahl index is deducted from one for ease of interpretation, and thus the calculated Herfindahl index score rises as competition in the sub-industry sector increases.

### **3.13.5 Industry membership**

The GICS sector in which an industry is classified is likely to influence a firm's GHG disclosures. Firms in sensitive sectors, from a climate change perspective, are expected to make disclosures, and to provide more detailed disclosure. Perhaps this is a self-servicing action on their behalf (Francis, 2011).

Accordingly, industry dummy variables that are based on Global Industry Classification Standard (GICS) sectors classifications are included. Consumer discretionary, consumer staples, energy, financials, health care, industrials, information technology, materials, telecommunication services and utilities, representing the ten-sector principal business activities framework for industry analysis (Standard & Poors, 2008) are included.

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<sup>34</sup> Since August 2008, the Global Industry Classification Standard consists of ten sectors aggregated from 24 industry groups, 68 industry sectors and 154 sub-industry sectors (Standard & Poors, 2008).

### 3.14 Control variables

It is likely that other factors influence the decision to report voluntarily on greenhouse gas emissions and thus five control variables are included in the statistical modelling. These are financial performance, audit quality, age of fixed assets, foreign listing status and size.

#### 3.14.1 Financial performance

Better-performing companies are likely to reveal their *good news* (Aerts & Cormier, 2009; Botosan, 2000; Hutton, Miller & Skinner, 2003) and thus financial performance has been linked positively to corporate disclosure (Cormier & Magnan, 1999, 2003; Lang & Lundholm, 1993; McGuire *et al.*, 1988). Financial performance is gauged using an accounting perspective and a capital market perspective.

The accounting measurement, return on assets (ROA) is widely used in accounting disclosure research as a control for firm performance (see, for example, the research of Aerts & Cormier, 2009; Alvarez *et al.*, 2008; Birt *et al.*, 2006; Cahan, Rahman & Perera, 2005; Collett & Hrasky, 2005; Dhaliwal *et al.*, 2009; El-Gazzar, Fornaro & Jacob, 2008; Eng & Mak, 2003; Francis *et al.*, 2008; Francis *et al.*, 2005; Haggard, Martin & Pereira, 2008; Leuz & Verrecchia, 2000; Rankin *et al.*, 2011). ROA is calculated as income before abnormal items<sup>35</sup> at the end of the year (either 2007 or 2009) divided by total assets at the end of the previous financial year (either 2006 or 2008).

Tobin's Q also features in accounting disclosure research (examples are the work of Cahan *et al.*, 2005; Clarkson *et al.*, 2008; Cormier *et al.*, 2009; Haggard *et al.*, 2008). The typical Tobin's Q ratio is measured by 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<sup>36</sup>. A value greater than 1 indicates that the capital market considers the

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<sup>35</sup> Earnings before taxes before abnormal items are still provided by the Aspect Huntley database even though the disclosure of abnormal items has been discontinued under AASB 101. Abnormal items are determined according to the discretion of the Aspect Huntley analyst allocated to the company (Aspect Huntley, 2012).

<sup>36</sup> It is noted that this formula is in reality a variation of the "approximate *q*", created by Chung and Pruitt (1994) using basic financial and accounting information. They found their simplified

company's assets to be greater than their book value. Thus measured, Tobin's Q encompasses investor expectations for company performance based on existing assets. In keeping with several recent studies of voluntary disclosures (for example, Chapple *et al.*, 2011; Clarkson *et al.*, 2008; Moroney *et al.*, 2011), this research measures Tobin's Q in the same way.

### **3.14.2 Audit quality**

Recall that sixteen of the forty-one index items are categorised as *soft* in that they are non-verified assertions by the company about their vision and strategy, environmental profile and environmental initiatives. Big 4 auditors are believed to provide higher quality and more credible audits. Their independent review of unaudited sections of the annual report may increase the perceived general credibility of voluntary GHG emission disclosures. Bar-Yosef & Livnat (1984) suggest that the selection of auditors is a signalling mechanism. This study uses a dichotomous variable assigning a value of 1 if a company engages a Big 4 auditor and 0 otherwise.

### **3.14.3 Age of fixed assets**

Older fixed assets are likely to be less efficient, more costly to operate, and less technically advanced than newer assets, and may be indicative of the company's future earnings prospects. Older assets are associated with lower environmental performance (Freedman & Jaggi, 1992) and are likely to be less efficient in managing GHG emissions than newer fixed assets. These factors could influence a manager's decision to report GHG disclosures.

Measuring the accumulated depreciation of tangible assets divided by gross property plant and equipment gives an indication of the age of the tangible assets. Although there have been conflicting results in prior research and in different theoretical frameworks, a positive direction is expected for the age of fixed assets variable.

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calculation of Tobin's Q to have a 96.6% degree of accuracy with more theoretically correct models. The original Tobin's Q is defined as the ratio of the market value of a firm to the replacement cost of its assets (Chung & Pruitt, 1994).

### 3.14.4 Foreign Listing

Foreign listing is included as a control variable, given the global interest in GHG management and reduction. A greater need for external capital can be indicated by multiple listing, and this may be an explanatory factor (Marston & Shrives, 1991). Foreign listing is measured as a dichotomous variable where corporations only listed on the Australian Stock Exchange are coded 0, and corporations listed on additional stock exchanges are coded 1.

### 3.14.5 Size

Large firms are more politically sensitive and have relatively larger wealth transfers imposed on them (political costs) than smaller firms (Watts & Zimmerman, 1986). Increased disclosures are a means of mitigating potential political costs. Large firms also are likely to have the resources to enable them to voluntarily disclose information (Meek *et al.*, 1995).

Operational measures of firm size are many, although there is some consistency within a particular theoretical research stream. Five operational measures for firm size are number of employees, market capitalisation, sales, income, and assets (Bujaki & Richardson, 1997). Various permutations of these measures are used for the different theoretical constructs. Interestingly, no theoretical reason exists in disclosure studies for any particular measure of size (Hackston & Milne, 1996). Therefore, this thesis emulates numerous disclosure studies (for example, Akhtaruddin & Haron, 2010; Amir & Ziv, 1997; Birt *et al.*, 2006; Bujaki & McConomy, 2002; El-Gazzar *et al.*, 2008; Francis *et al.*, 2005; Hackston & Milne, 1996; Hossain *et al.*, 1995; Kent & Ung, 2003; O'Sullivan *et al.*, 2008; Perera & Jubb, 2011; Sengupta, 1998) in measuring size as the natural log of total assets.

Using the number of employees is not preferred because, unlike the disclosure paper of Boesso and Kamalesh (2007), the focus of this study is not of the management of employee relationships as a major stakeholder group. Market capitalisation is eliminated as a size measure as it is used in the calculation of the financial performance variable, Tobin's Q. Similarly, sales are a component of the competition variable,

Herfindahl Index, and an element in calculating income. Income is used in the calculation of the financial performance variable Return on Assets, and although total assets are also a component of this variable, intuition suggests that logging the total assets is least likely to create multicollinearity issues.

### **3.15 Econometric Modelling**

Four econometric models are tested in this research. The first model uses the continuous variable, indexed disclosures, as the dependent variable and linear regression and Tobit regression techniques are applied. The second model has as its dependent variable the voluntary GHG disclosure behaviour of the Australian-listed companies for 2007 and 2009. Companies are placed in one of two categories, those that do disclose and those that do not disclose GHG information. Logistic regression is applied due to this variable's categorical nature (1 if disclosures are made, 0 otherwise). The final two models focus on the disclosing companies. Analysis is firstly conducted with the dependent variable being the number of disclosures made (Model 3), and subsequently, with the dependent variable as the ratio of hard to total disclosures to measure the quality of the disclosures (Model 4).

Robustness tests, although not forming part of the main statistical analysis, are performed and reported upon in a later section.

#### **3.15.1 Model 1**

Section 3.12 described how the content-quality of the 2007 and 2009 voluntary GHG disclosures made in annual reports and stand-alone sustainability reports of Australian publicly-listed companies are indexed. The preceding section operationalized the proxy measures for information asymmetry, agency theory, political costs, proprietary costs, and control variables. From these, the following model is specified to test the hypotheses developed in Chapter 2.

$$\text{VD} = \beta_0 + \beta_1 \text{ Borrowings next year} + \beta_2 \text{ Equity issued next year} + \beta_3 \text{ Leverage} + \beta_4 \text{ Ownership Concentration} + \beta_5 \text{ Competition} + \beta_6 \text{ Industry} + \beta_7 \text{ ROA} + \beta_8 \text{ Tobin's Q} + \beta_9 \text{ Audit Quality} + \beta_{10} \text{ Age of Fixed Assets} + \beta_{11} \text{ Foreign Listing Status} + \beta_{12} \text{ Size} + e$$

Where:

VD = the score of voluntary GHG disclosures based on annual reports and stand-alone sustainability reports.

Borrowings next year = the natural log of proceeds from borrowings in the following year.

Equity issued next year = the natural log of proceeds from issue of equity in the following year.

Leverage = the ratio of total liabilities to total assets.

Ownership Concentration = the percentage of ownership of the firm held by shareholders who own 5 per cent or more of the total shareholding.

Competition = the degree of competition in the industry sub-sector calculated as one minus the Herfindahl Index.

GICS sector = industry fixed effects; 1 = if the company is a member of the GICS sector - consumer discretionary, 0 otherwise; 1 = if the company is a member of the GICS sector - consumer staples, 0 otherwise; 1 = if the company is a member of the GICS sector - energy, 0 otherwise; 1 = if the company is a member of the GICS sector - financials, 0 otherwise; 1 = if the company is a member of the GICS sector - health care, 0 otherwise; 1 = if the company is a member of the GICS sector - industrials, 0 otherwise; 1 = if the company is a member of the GICS sector - information technology, 0; 1 = if the company is a member of the GICS sector - telecommunication services consumer staples, 0 otherwise.

ROA = income before abnormal items at the end of the year (either 2007 or 2009) divided by total assets at the end of the previous financial year (either 2006 or 2008).

Tobin's Q = the sum of market value of common equity, book value of preferred stock and book value of total debt, all divided by book value of total assets.

Audit Quality = a dichotomous variable where 1 equals the engagement of a Big 4 auditor, 0 otherwise.

Age of Fixed Assets = accumulated depreciation of property plant and equipment divided by gross property plant and equipment.

Foreign Listing Status = a dichotomous variable where 1 equals a listing on an overseas stock exchange in addition to the ASX, 0 otherwise.

Size = the natural log of total assets.

Model 1 is statistically analysed using multiple regression and Tobit regression techniques.

### 3.15.2 Model 2

This model features a categorical variable for voluntary disclosure as its dependent variable.

$$VD = \beta_0 + \beta_1 \text{ Borrowings next year} + \beta_2 \text{ Equity issued next year} + \beta_3 \text{ Leverage} + \beta_4 \text{ Ownership Concentration} + \beta_5 \text{ Competition} + \beta_6 \text{ Industry} + \beta_7 \text{ ROA} + \beta_8 \text{ Tobin's Q} + \beta_9 \text{ Audit Quality} + \beta_{10} \text{ Age of Fixed Assets} + \beta_{11} \text{ Foreign Listing Status} + \beta_{12} \text{ Size} + e$$

Where:

VD = a dichotomous variable for voluntary GHG disclosures for 2997 (2009); 1 if GHG disclosures were made, 0 otherwise.

Borrowings next year = the natural log of proceeds from borrowings in the following year.

Equity issued next year = the natural log of proceeds from issue of equity in the following year.

Leverage = the ratio of total liabilities to total assets.

Ownership Concentration = the percentage of ownership of the firm held by shareholders who own 5 per cent or more of the total shareholding.

Competition = the degree of competition in the industry sub-sector calculated as one minus the Herfindahl Index.

Industry = industry fixed effects; 1 = if the company is a member of the GICS sector - consumer discretionary, 0 otherwise; 1 = if the company is a member of the GICS sector - consumer staples, 0 otherwise; 1 = if the company is a member of the GICS sector - energy, 0 otherwise; 1 = if the company is a member of the GICS sector - financials, 0 otherwise; 1 = if the company is a member of the GICS sector - health care, 0 otherwise; 1 = if the company is a member of the GICS sector - industrials, 0 otherwise; 1 = if the company is a member of the GICS sector - information technology, 0; 1 = if the company is a member of the GICS sector - telecommunication services consumer staples, 0 otherwise.

ROA = income before abnormal items at the end of the year (either 2007 or 2009) divided by total assets at the end of the previous financial year (either 2006 or 2008).

Tobin's Q = the sum of market value of common equity, book value of preferred stock and book value of total debt, all divided by book value of total assets.

Audit Quality = a dichotomous variable where 1 equals the engagement of a Big 4 auditor, 0 otherwise.

Age of Fixed Assets = accumulated depreciation of property plant and equipment divided by gross property plant and equipment.

Foreign Listing Status = a dichotomous variable where 1 equals a listing on an overseas stock exchange in addition to the ASX, 0 otherwise.

Size = the natural log of total assets.

### **3.15.3 Model 3**

The third model is concerned with disclosing companies and applies multiple regression to this subsample. Model 3 is as follows:

$$VD = \beta_0 + \beta_1 \text{ Borrowings next year} + \beta_2 \text{ Equity issued next year} + \beta_3 \text{ Leverage} + \beta_4 \text{ Ownership Concentration} + \beta_5 \text{ Competition} + \beta_6 \text{ Industry} + \beta_7 \text{ ROA} + \beta_8 \text{ Tobin's Q} + \beta_9 \text{ Audit Quality} + \beta_{10} \text{ Age of Fixed Assets} + \beta_{11} \text{ Foreign Listing Status} + \beta_{12} \text{ Size} + e$$

Where:

VD = the indexed GHG disclosures based on annual reports and stand-alone sustainability reports for 2007 (2009) for disclosing companies only.

Borrowings next year = the natural log of proceeds from borrowings in the following year.

Equity issued next year = the natural log of proceeds from issue of equity in the following year.

Leverage = the ratio of total liabilities to total assets.

Ownership Concentration = the percentage of ownership of the firm held by shareholders who own 5 per cent or more of the total shareholding.

Competition = the degree of competition in the industry sub-sector calculated as one minus the Herfindahl Index.

Industry = industry fixed effects; 1 = if the company is a member of the GICS sector - consumer discretionary, 0 otherwise; 1 = if the company is a member of the GICS sector - consumer staples, 0 otherwise; 1 = if the company is a member of the GICS sector - energy, 0 otherwise; 1 = if the company is a member of the GICS sector - financials, 0 otherwise; 1 = if the company is a member of the GICS sector - health care, 0 otherwise; 1 = if the company is a member of the GICS sector - industrials, 0 otherwise; 1 = if the company is a member of the GICS sector - information technology, 0; 1 = if the company is a member of the GICS sector - telecommunication services consumer staples, 0 otherwise.

ROA = income before abnormal items at the end of the year (either 2007 or 2009) divided by total assets at the end of the previous financial year (either 2006 or 2008).

Tobin's Q = the sum of market value of common equity, book value of preferred stock and book value of total debt, all divided by book value of total assets.

Audit Quality = a dichotomous variable where 1 equals the engagement of a Big 4 auditor, 0 otherwise.

Age of Fixed Assets = accumulated depreciation of property plant and equipment divided by gross property plant and equipment.

Foreign Listing Status = a dichotomous variable where 1 equals a listing on an overseas stock exchange in addition to the ASX, 0 otherwise.

Size = the natural log of total assets.

#### **3.15.4 Model 4**

The final model considers the quality of the disclosures made and takes as its dependent variable the ratio of hard to total disclosures. Recall that hard disclosures are verifiable and are not easily replicated. Model 4 follows:

$$VD = \beta_0 + \beta_1 \text{ Borrowings next year} + \beta_2 \text{ Equity issued next year} + \beta_3 \text{ Leverage} + \beta_4 \text{ Ownership Concentration} + \beta_5 \text{ Competition} + \beta_6 \text{ Industry} + \beta_7 \text{ ROA} + \beta_8 \text{ Tobin's Q} + \beta_9 \text{ Audit Quality} + \beta_{10} \text{ Age of Fixed Assets} + \beta_{11} \text{ Foreign Listing Status} + \beta_{12} \text{ Size} + e$$

Where:

VD = the ratio of hard to total score of voluntary GHG disclosures based on annual reports and stand-alone sustainability reports, restricted to disclosing companies.

Borrowings next year = the natural log of proceeds from borrowings in the following year.

Equity issued next year = the natural log of proceeds from issue of equity in the following year.

Leverage = the ratio of total liabilities to total assets.

Ownership Concentration = the percentage of ownership of the firm held by shareholders who own 5 per cent or more of the total shareholding.

Competition = the degree of competition in the industry sub-sector calculated as one minus the Herfindahl Index.

Industry = industry fixed effects; 1= if the company is a member of the GICS sector - consumer discretionary, 0 otherwise; 1 = if the company is a member of the GICS sector - consumer staples, 0 otherwise; 1 = if the company is a member of the GICS sector - energy, 0 otherwise; 1 = if the company is a member of the GICS sector - financials, 0 otherwise; 1 = if the company is a member of the GICS sector - health care, 0 otherwise; 1 = if the company is a member of the GICS sector - industrials, 0 otherwise; 1 = if the company is a member of the GICS sector - information technology, 0; 1 = if the company is a member of the GICS sector - telecommunication services consumer staples, 0 otherwise.

ROA = income before abnormal items at the end of the year (either 2007 or 2009) divided by total assets at the end of the previous financial year (either 2006 or 2008).

Tobin's Q = the sum of market value of common equity, book value of preferred stock and book value of total debt, all divided by book value of total assets.

Audit Quality = a dichotomous variable where 1 equals the engagement of a Big 4 auditor, 0 otherwise.

Age of Fixed Assets = accumulated depreciation of property plant and equipment divided by gross property plant and equipment.

Foreign Listing Status = a dichotomous variable where 1 equals a listing on an overseas stock exchange in addition to the ASX, 0 otherwise.

Size = the natural log of total assets.

### **3.16 Summary**

This chapter described the sample, data studied, the methodology adopted, and the variables of interest in this investigation into the voluntary GHG disclosures of Australian listed-companies in 2007 and 2009. Four models for analysis were presented with alternate dependent variables and thus requiring the application of diverse regression techniques. Descriptive statistics are presented in the next chapter and results of analyses are discussed in Chapter 5.

## Chapter 4 Descriptive Statistics

### 4.1 Introduction

This study seeks to identify the motivating factors for companies making voluntary greenhouse gas emission (GHG) disclosures in their annual reports and stand-alone sustainability reports. Chapter 2 developed hypotheses derived from information asymmetry, agency, political cost and proprietary costs theories. It is proposed that taking measures to reduce information asymmetry by disclosing information about GHG performance allows capital market participants to better evaluate the future earnings potential of the company. Additionally, it is proposed that political cost pressures arising from carbon emission sensitivity are reduced when greater corporate transparency and accountability exists. In contrast, however, is the proprietary cost consideration that more disclosures may serve to the detriment of a company's competitive position in the product market.

Chapter 3 describes the research methodology used to measure the dependent<sup>37</sup>, independent and control variables and describes the basic model for statistical testing.

In this chapter the disclosure index and the descriptive statistics for the disclosed items are presented and discussed in Sections 4.2 to 4.5. Section 4.6 summarises the disclosure index findings. In Section 4.7 the results of reliability testing are reported. Descriptive statistics for the sample companies are presented in Section 4.8.

### 4.2 Disclosure Index

Two sources of disclosures are examined and these are those in the companies' annual reports and stand-alone sustainability reports. In 2007, 227 companies report GHG information in their annual reports, and 27 in their stand-alone sustainability reports. In 2009, GHG information is reported in 388 company annual reports and 43

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<sup>37</sup> Companies' disclosures were only collected when they made statements that referred to greenhouse gas emissions, carbon emissions, and/or CO<sub>2</sub> emissions or with specific statements about the NGER Act 2007 (Cth). This index measures the quality of GHG emission information by considering the company's governance system, external verification of systems and initiatives, environmental spending, strategic objectives, environmental profile and initiatives, as well as actual GHG performance data.

stand-alone sustainability reports. In total, 228 companies make GHG disclosures in either or both types of reports in 2007, and 390 in 2009<sup>38</sup>.

The categories making up the disclosure index permit an inference of the quality of those disclosures. Hard disclosures are statements made about GHG performance and management that are able to be substantiated through external verification. Soft disclosures are claims that do not have this third party oversight.

A maximum score of 25 is possible for statements that fit the hard disclosure category, and a maximum score of 16 is possible for statements matching the soft disclosure category. Hard disclosures are discussed first in Section 4.3. A discussion of soft disclosures follows in Section 4.4, and the aggregated disclosures are discussed in Section 4.5.

### **4.3 Hard Disclosures**

Table 4-1 shows the index of hard voluntary greenhouse disclosures found in companies' annual reports and stand-alone sustainability reports for 2007 and 2009. In this section, hard disclosures concerning greenhouse gas emission performance and management of ASX-listed companies for 2007 and 2009 obtained from annual reports are discussed first, and those made in sustainability reports are discussed second.

The hard disclosure category comprises statements grouped into four sub-categories: A1 Governance structure and management systems; A2 Credibility; A3 GHG performance indicators; and A4 Environmental spending. These are presented in Table 4-1 in Panels A, B, C and D respectively.

#### **Annual Reports**

In 2007 (2009) the highest annual report score for companies making statements that correspond with the hard disclosure category is 12 (10), the lowest<sup>39</sup> is 0 (0). In 2007, 81.11 per cent of companies making voluntary GHG disclosures in their annual

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<sup>38</sup> In 2007, one company makes GHG disclosures only in their sustainability report. Two companies make GHG disclosures in their sustainability reports only in 2009.

<sup>39</sup> Note that the lowest score for each hard category for each year is zero for annual report disclosures. It is therefore not reported separately again in this discussion.

reports make hard disclosures. Some 54.87 per cent of companies make the same type of disclosures in 2009. While the proportion of disclosing companies with verifiable disclosures is higher in 2007, in absolute terms the 2009 results represent 37 additional companies reporting verifiable information about their governance structure and management systems, external verification or certification of performance or programs, actual GHG performance data, and spending on environmental initiatives in their annual reports.

### **Sustainability Reports**

The second source of disclosures analysed are companies' stand-alone sustainability reports. In 2007, there are 27 stand-alone sustainability reports that are found to include GHG disclosures. This number is greater in 2009, with 43 companies found to report their GHG emission performance and management therein. Results of indexation of hard disclosure items included in these sustainability reports, as presented in Table 4-1, follow.

All companies report hard disclosure items in their sustainability reports for both years (2007, 100 per cent, 2009, 100 per cent). In 2007, the maximum<sup>40</sup> category score achieved for the hard disclosure category is 17, the minimum score is one. In 2009, the highest score is 20, the lowest score is one.

#### **4.3.1 Governance structure and management systems**

Table 4-1, Panel A provides data on governance structure and management systems disclosures. Annual report disclosures are discussed first and sustainability report disclosures follow. The maximum score possible for this category is six.

##### *Annual Reports*

Some 57.14 per cent of disclosing companies provide statements in their annual reports about their governance structure and management systems (item A1) in 2007. In 2009, some 35.64 per cent of companies make disclosures within this category. The highest (lowest) score found for this type of disclosure is four (zero) for both 2007 and

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<sup>40</sup> Recall the maximum score possible for this category is 25.

2009. Some 6.91 (3.08) per cent of disclosing companies report the existence of a department for pollution control and/or management positions for environmental management (item A1.1) in 2007 (2009). More companies have an environmental and/or a public issues committee on the board in 2007 (2009) (item A1.2), with 24.42 (15.90) per cent of disclosing companies providing this information in their annual reports. The proportion of disclosing companies notifying the existence of terms and conditions applicable to suppliers and/or customers regarding environmental practices (item A1.3) is 9.22 (6.92) per cent in 2007 (2009). In 2007 (2009) some 30.41 (14.36) per cent of disclosing companies report stakeholder involvement in setting corporate environmental policies (item A1.4). A total of 13.36 (8.21) per cent of disclosing companies report the implementation of ISO14001 at the plant and/or firm level (item A1.5) in 2007 (2009). Only 4.61 (3.08) per cent of disclosing companies link executive compensation to environmental performance in 2007 (2009) in their annual reports (item A1.6).

### *Sustainability Reports*

In 2007 (2009) some 70.37 (76.74) per cent of disclosing companies make statements concerning their governance structure and management systems (disclosure category A1) in their sustainability reports. Here, the highest<sup>41</sup> (lowest) category score is 5 (0) for both 2007 and 2009.

For five items, 2009 disclosures are greater than those in 2007. Item A1.1, existence of a department for pollution control and/or management positions for environmental management is reported by 18.52 per cent of disclosers in 2007 and 20.93 per cent of disclosers in 2009. Some 33.33 per cent of companies disclosing in 2007 relate the existence of an environmental and/or a public issues committee on the board (item A1.2). The proportion of disclosing companies making these disclosures in 2009 is 44.19 per cent. Statements about the existence of terms and conditions applicable to suppliers and/or customers regarding environmental practices (item A1.3) are made by 29.63 per cent of disclosing companies in 2007 and 39.53 per cent in 2009. Allowing stakeholder involvement in setting corporate environmental policies (item

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<sup>41</sup> Recall the maximum score possible for this category is 6.

A1.4) is reported by 29.63 per cent of companies making disclosures in 2007, and 41.86 per cent in 2009. The implementation of ISO14001 at the plant and/or firm level (A1.5) is an assertion made by 33.33 per cent of disclosing companies in 2007 and 32.56 per cent of disclosing companies in 2009. A statement about executive compensation being linked to environmental performance (item A1.6) is provided by 3.70 per cent of disclosing companies in 2007. Some 4.65 per cent of disclosing companies make this statement in 2009 in their sustainability reports.

### **4.3.2 Credibility**

Table 4-1, Panel B provides data on credibility disclosures. The credibility (disclosure category A2) of companies' disclosures is made up of ten items. Annual report disclosures are discussed first, followed by sustainability report disclosures. It is possible for a company to score 10 for disclosures that fit within this group.

#### *Annual Reports*

The maximum number of annual report statements found to fit within the credibility category is 5 (4) for 2007 (2009). In 2007, some 59.45 per cent of disclosing companies report this information. In comparison, in 2009, 34.36 per cent of companies make these types of disclosures.

Some 3.69 (1.28) per cent of companies report the adoption of GRI sustainability reporting guidelines (item A2.1) in 2007 (2009). Only 0.92 (0.26) per cent of companies state they have independent verification/assurance about environmental information disclosed in the annual report or sustainability report (item A2.2). The number of companies that report having periodic independent verifications/audits on their environmental performance and/or systems (item A2.3) amounts to 13.82 (10.00) per cent in 2007 (2009). Even fewer companies make statements that they have certification of environmental programs by independent agencies (item A2.4), with 10.60 (4.10) per cent telling of this in 2007 (2009). Companies making disclosures about having product certification with respect to environmental impact (item A2.5) comprise 3.69 (3.59) of disclosing companies in 2007 (2009). A total of 22.58 (9.49) per cent of disclosing companies make annual report statements about achieving external environmental performance awards and/or being

included in a sustainability index (item A2.6) in 2007 (2009). Reporting of stakeholder involvement in the environmental disclosure process (item A2.7) is made by 1.38 per cent of disclosing companies in 2007. No companies are found making this type of disclosure in their annual report in 2009. Some 11.52 (4.10) per cent of disclosing companies report participation in voluntary environmental initiatives endorsed by government (item A2.8) in 2007 (2009). Participation in industry specific associations/initiatives to improve environmental practices (item A2.9) is reported by 19.82 (6.92) per cent of companies in their 2007 (2009) annual reports. The final item in this sub-category, participation in other environmental organisations/associations to improve environmental practices (item 2.10) is disclosed by 11.06 (9.74) per cent of companies in 2007 (2009) in their annual reports.

### *Sustainability Reports*

Statements concerning the credibility disclosure category (A2) are made by 92.59 (97.67) per cent of disclosing companies in 2007 (2009) in their sustainability reports. The maximum<sup>42</sup> (minimum) score achieved for this group of disclosures is 7(0) in 2007 and 8 (1) in 2009. Some 48.15 per cent of disclosing companies indicate that they have adopted GRI sustainability reporting guidelines (item A2.1) in 2007. In 2009, this proportion is 74.42 per cent. Assertions of independent verification/assurance about environmental information disclosures (item A2.2) are made by 44.44 (37.21) per cent of disclosing companies in 2007 (2009). Some 29.63 (37.21) per cent of disclosing companies state that they have periodic independent verifications/audits on their environmental performance and/or systems (item A2.3) in 2007 (2009). Obtaining certification of environmental programs by independent agencies (item A2.4) is done by 7.41 (2.33) per cent of disclosing companies in 2007 (2009). The per centage of companies that have their products certified with respect to their environmental impact (item A2.5) is 7.41 per cent in 2007 and in 2009 this rises to 27.91 per cent. Of the 27 (43) companies in 2007 (2009) whose sustainability reports are considered for this index, 66.67 (67.44) per cent state they have received external environmental performance awards and/or inclusion in a sustainability index (item A2.6). Some 3.70

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<sup>42</sup> Recall the maximum score possible for this category is 10.

(25.58) per cent of these disclosing companies have stakeholder involvement in the environmental disclosure process (item A2.7) in 2007 (2009). Participation in voluntary environmental initiatives endorsed by governments (item A2.8) is asserted by 33.33 (18.60) per cent of disclosing companies in 2007 (2009). Participation in industry specific associations/initiatives to improve environmental practices (item A2.9) is stated by 33.33 (27.91) per cent of disclosing companies in 2007 (2009). Statements concerning participation in other environmental organisations/associations to improve environmental practices (item A2.10) are made by 55.56 (65.12) per cent of disclosers in their sustainability reports.

### **4.3.3 GHG performance indicators**

The GHG performance indicators category (disclosure category A3) is concerned with factual data about GHG emissions or energy usage. Indexing results are presented in Panel C, Table 4-1. This category comprises six items and has a maximum score of six. Annual report disclosures are presented first, and sustainability report disclosures follow.

#### *Annual Reports*

In both years companies reporting GHG information in their annual reports achieve a maximum score of five. Some 25.81 (17.44) per cent of companies provide GHG performance indicators in 2007 (2009) in their annual reports. The presentation of performance data (item A3.1) is made by 25.35 (16.41) per cent of companies in 2007 (2009). Performance data is presented relative to peers/rivals (item A3.2) by 1.38 (0.26) per cent of disclosing companies in 2007 (2009). In 2007 some 8.29 per cent of disclosing companies provide GHG performance data relative to previous periods (item A3.3). This category of information is presented by 7.44 per cent of disclosing companies in 2009. The presentation of performance data relative to targets (item A3.4) is made by 4.15 (2.05) per cent of disclosing companies in 2007 (2009). Performance data in absolute and normalised form (item A3.5) is presented by 4.15 (2.31) per cent of disclosing companies in 2007 (2009). Disaggregation of performance data to the plant, business unit, or geographic segment (item A3.6) is reported by 4.15 (5.13) per cent of disclosing companies in 2007 (2009).

### *Sustainability Reports*

Sustainability report statements that fall within the third category of hard disclosure items, GHG performance indicators, have a maximum<sup>43</sup> (minimum) score of 5 (0) in both years. The respective per centages of participating disclosers are 88.89 and 86.05 per centage for 2007 and 2009. Some 88.89 (86.05) per cent of disclosing companies present performance data (item A3.1) in 2007 (2009). The presentation of performance data relative to peers/rivals or industry (item A3.2) is carried out by 3.70 (0.00) per cent of disclosers in 2007 (2009). Providing performance data relative to previous periods (item A3.3) is done by 81.48 (76.74) per cent of disclosing companies in 2007 (2009). Presenting performance data relative to targets (item A3.4) is carried out by 33.33 (30.23) per cent of disclosers in 2007 (2009). Performance data, presented in absolute and normalised form (item A3.5), is provided by 55.56 (55.81) per cent of disclosing companies in 2007 (2009). Disaggregating performance data at the plant, business unit, or geographic segment (item A3.6) is reported in sustainability reports by 66.67 (72.09) per cent of disclosers in 2007 (2009).

#### **4.3.4 Environmental spending**

The final hard disclosure category is concerned with environmental spending (disclosure category A4, Panel D, Table 4-1). The reporting of dollar amounts saved by environment initiatives, or spent on technologies, research and development, or innovations that enhance environmental performance and/or efficiency, and paid as environmental fines is in evidence. The maximum score possible is three. Disclosures made in annual reports are discussed first; sustainability report disclosures are discussed afterwards.

### *Annual Reports*

The maximum score of three is achieved by the 2007 disclosing companies making annual report disclosures. In 2009, however, the maximum score achieved is two for GHG disclosing companies. In 2007 (2009) some 11.52 (4.62) per cent of disclosing companies report information that fits into this category. Some 5.07 (0.77)

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<sup>43</sup> Recall the maximum score possible for this category is 6.

per cent of 2007 (2009) disclosing companies report the dollar amount of savings arising from environmental initiatives by their company (item A4.1). The per cent of companies disclosing the amount spent on technologies, research and development and/or innovations to enhance environmental performance and/or efficiency (item A4.2) is 4.15 per cent in 2007 and 2.05 per cent in 2009. In 2007, 5.07 per cent of disclosers reveal the amount spent on fines related to environmental issues (item A4.3). There are only 2.05 per cent of disclosing companies making these types of disclosures in 2009 in their annual reports.

### *Sustainability Reports*

Some 44.44 (51.16) per cent of disclosing companies report statements about their environmental spending in their sustainability reports. The maximum<sup>44</sup> (minimum) score achieved in 2007 is 2 (0) and in 2009 the maximum (minimum) score is 3 (0). A summary of dollar savings arising from environmental initiatives to the company (item A4.1) is provided by 7.41 (13.95) per cent of disclosing companies in 2007 (2009). The per cent of disclosers indicating the amount spent on technologies, research and development and/or innovations to enhance environmental performance and/or efficiency (item A4.2) is 33.33 per cent in 2007 and 16.28 per cent in 2009. Some 14.81 (32.56) per cent of disclosers detail the amount spent on fines related to environmental issues (item A4.3) in 2007 (2009) in their sustainability reports.

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<sup>44</sup> Recall the maximum score possible for this category is 3.

**Table 4-1 Index of Quality of Voluntary Greenhouse Gas Emission Disclosures<sup>45</sup> – Hard Disclosure Items**

Disclosure Category		2007				2009			
		Annual Reports		Sustainability Reports		Annual Reports		Sustainability Reports	
		Percentage of firms attaining the item (%) (n=217)	Highest (lowest) Category Score	Percentage of firms attaining the item (%) (n=27)	Highest (lowest) Category Score	Percentage of firms attaining the item (%) (n=388)	Highest (lowest) Category Score	Percentage of firms attaining the item (%) (n=43)	Highest (lowest) Category Score
<b>HARD DISCLOSURE ITEMS</b>		<b>81.11</b>	<b>12(0)</b>	<b>100.00</b>	<b>17(1)</b>	<b>54.87</b>	<b>10(0)</b>	<b>100.00</b>	<b>20(1)</b>
<b>Panel A</b>									
<b>A1</b>	<b>Governance structure and management systems (max score is 6)</b>	<b>57.14</b>	<b>4(0)</b>	<b>70.37</b>	<b>5(0)</b>	<b>35.64</b>	<b>4(0)</b>	<b>76.74</b>	<b>5(0)</b>
A1.1	Existence of a department for pollution control and/or management positions for environmental management	6.91		18.52		3.08		20.93	
A1.2	Existence of an environmental and/or a public issues committee on the board	24.42		33.33		15.90		44.19	
A1.3	Existence of terms and conditions applicable to suppliers and/or customers regarding environmental practices	9.22		29.63		6.92		39.53	
A1.4	Stakeholder involvement in setting corporate environmental policies	30.41		29.63		14.36		41.86	
A1.5	Implementation of ISO14001 at the plant and/or firm level	13.36		33.33		8.21		32.56	
A1.6	Executive compensation is linked to environmental performance	4.61		3.70		3.08		4.65	
<b>Panel B</b>									
<b>A2</b>	<b>Credibility (max score is 10)</b>	<b>59.45</b>	<b>5(0)</b>	<b>92.59</b>	<b>7(0)</b>	<b>34.36</b>	<b>4(0)</b>	<b>97.67</b>	<b>8(1)</b>
A2.1	Adoption of GRI sustainability reporting guidelines	3.69		48.15		1.28		74.42	

<sup>45</sup> Companies' disclosures were only collected when they made statements that referred to greenhouse gas emissions, carbon emissions, and/or CO2 emissions or with specific statements about the NGER Act 2007 (Cth). This index measures the quality of GHG emission information by considering the company's governance system, external verification of systems and initiatives, environmental spending, strategic objectives, environmental profile and initiatives, as well as actual GHG performance data.

Disclosure Category		2007				2009			
		Annual Reports		Sustainability Reports		Annual Reports		Sustainability Reports	
		Percentage of firms attaining the item (%) (n=217)	Highest (lowest) Category Score	Percentage of firms attaining the item (%) (n=27)	Highest (lowest) Category Score	Percentage of firms attaining the item (%) (n=388)	Highest (lowest) Category Score	Percentage of firms attaining the item (%) (n=43)	Highest (lowest) Category Score
A2.2	Independent verification/assurance about environmental information disclosed in the annual report or sustainability report	0.92		44.44		0.26		37.21	
A2.3	Periodic independent verifications/audits on environmental performance and/or systems	13.82		29.63		10.00		37.21	
A2.4	Certification of environmental programs by independent agencies	10.60		7.41		4.10		2.33	
A2.5	Product certification with respect to environmental impact	3.69		7.41		3.59		27.91	
A2.6	External environmental performance awards and/or inclusion in a sustainability index	22.58		66.67		9.49		67.44	
A2.7	Stakeholder involvement in the environmental disclosure process	1.38		3.70		0.00		25.58	
A2.8	Participation in voluntary environmental initiatives endorsed by government	11.52		33.33		4.10		18.60	
A2.9	Participation in industry specific associations/initiatives to improve environmental practices	19.82		33.33		6.92		27.91	
A2.10	Participation in other environmental organisations/associations to improve environmental practices (if not awarded under 8 or 9 above)	11.06		55.56		9.74		65.12	
<b>Panel C</b>									
<b>A3</b>	<b>GHG performance indicators (max score is 6)</b>	<b>25.81</b>	<b>5(0)</b>	<b>88.89</b>	<b>5(0)</b>	<b>17.44</b>	<b>5(0)</b>	<b>86.05</b>	<b>5(0)</b>
A3.1	Performance data is presented	25.35		88.89		16.41		86.05	
A3.2	Performance data is presented relative to peers/rivals or industry	1.38		3.70		0.26		0.00	
A3.3	Performance data is presented relative to previous periods (trend analysis)	8.29		81.48		7.44		76.74	

Disclosure Category		2007				2009			
		Annual Reports		Sustainability Reports		Annual Reports		Sustainability Reports	
		Percentage of firms attaining the item (%) (n=217)	Highest (lowest) Category Score	Percentage of firms attaining the item (%) (n=27)	Highest (lowest) Category Score	Percentage of firms attaining the item (%) (n=388)	Highest (lowest) Category Score	Percentage of firms attaining the item (%) (n=43)	Highest (lowest) Category Score
A3.4	Performance data is presented relative to targets	4.15		33.33		2.05		30.23	
A3.5	Performance data is presented in absolute and normalised form	4.15		55.56		2.31		55.81	
A3.6	Performance data is presented at disaggregate level (i.e., plant, business unit, geographic segment)	4.15		66.67		5.13		72.09	
<b>Panel D</b>									
<b>A4</b>	<b>Environmental spending (max score is 3)</b>	<b>11.52</b>	<b>3(0)</b>	<b>44.44</b>	<b>2(0)</b>	<b>4.62</b>	<b>2(0)</b>	<b>51.16</b>	<b>3(0)</b>
A4.1	Summary of dollar savings arising from environmental initiatives to the company	5.07		7.41		0.77		13.95	
A4.2	Amount spent on technologies, R&D and/or innovations to enhance environmental performance and/or efficiency	4.15		33.33		2.05		16.28	
A4.3	Amount spent on fines related to environmental issues	5.07		14.81		2.05		32.56	

#### **4.4 Soft Disclosures**

Three types of disclosures encompass the soft disclosure items. Soft disclosures are claims made without supporting evidence from third party sources. They are concerned with claims about corporate vision and strategy (disclosure category A5), corporate environmental profile (disclosure category A6) and environmental initiatives (disclosure category A7). The total score possible is 16, being 6 for vision and strategy claims, 4 for environmental profile assertions and 6 for statements covering environmental initiatives. Table 4-2, Panels A, B, and C present the findings. Discussions on annual report disclosures are presented first, followed by sustainability report disclosures, for each soft disclosure category.

The highest (lowest<sup>46</sup>) score in the soft categories made in annual reports in 2007 is 10 (0); in 2009 this score is 7 (0). Some 96.77 per cent of companies make soft disclosures in 2007. A similar proportion is observed in 2009 with 96.41 per cent of disclosing companies making statements about their vision and strategy, environmental profile and/or environmental initiatives.

With regard to sustainability reports, soft disclosure items are made by 100 per cent of disclosing companies in 2007 and 97.67 per cent of disclosing companies in 2009. The highest (lowest) scores are 12 (1) in 2007 and 12 (0) in 2009.

##### **4.4.1 Vision and strategy claims**

Findings of vision and strategy claims are reported in disclosure category A5, Table 4-2, Panel A. Some six items comprise this category, making a maximum (minimum) possible score of 6 (0). Annual reports disclosures are discussed first.

##### *Annual Reports*

Vision and strategy claims are made by 92.63 (81.03) per cent of disclosing companies in annual reports. These scores are achieved by disclosing companies in both years.

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<sup>46</sup> The lowest soft disclosure score for the three categories is zero for both years. Minimum scores are not referred to again in this discussion.

The proportion of companies where the CEO's statement to shareholders and/or stakeholders (item A5.1) includes environmental performance information is 11.98 per cent in 2007 and 11.79 per cent in 2009. In 2007, 62.21 per cent of disclosing companies make a statement about their corporate environmental policy, values and principles, and environmental codes of conduct (item A5.2). The same types of disclosures are made by 52.05 per cent of disclosing companies in 2009. Statements about formal management systems regarding environmental risk and performance (item A5.3) are reported by 55.76 per cent of companies making GHG disclosures in 2007. Some 48.46 per cent of disclosing companies do so in 2009. A statement that the firm undertakes periodic reviews and evaluations of its environmental performance (item A5.4) is put forward by 35.94 (44.10) per cent of disclosing companies in 2007 (2009). The reporting of measurable goals in terms of future environmental performance (item A5.5) is made in 2007 (2009) by 13.36 (6.15) per cent of disclosing companies. The final index item for this category, a statement about specific environmental innovations and/or new technologies (item A5.6) is reported by 47.47 (17.69) of annual report disclosers in 2007 (2009).

### *Sustainability Reports*

The maximum (minimum) score achieved by sustainability report disclosing companies is 6 (1) in 2007 and 6 (0) in 2009. In 2007, 100 per cent of disclosing companies make vision and strategy claims in this type of report. In 2009, this figure is 96.67 per cent.

CEO statements on environmental performance in a letter to shareholders and/or stakeholders (item A5.1) are made by 55.56 (23.26) per cent of disclosing companies. Statements of corporate environmental policy, values and principles and environmental codes of conduct (item A5.2) are given by 92.59 (93.02) of disclosers in 2007 (2009). Some 62.96 (69.77) per cent of disclosers make statements about formal management systems regarding environmental risk and performance (item A5.3) in 2007 (2009). Some 29.63 (44.19) per cent of disclosing companies provide a statement that the firm undertakes periodic reviews and evaluations of its environmental performance (item A5.4) in 2007 (2009). The provision of a statement concerning measurable goals in terms of future environmental performance (item A5.5) is made by 48.15 (53.49) per

cent of disclosing companies. Details of specific environmental innovations and/or new technologies (item A5.6) are given by 59.26 (72.09) per cent of disclosers in 2007 (2009) in their sustainability reports.

#### **4.4.2 Environmental profile**

Disclosure category A6 covers the corporation's environmental profile and consists of four items. The maximum score possible is four. Findings are presented in Table 4-2, Panel B. Discussions on annual report disclosures are presented first, followed by discussions on sustainability report disclosures.

##### *Annual Reports*

The maximum score obtained by companies making environmental profile disclosures in annual reports in both years is two. Some 25.35 per cent of disclosing companies make claims about their environmental profile in 2007. This proportion is much higher in 2009, with 45.13 per cent of companies setting forth disclosures of this nature. Some 1.38 (38.49) per cent of companies make statements about their obligations regarding climate change regulations (item A6.1) in 2007 (2009). Providing an overview of the environmental impact of the industry (item A6.2) is carried out by some 4.15 (2.05) per cent of companies in 2007 (2009). An overview of how the business operations and/or products and services impact the environment (item A6.3) is given by 21.66 (5.13) per cent of disclosers in 2007 (2009). Very little evidence is found of companies giving an overview of corporate environmental performance relative to industry peers (item A6.4). Only 0.46 per cent of companies report this information in 2007 and no companies report this in 2009.

##### *Sustainability Reports*

The maximum<sup>47</sup> (minimum) scores achieved by companies making environmental profiles in sustainability reports are 2 (0) in 2007 and 2 (0) in 2009. A total of 44.44 per cent of disclosers make statements in this category in 2007. In 2009 this rises to 62.79 per cent. Some 37.04 (51.16) per cent of disclosing companies make

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<sup>47</sup> Recall the maximum score possible for this category is 4.

statements about the firm's obligations regarding climate change regulations (item A6.1) in 2007 (2009). An overview of environmental impact of the industry (item A6.2) is provided by 3.70 (2.33) per cent of disclosers in 2007 (2009). A statement giving an overview of how the business operations and/or products and services impact the environment (item A6.3) is provided by 14.81 (23.26) per cent of disclosing companies in 2007 (2009). No companies provide an overview of corporate environmental performance relative to industry peers in 2007 or 2009 in their sustainability reports.

#### **4.4.3 Environmental initiatives**

The final category of soft disclosures is about corporate environmental initiatives (disclosure category A7). Some six statement types make up this category and therefore the maximum score possible is six. Table 4-2, Panel C, provides the findings. Annual report disclosures lead the discussion for this category, followed by sustainability report disclosures.

##### *Annual Reports*

In both years, the maximum score for annual report disclosures relating to environmental initiatives is three. There are 31.34 per cent of disclosing companies making statements about their environmental initiatives in 2007. This proportion is 17.95 per cent in 2009.

Some 4.15 (3.08) per cent of companies provide a substantive description of employee training in environmental management and operations (item A7.1) in 2007 (2009). In 2007 no companies reveal the existence of response plans in case of environmental accidents (item A7.2), but 0.77 per cent do in 2009. Internal environmental awards (item A7.3) are provided by 0.92 (0.26) per cent of disclosers in 2007 (2009). Some 15.67 (12.56) per cent of disclosing companies state that they carry out internal environmental audits (item A7.4) in 2007 (2009). In 2007 (2009), some 1.38 (0.26) per cent of disclosing companies indicate that their environmental programs are internally certified (item A7.5). Community involvement and/or donations related to the environment (item A7.6) is reported by 13.82 (4.10) per cent of disclosing companies in 2007 (2009) in their annual reports.

### *Sustainability Reports*

Environmental initiative statements are made in sustainability reports by some 66.67 (86.05) per cent of disclosing companies in 2007 (2009). The maximum<sup>48</sup> (minimum) score obtained is 5 (0) for both years. In 2007, some 14.81 per cent of companies provide a substantive description of employee training in environmental management and operations (item A7.1). The comparable figure for 2009 is 34.88 per cent. Information about the existence of response plans in case of environmental accidents (item A7.2) is provided by 14.81 per cent of disclosers in 2007 and 13.95 per cent of disclosers in 2009. Internal environmental awards (A7.3) are a feature of some 7.41 (11.63) per cent of disclosing companies in 2007 (2009). Some 33.33 (32.56) per cent of disclosers carry out internal environmental audits (item A7.4) in 2007 (2009). In 2007, 3.70 per cent of disclosing companies make a statement about internal certification of environmental programs (item A7.5). No companies report this in their 2009 sustainability reports. Community involvement and/or donations related to the environment (item A7.6) is asserted by some 55.56 (67.44) per cent of sustainability report disclosers in 2007 (2009).

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<sup>48</sup> Recall the maximum score possible for this category is 6.

**Table 4-2 Index of Quality of Voluntary Greenhouse Gas Emission Disclosures<sup>49</sup> – Soft Disclosure Items**

		2007				2009			
		Annual Reports		Sustainability Reports		Annual Reports		Sustainability Reports	
Disclosure Category		Percentage of firms attaining the item (%) (n=217)	Highest (lowest) Category Score	Percentage of firms attaining the item (%) (n=27)	Highest (lowest) Category Score	Percentage of firms attaining the item (%) (n=388)	Highest (lowest) Category Score	Percentage of firms attaining the item (%) (n=43)	Highest (lowest) Category Score
<b>SOFT DISCLOSURE ITEMS</b>		<b>96.77</b>	<b>10(0)</b>	<b>100.00</b>	<b>12(1)</b>	<b>96.41</b>	<b>7(0)</b>	<b>97.67</b>	<b>12(0)</b>
<b>Panel A</b>									
<b>A5</b>	<b>Vision and strategy claims (max score is 6)</b>	<b>92.63</b>	<b>6(0)</b>	<b>100.00</b>	<b>6(1)</b>	<b>81.03</b>	<b>6(0)</b>	<b>97.67</b>	<b>6(0)</b>
A5.1	CEO statement on environmental performance in letter to shareholders and/or stakeholders	11.98		55.56		11.79		23.26	
A5.2	A statement of corporate environmental policy, values and principles, environmental codes of conduct	62.21		92.59		52.05		93.02	
A5.3	A statement about formal management systems regarding environmental risk and performance	55.76		62.96		48.46		69.77	
A5.4	A statement that the firm undertakes periodic reviews and evaluations of its environmental performance	35.94		29.63		44.10		44.19	
A5.5	A statement of measurable goals in terms of future environmental performance (if not awarded under A3)	13.36		48.15		6.15		53.49	
A5.6	A statement about specific environmental innovations and/or new technologies	47.47		59.26		17.69		72.09	
<b>Panel B</b>									
<b>A6</b>	<b>Environmental profile (max score is 4)</b>	<b>25.35</b>	<b>2(0)</b>	<b>44.44</b>	<b>2(0)</b>	<b>45.13</b>	<b>2(0)</b>	<b>62.79</b>	<b>2(0)</b>

<sup>49</sup> Companies' disclosures were only collected when they made statements that referred to greenhouse gas emissions, carbon emissions, and/or CO2 emissions or with specific statements about the NGER Act 2007 (Cth). This index measures the quality of GHG emission information by considering the company's governance system, external verification of systems and initiatives, environmental spending, strategic objectives, environmental profile and initiatives, as well as actual GHG performance data.

Disclosure Category		2007				2009			
		Annual Reports		Sustainability Reports		Annual Reports		Sustainability Reports	
		Percentage of firms attaining the item (%) (n=217)	Highest (lowest) Category Score	Percentage of firms attaining the item (%) (n=27)	Highest (lowest) Category Score	Percentage of firms attaining the item (%) (n=388)	Highest (lowest) Category Score	Percentage of firms attaining the item (%) (n=43)	Highest (lowest) Category Score
A6.1	A statement about the firm's obligations regarding climate change regulations	1.38		37.04		38.49		51.16	
A6.2	An overview of environmental impact of the industry	4.15		3.70		2.05		2.33	
A6.3	An overview of how the business operations and/or products and services impact the environment	21.66		14.81		5.13		23.26	
A6.4	An overview of corporate environmental performance relative to industry peers	0.46		0.00		0.00		0.00	
<b>Panel C</b>									
<b>A7</b>	<b>Environmental initiatives (max score is 6)</b>	<b>31.34</b>	<b>3(0)</b>	<b>66.67</b>	<b>5(0)</b>	<b>17.95</b>	<b>3(0)</b>	<b>86.05</b>	<b>5(0)</b>
A7.1	A substantive description of employee training in environmental management and operations	4.15		14.81		3.08		34.88	
A7.2	Existence of response plans in case of environmental accidents	0.00		14.81		0.77		13.95	
A7.3	Internal environmental awards	0.92		7.41		0.26		11.63	
A7.4	Internal environmental audits	15.67		33.33		12.56		32.56	
A7.5	Internal certification of environmental programs	1.38		3.70		0.26		0.00	
A7.6	Community involvement and/or donations related to environment (if not awarded under A1.4 or A2.7)	13.82		55.56		4.10		67.44	

## **4.5 Aggregated Annual Reports and Sustainability Report Disclosures**

It is appropriate to combine the two sources of voluntary GHG emission performance and management disclosures to obtain a clear picture of corporate behaviour in this respect. Some 218 companies make voluntary GHG disclosures in 2007 in either or both of these two reports. In 2009 the number of companies is 390.

Table 4-3 shows the aggregation of the annual report and stand-alone sustainability report indexation results for hard disclosure items. Soft disclosure results are found in Table 4-4. Hard disclosures are discussed first; a discussion on soft disclosures follows.

### **4.5.1 Hard disclosures**

Hard disclosure items are provided by 81.65 (56.67) per cent of disclosers in 2007 (2009). The maximum hard category score is 19 in 2007 and 20 in 2009, showing that some disclosing companies are extending their reporting of verifiable information. In both years the minimum score is 0, meaning that at least one company in each year makes only soft GHG disclosures and provides no GHG performance and management information that is verifiable. Overall, these results do indicate that more companies make disclosures that are capable of being authenticated and in that respect, the quality of disclosures improves from 2007 to 2009.

### **4.5.2 Governance structure and management systems**

Some 59.17 (37.44) per cent of disclosing companies make disclosures in the governance structure and management systems category (disclosure category A1, Table 4-3, Panel A). The maximum (minimum) score is 5 (0) in 2007 and 6 (0) in 2009. This signifies that more companies consider it important to make these types of disclosures and that the quality of these disclosures improves in 2009.

A statement concerning the existence of a department for pollution control and/or management positions for environmental management (item A1.1) is provided by 9.17 (5.38) per cent of disclosing companies in 2007 (2009). Reports of the existence of an environmental and/or a public issues committee on the board (item

A1.2) are made by 26.15 (17.18) per cent of disclosers in 2007 (2009). Providing notice of the existence of terms and conditions applicable to suppliers and/or customers regarding environmental practices (item A1.3) is done by 12.84 (9.74) per cent of disclosing companies in 2007 (2009). Assertions that stakeholders are involved in the setting of corporate environmental policies (item A1.4) are made by 32.11 (17.95) per cent of disclosers in 2007 (2009). Some 16.06 (11.03) per cent of disclosing companies indicate they have implemented ISO14001 at the plant and/or firm level (item A1.5). Statements relating to the linking of executive compensation to environmental performance (item A1.6) are made by 5.05 (3.33) per cent of disclosers.

### **4.5.3 Credibility**

Statements that assist readers in gauging the credibility of initiatives undertaken by corporations in their GHG performance and management are indexed at category A2, Table 4-3, Panel B. The maximum score possible is 10. In 2007, some 61.93 per cent of disclosing companies make these types of disclosures. The maximum (minimum) score achieved is 8 (0). Some 38.72 per cent of disclosing companies make these reports in 2009. The maximum (minimum) score is 8 (0) in 2009 also. Although the quality of credibility disclosures remains the same, in absolute terms, more companies make these types of disclosures in 2009.

The percentage of disclosing companies indicating they have adopted GRI sustainability reporting guidelines (item A2.1) is 9.17 per cent in 2007 and 8.21 per cent in 2009. In absolute terms, some 20 companies have adopted GRI guidelines in 2007 and 32 have done so in 2009, a 60 per cent increase. Statements concerning the independent verification/assurance about environmental information disclosed in the annual report or sustainability report (item A2.2) are made by 5.50 (4.10) per cent of disclosing companies in 2007 (2009). Some 16.06 (13.59) per cent of disclosers indicate in 2007 (2009) that periodic independent verification/audits are performed on their environmental performance and/or systems (item A2.3). Independent certification of environmental programs (item A2.4) is specified by 11.47 (4.10) per cent of disclosing companies in 2007 (2009). Statements concerning the certification of products with respect to environmental impact (item A2.5) are made by 4.59 (5.90) per

cent of disclosing companies in 2007 (2009). Some 25.69 (14.10) per cent of disclosers state they have achieved external environmental performance awards and/or the inclusion in a sustainability index (item A2.6) in 2007 (2009). Reports of stakeholder involvement in the environmental disclosure process (item A2.7) are made by 1.83 (2.82) per cent of disclosing companies in 2007 (2009). Some 15.14 (6.15) per cent of disclosing companies indicate they participate in voluntary environmental initiatives endorsed by government (item A2.8) in 2007 (2009). Participation in industry specific associations/initiatives to improve environmental practices (item A2.9) are stipulated by 22.02 (9.23) per cent of disclosers in 2007 (2009). Some 16.06 (15.64) per cent of disclosers report that they participate in other environmental organisations/associations to improve environmental practices (item A2.10) in 2007 (2009).

#### **4.5.4 GHG performance indicators**

The quality of reporting of GHG performance indicators (disclosure category A3, Table 4-3, Panel C) remains constant for 2007 and 2009. In both years the maximum (minimum) score is 5 (0). Some 31.65 per cent of disclosing companies reveal GHG performance data in 2007. This represents 69 companies. In 2009, 24.10 per cent (94 companies) make the same type of disclosures.

GHG performance data is presented (item A3.1) by 31.19 (23.33) per cent of disclosing companies in 2007 (2009). GHG performance data, presented relative to peers/rivals or industry (item A3.2), is provided by 1.83 (0.26) per cent of disclosers in 2007 (2009). The presentation of GHG performance data relative to previous periods (item A3.3) comes from 15.60 (13.85) per cent of disclosing companies in 2007 (2009). Providing GHG performance data relative to targets (item A3.4) is made by 6.42 (4.10) per cent of disclosing companies in 2007 (2009). Reporting GHG performance data in absolute and normalised form (item A3.5) is done by 10.55 (7.95) per cent of disclosers in 2007 (2009). GHG performance data presented at disaggregate level (item A3.6) is made by 11.47 (11.54) per cent of disclosers in 2007 (2009).

#### 4.5.5 Environmental spending

The final hard disclosure category, environmental spending (A4, Table 4-3, Panel D), is where companies report the dollar amounts spent or saved on environmental matters. The maximum score possible is three and this is achieved in both years. The minimum score in both years is zero. Some 14.68 per cent of disclosing companies report in this category in 2007; in 2009, the percentage is 9.23 per cent. The quality of disclosures for this category remains steady for the two years under examination, but four more companies report this type of information in 2009.

A summary of dollar savings arising from environmental initiatives to the company (item A4.1) is given by 5.50 (2.31) per cent of disclosing companies in 2007 (2009). Some 7.34 (3.85) per cent of disclosers make statements about the amount spent on technologies, research and development and/or innovations to enhance environmental performance and/or efficiency (item A4.2) in 2007 (2009). The dollar amount spent on fines related to environmental issues (item A4.3) is stipulated by 5.96 (4.87) per cent of disclosers in 2007 (2009).

**Table 4-3 Index of Hard Disclosures from Annual Reports and Sustainability Reports, Aggregated**

Disclosure Category		2007		2009	
		Aggregated Sources		Aggregated Sources	
		Percentage of firms attaining the item (%) (n=218)	Highest (lowest) Category Score	Percentage of firms attaining the item (%) (n=390)	Highest (lowest) Category Score
<b>HARD DISCLOSURE ITEMS</b>		<b>81.65</b>	<b>19(0)</b>	<b>56.67</b>	<b>20(0)</b>
<b>Panel A</b>					
<b>A1</b>	<b>Governance structure and management systems (max score is 6)</b>	<b>59.17</b>	<b>5(0)</b>	<b>37.44</b>	<b>6(0)</b>
A1.1	Existence of a Department for pollution control and/or management positions for environmental management	9.17		5.38	
A1.2	Existence of an environmental and/or a public issues committee on the board	26.15		17.18	
A1.3	Existence of terms and conditions applicable to suppliers and/or customers regarding environmental practices	12.84		9.74	

		2007		2009	
		Aggregated Sources		Aggregated Sources	
Disclosure Category		Percentage of firms attaining the item (%) (n=218)	Highest (lowest) Category Score	Percentage of firms attaining the item (%) (n=390)	Highest (lowest) Category Score
A1.4	Stakeholder involvement in setting corporate environmental policies	32.11		17.95	
A1.5	Implementation of ISO14001 at the plant and/or firm level	16.06		11.03	
A1.6	Executive compensation is linked to environmental performance	5.05		3.33	
<b>Panel B</b>					
<b>A2</b>	<b>Credibility (max score is 10)</b>	<b>61.93</b>	<b>8(0)</b>	<b>38.72</b>	<b>8(0)</b>
A2.1	Adoption of GRI sustainability reporting guidelines	9.17		8.21	
A2.2	Independent verification/assurance about environmental information disclosed in the annual report or sustainability report	5.50		4.10	
A2.3	Periodic independent verifications/audits on environmental performance and/or systems	16.06		13.59	
A2.4	Certification of environmental programs by independent agencies	11.47		4.10	
A2.5	Product Certification with respect to environmental impact	4.59		5.90	
A2.6	External environmental performance awards and/or inclusion in a sustainability index	25.69		14.10	
A2.7	Stakeholder involvement in the environmental disclosure process	1.83		2.82	
A2.8	Participation in voluntary environmental initiatives endorsed by government	15.14		6.15	
A2.9	Participation in industry specific associations/initiatives to improve environmental practices	22.02		9.23	
A2.10	Participation in other environmental organisations/associations to improve environmental practices (if not awarded under 8 or 9 above)	16.06		15.64	
<b>Panel C</b>					
<b>A3</b>	<b>GHG performance indicators (max score is 6)</b>	<b>31.65</b>	<b>5(0)</b>	<b>24.10</b>	<b>5(0)</b>
A3.1	Performance data is presented	31.19		23.33	
A3.2	Performance data is presented relative to peers/rivals or industry	1.83		0.26	
A3.3	Performance data is presented relative to previous periods (trend analysis)	15.60		13.85	
A3.4	Performance data is presented relative to targets	6.42		4.10	
A3.5	Performance data is presented in absolute and normalised form	10.55		7.95	
A3.6	Performance data is presented at disaggregate level (i.e., plant, business unit, geographic segment)	11.47		11.54	

		2007		2009	
		Aggregated Sources		Aggregated Sources	
Disclosure Category		Percentage of firms attaining the item (%) (n=218)	Highest (lowest) Category Score	Percentage of firms attaining the item (%) (n=390)	Highest (lowest) Category Score
<b>Panel D</b>					
<b>A4</b>	<b>Environmental spending (max score is 3)</b>	<b>14.68</b>	<b>3(0)</b>	<b>9.23</b>	<b>3(0)</b>
A4.1	Summary of dollar savings arising from environmental initiatives to the company	5.50		2.31	
A4.2	Amount spent on technologies, R&D and/or innovations to enhance environmental performance and/or efficiency	7.34		3.85	
A4.3	Amount spent on fines related to environmental issues	5.96		4.87	

#### 4.5.6 Soft disclosures

Findings concerning soft disclosures are presented in Table 4-4, Panels A, B and C. Statements that are termed soft disclosure items are made by 96.79 per cent of disclosing companies in 2007 and 96.41 per cent of disclosing companies in 2009. The maximum score possible for soft disclosure items is 16. Maximum scores for these types of disclosures are 12 for both years. The minimum is 0 for both years. It is concluded that the quality of soft disclosures remains the same for these two years. However, while disclosing companies are not increasing their level of soft disclosures, more companies make them in 2009.

#### 4.5.7 Vision and strategy claims

Vision and strategy claims (disclosure category A5, Table 4-4, Panel A) are made by 92.66 (81.79) per cent of disclosing companies in 2007 (2009). The maximum (minimum) score for this category is 6 (0). This range is achieved by companies in both years, indicating no decline in this type of disclosure between 2007 and 2009. CEO statements on environmental performance in a letter to shareholders and/or stakeholders (item A5.1) are made by 17.89 (13.85) per cent of disclosing companies in 2007 (2009). Reports about corporate environmental policy, values and principles, and environmental codes of conduct are provided by 65.60 (55.38) per cent of disclosers in 2007 (2009). Formal management systems regarding environmental risk and performance (item A5.3)

are referred to by 57.80 (50.77) per cent of disclosing companies in 2007 (2009). Indications of internal periodic reviews and evaluations of environmental performance (item A5.4) are provided by 38.07 (45.38) per cent of disclosers in 2007 (2009). Measurable goals in terms of future environmental performance (item A5.5) are given by 16.06 (11.03) per cent of disclosing companies in 2007 (2009). Statements about specific environmental innovations and/or new technologies (item A5.6) are made by 50.00 (23.85) per cent of disclosers in 2007 (2009).

#### **4.5.8 Environmental profile**

Disclosure category A6 (Table 4-4, Panel B) deals with the corporation's environmental profile statements. A maximum score of four is achievable, but for both years the maximum, (minimum) score is 2 (0). Some 28.90 (48.97) per cent of disclosing companies report information that belongs to this category. Companies are not increasing their statements about their environmental profile, but the number of companies making these disclosures grows in 2009. This is most noticeable in their statements about the firm's obligations regarding climate change regulations (item A6.1). In 2007, some 5.96 per cent of disclosing companies are observed making these statements. This percentage rises to 43.08 per cent in 2009. This increase results from many more companies making references to their obligations (or lack of obligation) under the NGER Act 2007 (Cth) or making references to their obligations under other climate change regulations in their 2009 reports. This indicates that climate change is an issue under consideration by many Australian corporations and is important enough to be included in their generalised external reporting. Some 4.59 (2.31) per cent of disclosing companies provide an overview of the environmental impact of the industry (item A6.2) in 2007 (2009). The impact of business operations and/or products and services upon the environment (item A6.3) is reported by 22.48 (7.18) per cent of disclosers in 2007 (2009). The provision of an overview of corporate environmental performance relative to industry peers (item A6.4) is only made by 0.46 per cent of companies in 2007 and by no companies in 2009. This occurrence is suggestive of proprietary cost concerns influencing the disclosure decision.

#### 4.5.9 Environmental initiatives

Reports of environmental initiatives (disclosure category A7, Table 4-4, Panel C) are made by 36.70 (23.85) per cent of disclosing companies in 2007 (2009). The maximum score for this category is six. In 2007 the scores range from 0 to 5. A similar range occurs in 2009. From this, it is construed that while the nature of items reported remains steady, more companies are expressing this kind of information in their annual reports or stand-alone sustainability reports. Some 5.96 (6.67) per cent of disclosing companies give a substantive description of employee training in environmental management and operations (item A7.1) in 2007 (2009). Statements concerning the existence of response plans in case of environmental accidents (item A7.2) are provided by 1.83 (2.31) per cent of disclosers in 2007 (2009). Internal environmental awards (item A7.3) are given by 1.83 (1.54) of disclosing companies in 2007 (2009). Internal environmental audits (item A7.4) are carried out by 19.72 (14.62) per cent of disclosers. Some 1.83 (0.26) per cent of disclosing companies have internal certification of environmental programs (item A7.5) in 2007 (2009). Statements of community involvement and/or donations related to the environment (item A7.6) are made by 18.81 (10.26) per cent of disclosers in 2007 (2009).

**Table 4-4 Index of Soft Disclosures from Annual Reports and Sustainability Reports, Aggregated**

		2007		2009	
		Aggregated Sources		Aggregated Sources	
Disclosure Category		Percentage of firms attaining the item (%) (n=218)	Highest (lowest) Category Score	Percentage of firms attaining the item (%) (n=390)	Highest (lowest) Category Score
<b>SOFT DISCLOSURE ITEMS</b>		<b>96.79</b>	<b>12(0)</b>	<b>96.41</b>	<b>12(0)</b>
<b>Panel A</b>					
<b>A5</b>	<b>Vision and strategy claims (max score is 6)</b>	<b>92.66</b>	<b>6(0)</b>	<b>81.79</b>	<b>6(0)</b>
A5.1	CEO statement on environmental performance in letter to shareholders and/or stakeholders	17.89		13.85	
A5.2	A statement of corporate environmental policy, values and principles, environmental codes of conduct	65.60		55.38	
A5.3	A statement about formal management systems regarding environmental risk and performance	57.80		50.77	

Disclosure Category		2007		2009	
		Aggregated Sources		Aggregated Sources	
		Percentage of firms attaining the item (%) (n=218)	Highest (lowest) Category Score	Percentage of firms attaining the item (%) (n=390)	Highest (lowest) Category Score
A5.4	A statement that the firm undertakes periodic reviews and evaluations of its environmental performance	38.07		45.38	
A5.5	A statement of measurable goals in terms of future environmental performance (if not awarded under A3)	16.06		11.03	
A5.6	A statement about specific environmental innovations and/or new technologies	50.00		23.85	
<b>Panel B</b>					
<b>A6</b>	<b>Environmental profile (max score is 4)</b>	<b>28.90</b>	<b>2(0)</b>	<b>48.97</b>	<b>2(0)</b>
A6.1	A statement about the firm's obligations regarding climate change regulations	5.96		43.08	
A6.2	An overview of environmental impact of the industry	4.59		2.31	
A6.3	An overview of how the business operations and/or products and services impact the environment	22.48		7.18	
A6.4	An overview of corporate environmental performance relative to industry peers	0.46		0.00	
<b>Panel C</b>					
<b>A7</b>	<b>Environmental initiatives (max score is 6)</b>	<b>36.70</b>	<b>5(0)</b>	<b>23.85</b>	<b>5(0)</b>
A7.1	A substantive description of employee training in environmental management and operations	5.96		6.67	
A7.2	Existence of response plans in case of environmental accidents	1.83		2.31	
A7.3	Internal environmental awards	1.83		1.54	
A7.4	Internal environmental audits	19.72		14.62	
A7.5	Internal certification of environmental programs	1.83		0.26	
A7.6	Community involvement and/or donations related to environment (if not awarded under A1.4 or A2.7)	18.81		10.26	

#### 4.6 Summary of Disclosures

In summary, more companies make voluntary GHG disclosures in 2009 when compared to 2007. The quality of the disclosures, measured by reference to hard disclosure items is improving in that some companies are making more hard disclosures in 2009 than in 2007. Soft disclosures remain steady.

The sustainability report is a source of greater GHG emission disclosures in 2007 for 37 of the index items. Recall that 217 companies make voluntary GHG

emission disclosures in their 2007 annual reports and 27 in their stand-alone sustainability reports. Some 26 of those sustainability reports pertain to companies that make GHG emission disclosures in their annual reports. It is clear disclosing companies perceive that the sustainability report is a means of providing interested parties with superior information concerning corporate GHG emission performance and management.

There are four exceptions to this inference. Statements that executive compensation is linked to environmental performance (item A1.6) are reported in 4.61 per cent of disclosing companies' 2007 annual reports, but only in 3.70 per cent of sustainability reports for the same year. Some 10.60 per cent of disclosing companies report information about certification of environmental programs by independent agencies (item A2.4) in their annual reports in 2007, but this percentage drops to 7.41 per cent in their 2007 sustainability reports. Disclosing companies give an overview of the environmental impact of the industry (item A6.2) in 4.15 per cent of annual report statements, compared with only 3.70 per cent in sustainability reports in 2007. An overview of corporate environmental performance relative to industry peers (item A6.4) is provided by 0.46 per cent of disclosing companies in their annual reports in 2007 and by no companies in their sustainability report in that year.

In 2009, comparisons between the two disclosure sources reveal a similar pattern. Some 388 companies make annual report disclosures and 43 of these same companies report GHG information in their sustainability reports. More disclosures are made in the sustainability reports for all index items, excluding the following. In 2009, the sustainability report is the source of statements about the certification of environmental programs by independent agencies (item A2.4) for only 2.33 per cent of disclosing companies, a decrease from the 4.10 per cent of disclosing companies making these statements in their annual report. No company presents performance data relative to peers/rivals or industry (item A3.2) in their sustainability report in 2009 but 0.26 per cent do in their annual reports. Finally, statements concerning internal certification of environmental programs (item A7.5) are presented by 0.26 per cent of disclosing companies in their 2009 annual reports, but no company provides this information in their sustainability report for that year.

Taken together, these results permit the conclusion that the event of the NGER Act 2007 (Cth) has firstly prompted more companies to make voluntary GHG disclosures in their annual reports and/or stand-alone sustainability reports. Secondly, the observation of increases in hard disclosure categories and not in soft disclosure categories allows the conclusion that since this legislation, some companies now report better quality information about their GHG emission performance and management in these two non-mandatory settings.

To improve the informative of the research, a summary of all aggregated disclosures follows in Table 4-5. This table provides additional information not previously tabulated, i.e., it provides the number of firms making disclosures that match the index items.

**Table 4-5 Summary of all Disclosures**

Disclosure Category		2007		2009	
		Aggregated Sources (n = 218)		Aggregated Sources (n = 390)	
		Percentage of firms attaining the item (%)	Number of disclosing companies	Percentage of firms attaining the item (%)	Number of disclosing companies
<b>HARD DISCLOSURE ITEMS</b>		<b>81.65</b>	<b>178</b>	<b>56.67</b>	<b>221</b>
<b>A1</b>	<b>Governance structure and management systems</b>	<b>59.17</b>	<b>129</b>	<b>37.44</b>	<b>146</b>
A1.1	Existence of a Department for pollution control and/or management positions for environmental management	9.17	20	5.38	21
A1.2	Existence of an environmental and/or a public issues committee on the board	26.15	57	17.18	67
A1.3	Existence of terms and conditions applicable to suppliers and/or customers regarding environmental practices	12.84	28	9.74	38
A1.4	Stakeholder involvement in setting corporate environmental policies	32.11	70	17.95	70
A1.5	Implementation of ISO14001 at the plant and/or firm level	16.06	35	11.03	43
A1.6	Executive compensation is linked to environmental performance	5.05	11	3.33	13
<b>A2</b>	<b>Credibility</b>	<b>61.93</b>	<b>135</b>	<b>38.72</b>	<b>151</b>
A2.1	Adoption of GRI sustainability reporting guidelines	9.17	20	8.21	32

		2007		2009	
		Aggregated Sources (n = 218)		Aggregated Sources (n = 390)	
Disclosure Category		Percentage of firms attaining the item (%)	Number of disclosing companies	Percentage of firms attaining the item (%)	Number of disclosing companies
A2.2	Independent verification/assurance about environmental information disclosed in the annual report or sustainability report	5.50	12	4.10	16
A2.3	Periodic independent verifications/audits on environmental performance and/or systems	16.06	35	13.59	53
A2.4	Certification of environmental programs by independent agencies	11.47	25	4.10	16
A2.5	Product Certification with respect to environmental impact	4.59	10	5.90	23
A2.6	External environmental performance awards and/or inclusion in a sustainability index	25.69	56	14.10	55
A2.7	Stakeholder involvement in the environmental disclosure process	1.83	4	2.82	11
A2.8	Participation in voluntary environmental initiatives endorsed by government	15.14	33	6.15	24
A2.9	Participation in industry specific associations/initiatives to improve environmental practices	22.02	48	9.23	36
A2.10	Participation in other environmental organisations/associations to improve environmental practices (if not awarded under 8 or 9 above)	16.06	35	15.64	61
<b>A3</b>	<b>GHG performance indicators</b>	<b>31.65</b>	<b>69</b>	<b>24.10</b>	<b>94</b>
A3.1	Performance data is presented	31.19	68	23.33	91
A3.2	Performance data is presented relative to peers/rivals or industry	1.83	4	0.26	1
A3.3	Performance data is presented relative to previous periods (trend analysis)	15.60	34	13.85	54
A3.4	Performance data is presented relative to targets	6.42	14	4.10	16
A3.5	Performance data is presented in absolute and normalised form	10.55	23	7.95	31
A3.6	Performance data is presented at disaggregate level (i.e., plant, business unit, geographic segment)	11.47	25	11.54	45
<b>A4</b>	<b>Environmental spending</b>	<b>14.68</b>	<b>32</b>	<b>9.23</b>	<b>36</b>
A4.1	Summary of dollar savings arising from environmental initiatives to the company	5.50	12	2.31	9
A4.2	Amount spent on technologies, R&D and/or innovations to enhance environmental performance and/or efficiency	7.34	16	3.85	15

		2007		2009	
		Aggregated Sources (n = 218)		Aggregated Sources (n = 390)	
Disclosure Category		Percentage of firms attaining the item (%)	Number of disclosing companies	Percentage of firms attaining the item (%)	Number of disclosing companies
A4.3	Amount spent on fines related to environmental issues	5.96	13	4.87	19
<b>SOFT DISCLOSURE ITEMS</b>		<b>96.79</b>	<b>211</b>	<b>96.41</b>	<b>376</b>
<b>A5</b>	<b>Vision and strategy claims</b>	<b>92.66</b>	<b>202</b>	<b>81.79</b>	<b>319</b>
A5.1	CEO statement on environmental performance in letter to shareholders and/or stakeholders	17.89	39	13.85	54
A5.2	A statement of corporate environmental policy, values and principles, environmental codes of conduct	65.60	143	55.38	216
A5.3	A statement about formal management systems regarding environmental risk and performance	57.80	126	50.77	198
A5.4	A statement that the firm undertakes periodic reviews and evaluations of its environmental performance	38.07	83	45.38	177
A5.5	A statement of measurable goals in terms of future environmental performance (if not awarded under A3)	16.06	35	11.03	43
A5.6	A statement about specific environmental innovations and/or new technologies	50.00	109	23.85	93
<b>A6</b>	<b>Environmental profile</b>	<b>28.90</b>	<b>63</b>	<b>48.97</b>	<b>191</b>
A6.1	A statement about the firm's obligations regarding climate change regulations	5.96	13	43.08	168
A6.2	An overview of environmental impact of the industry	4.59	10	2.31	9
A6.3	An overview of how the business operations and/or products and services impact the environment	22.48	49	7.18	28
A6.4	An overview of corporate environmental performance relative to industry peers	0.46	1	0.00	0
<b>A7</b>	<b>Environmental initiatives</b>	<b>36.70</b>	<b>80</b>	<b>23.85</b>	<b>93</b>
A7.1	A substantive description of employee training in environmental management and operations	5.96	13	6.67	26
A7.2	Existence of response plans in case of environmental accidents	1.83	4	2.31	9
A7.3	Internal environmental awards	1.83	4	1.54	6
A7.4	Internal environmental audits	19.72	43	14.62	57
A7.5	Internal certification of environmental programs	1.83	4	0.26	1
A7.6	Community involvement and/or donations related to environment (if not awarded under A1.4 or A2.7)	18.81	41	10.26	40

#### 4.7 Intercoder Reliability Tests

A discussion the indexation process and of tests of reliability is provided in Section 3.11. Krippendorff's agreement coefficient *alpha* is used to evaluate intercoder reliability. An  $\alpha$  of 84 is achieved, which is an acceptable level (Neuendorf, 2002) and thus the index data as a whole is reliable (Krippendorff, 2004).

#### 4.8 Descriptive Statistics

This study is based on a census of ASX-listed companies during the years 2007 and 2009 and is concerned with their motivations to voluntarily disclose greenhouse gas emission information in their annual reports and sustainability reports. Data were available for 1,776 companies in 2007 and 1,853 in 2009<sup>50</sup>. In these final samples, some 218 companies are found to have made greenhouse gas emission disclosures in 2007 and 390 in 2009. The following table summarises the four dependent variable measures used for hypotheses testing.

**Table 4-6 Summary of Dependent Variable Measures**

Model	Dependent Variable	Year	Disc	Non-Disc	Mean	Med	Std Dev	Min	Max	N
1	Total Disclosures	2007			0.80	0.00	2.88	0	31	1776
		2009			1.07	0.00	3.25	0	32	1853
2	Disclosure Behaviour	2007	218	1558						1776
		2009	390	1463						1853
3	Total Disclosures	2007			6.54	5.00	5.49	1	31	218
		2009			5.10	3.00	5.44	1	32	390
4	Ratio of Hard to Total Disclosures	2007			0.41	0.48	0.26	0	1	218
		2009			0.28	0.25	0.29	03	1	390

Table 4-7 and Table 4-8 respectively provide the descriptive data for the whole sample, the disclosing companies, and the non-disclosing companies for 2007 and 2009.

<sup>50</sup> According to the Australian Securities Exchange (Australian Securities Exchange, 2008, 2010), there were 2,209 listed entities at 31 December, 2007, and 2,181 at the same date in 2009. Included in these figures are trusts with quoted equities, entities that trade as stapled securities, and entities with debt securities only. These are beyond the scope of this study. Additionally, new listings and delistings occur during each year, and their annual reports are not necessarily available in those circumstances.

The 2007 whole sample descriptive statistics for independent variables are discussed first. Next, this discussion is expanded to disclosing companies and non-disclosing companies for 2007. Subsequently the 2009 whole sample descriptive statistics for independent variables are reviewed in Section 4.8.3. A discussion of the disclosing and non-disclosing samples' descriptive statistics for independent variables for 2009 follows at Section 4.8.4.

#### **4.8.1 Whole sample descriptive statistics, 2007**

In Table 4-7, the continuous variables are tabulated in Panel A. Categorical variables are shown in Panel B. Continuous variables are discussed first.

The mean borrowings next year for the whole sample are 6.83. The minimum for this variable is 0.00, the maximum is 24.24. Equity issued next year has a mean of 9.55; the range is 0.00 to 21.81. The leverage variable has a mean value of 0.37 and a minimum (maximum) of 0.00 (13.56). Ownership concentration has a mean of 22.43; the range is 0.00 to 100.00. Competition has a mean of 0.72, and ranges from 0.00 to 1.00. ROA ranges from -77.19 to 23.52, and has a mean of -0.37. The mean value for Tobin's Q is 2.88, the minimum is 0.00 and the maximum is 144.55. Age of fixed assets has a mean of 0.29; the minimum is 0.00 and maximum is 1.00. The final continuous variable, size, has a minimum of 10.55, a maximum of 27.06, and a mean of 17.58.

Several categorical variables are used in this research, GICS sector, audit quality and foreign listing status. GICS sector dummy variables are used as independent variables; audit quality and foreign listing status are control variables.

Companies may belong to one out of ten GICS sectors. Some 570 companies are members of the GICS sector – materials. These companies represent 32.09 per cent of the companies studied. GICS sector – consumer discretionary has 167 companies (9.40 per cent) in this study. GICS sector – consumer staples is represented by 47 companies, or 2.65 per cent of the sample. There are 207 companies (11.66 per cent) in the GICS sector – energy. Some 278 of the companies studied belong to GICS sector – financials. This represents 15.65 per cent of the sample. GICS sector – health care has 150

companies, or 8.45 per cent of the sample. Some 112 (6.31 per cent) of companies are designated as part of the GICS sector – information technology. GICS sector – telecommunication services has 30 companies or 1.69 per cent of the sample. The final, and smallest, GICS sector membership is utilities. There are 29 companies, or 1.63 per cent, belonging to this sector in 2007.

Some 872 companies (49.10 per cent) have a Big 4 auditor. Only 11.77 per cent (209) of companies are listed on another exchange outside of Australia.

#### **4.8.2 Disaggregated descriptive statistics, 2007 (disclosing and non-disclosing companies)**

Table 4-7 continues to be discussed in this section. Separating the sample companies by their GHG disclosure behaviour allows a better understanding of their respective characteristics. Recall that in 2007, 218 companies provide GHG disclosures in either or both annual reports and stand-alone sustainability reports and the remaining 1,558 companies do not. The continuous variables are first discussed, then the categorical variables.

The disclosing companies' borrowings next year have a mean of 13.62 (minimum 0.00, maximum 24.24). In comparison, non-disclosers' borrowing next year averages 5.88 (minimum 0.00, maximum 23.16). The mean value of equity issued next year by disclosing companies is 10.09 (minimum 0.00, maximum 21.81). In the non-disclosing group, these values are mean, 9.48, minimum 0.00 and maximum 21.30. Disclosing companies are, on average, more highly leveraged, with a mean of 0.51 (minimum 0.02, maximum 2.81). In contrast, non-disclosing companies have a mean of 0.36 for leverage, and a range of 0.00 to 13.56. Disclosers' ownership concentration has a mean of 27.22 (minimum 0.00, maximum 97.53). These same statistics in the disclosing group are mean of 21.76, minimum 0.00, maximum 100.00. The competition measure is lower in the disclosing companies with a mean value of 0.67 (minimum 0.00, maximum 1.00). In the disclosers, the range is the same, but the mean value is 0.72. Disclosers' average ROA is 0.00 (minimum -2.10, maximum 0.85). Non-disclosers have a mean ROA of -0.42 (minimum -77.19, maximum 23.52). The mean value of Tobin's Q in the disclosing sample is 2.61 (minimum 0.12, maximum 48.57). Non-

disclosers' mean Tobin's Q value is 2.92 (minimum 0.00, maximum 144.55). The age of fixed assets is greater in disclosing companies. Their mean value is 0.32 (minimum 0.00, maximum 0.92). Non-disclosers' asset age is 0.29 on average (minimum 0.00, maximum 1.00). Finally, disclosing companies are larger on average, with a mean size of 20.42 (minimum 12.93, maximum 27.06). Non-disclosers' mean size is 17.19 (minimum 10.55, maximum 25.56).

Some 55 disclosing companies belong to the GICS sector – materials. This represents 25.23 per cent of the disclosing companies' total. Of the non-disclosing subset, there are 515 companies (representing 33.06 per cent of the total non-disclosers) that are in this sector. GICS sector – consumer discretionary has some 21 companies making disclosures (9.63 per cent of the disclosing group). Some 146 non-disclosing companies, or 9.37 per cent overall, are part of this sector. GICS sector – consumer staples is populated by 11 (5.05 per cent) disclosing companies, while 36 (2.31 per cent) non-disclosers make up the rest of this sector. There are 30 disclosing companies (13.76 per cent) in the GICS sector – energy and 177 (11.36 per cent) non-disclosing companies. GICS sector – financials has 43 disclosing companies within its midst. This number represents 19.72 per cent of disclosers. Non-disclosing companies in the GICS sector – financials number 235 (15.08 per cent of the total non-disclosing group). GICS sector – health care is split into 5 disclosing companies (2.29 per cent of the disclosing group) and 145 non-disclosing companies (9.31 per cent of the non-disclosing group). Statistics for the GICS sector – industrials are 37 companies do disclose (16.97 per cent of the disclosers overall) and 149 companies make no disclosures (9.56 per cent of the non-disclosing subset). GICS sector – information technology comprises 5 disclosing companies (2.29 per cent of the total disclosing group) and 107 non-disclosers (6.87 per cent of the total non-disclosing companies). GICS sector – telecommunication services has 2 disclosing companies (representing 0.92 per cent of disclosers) and 28 non-disclosing companies (1.80 per cent of the whole non-disclosing group). The smallest GICS sector group, GICS sector – utilities has 9 disclosing companies (4.13 per cent of the total disclosing group) and 20 non-disclosing companies (1.28 per cent of the non-disclosing group).

Some 181 disclosing companies (83.03 per cent) have a Big 4 auditor, while 691 non-disclosing companies (44.35 per cent) also use their services. Some 45 disclosing companies (20.64 per cent) are listed on a foreign stock exchange, and the comparable figure for non-disclosing companies is 164 (10.53 per cent of the total non-disclosing group).

**Table 4-7 2007 Descriptive statistics for the independent & control variables**

Variable	Panel A - Continuous Variables														
	2007 All Companies, <i>n</i> = 1776					2007 Disclosing Companies, <i>n</i> = 218					2007 Non-Disclosing Companies, <i>n</i> = 1558				
	n	Mean	Std. Dev.	Min.	Max.	n	Mean	Std. Dev.	Min.	Max.	n	Mean	Std. Dev.	Min.	Max.
Borrowings next year	1776	6.83	8.30	0.00	24.24	218	13.62	8.72	0.00	24.24	1558	5.88	7.78	0.00	23.16
Equity issued next year	1776	9.55	7.45	0.00	21.81	218	10.09	8.15	0.00	21.81	1558	9.48	7.34	0.00	21.30
Leverage	1776	0.37	0.59	0.00	13.56	218	0.51	0.28	0.02	2.81	1558	0.36	0.62	0.00	13.56
Ownership concentration	1776	22.43	23.74	0.00	100.00	218	27.22	24.46	0.00	97.53	1558	21.76	23.56	0.00	100.00
Competition	1776	0.72	0.22	0.00	1.00	218	0.67	0.24	0.00	1.00	1558	0.72	0.21	0.00	1.00
ROA	1776	-0.37	3.25	-77.19	23.52	218	0.00	0.35	-2.10	0.85	1558	-0.42	3.46	-77.19	23.52
Tobin's Q	1776	2.88	5.17	0.00	144.55	218	2.61	4.56	0.12	48.57	1558	2.92	5.25	0.00	144.55
Age of fixed assets	1776	0.29	0.28	0.00	1.00	218	0.32	0.23	0.00	0.92	1558	0.29	0.29	0.00	1.00
Size	1776	17.58	2.34	10.55	27.06	218	20.42	2.68	12.93	27.06	1558	17.19	2.00	10.55	25.56
Variable	Panel B - Categorical Variables														
	2007 All Companies, <i>n</i> = 1776		2007 Disclosing Companies, <i>n</i> = 218			2007 Non-Disclosing Companies, <i>n</i> = 1558									
	Yes	Percentage	Yes	Percentage	Yes	Percentage									
GICS Sector - Materials	570	32.09	55	25.23	515	33.06									
GICS Sector – Consumer Discretionary	167	9.40	21	9.63	146	9.37									
GICS Sector – Consumer Staples	47	2.65	11	5.05	36	2.31									
GICS Sector – Energy	207	11.66	30	13.76	177	11.36									
GICS Sector – Financials	278	15.65	43	19.72	235	15.08									
GICS Sector – Health Care	150	8.45	5	2.29	145	9.31									
GICS Sector – Industrials	186	10.47	37	16.97	149	9.56									
GICS Sector – Information Technology	112	6.31	5	2.29	107	6.87									
GICS Sector – Telecommunication Services	30	1.69	2	0.92	28	1.80									
GICS Sector – Utilities	29	1.63	9	4.13	20	1.28									
Audit quality	872	49.10	181	83.03	691	44.35									
Foreign listing status	209	11.77	45	20.64	164	10.53									

### 4.8.3 Whole sample descriptive statistics, 2009

Table 4-8 sets out the 2009 continuous variables in Panel A. These are discussed first. Categorical variables for this year are shown in Panel B and are discussed latterly. There are 1,853 companies in total studied in this year, 390 of which have been identified as GHG disclosing companies, the remaining 1,463 are non-disclosers.

In 2009, the average borrowings next year are 5.36 (minimum 0.00, maximum 24.03). Compared to 2007, 2009 companies are generally borrowing less on average. The mean borrowings next year for all companies is around 22 per cent lower in 2009.

Equity issued next year, with a mean value of 9.52, ranges from 0.00 to 21.33. This trend is very similar to that of 2007. Leverage has a mean of 0.64 and a range of 0.00 to 109.78. This represents an increase of around 73 per cent from 2007. The average ownership concentration is 24.73 (minimum 0.00, maximum 100.00), and is around a 10 per cent upwards change from 2007. Competition is 0.71 on average and ranges from 0.00 to 1.00. This is similar to 2007's statistics. ROA generally improves in 2009 by around 32 per cent. The average ROA is -0.25 (minimum -18.89, maximum 2.76). Tobin's Q experiences a drop since 2007, and has a mean of 2.80 and a range of 0.02 to 455.21. Age of fixed assets marginally increases in 2009, and is 0.30 on average, with a range of 0.00 to 1.00. Size remains steady in 2009. The size variable has a mean of 17.37 (minimum 9.43, maximum 27.21).

A study of the GICS sector categorical variables reveals a number of changes in membership since 2007. While there are 77 more companies listed on the ASX in 2009 in comparison to 2007, five GICS sectors (materials, energy, financials, industrials and utilities) see an increase in constituents and the opposite occurs in the other five GICS sectors (consumer discretionary, consumer staples, health care, information technology and telecommunication services). The biggest change occurs in the GICS sectors – materials. Here some 69 companies join since 2007, making 639 member companies, or 34.48 per cent of all companies. GICS sector - consumer discretionary drops 7 members, resulting in 160 companies or 8.63 per cent of total companies participating in this sector during 2009. GICS sector – consumer staples also undergoes a reduction in membership, with two companies leaving its ranks since 2007. As a result, there are 45

(2.43 per cent) companies belonging to this sector in 2009. The GICS sector – energy increases its membership by a further 19 companies. In 2009 there are 226 companies in this sector, representing 12.20 per cent of all companies for that year. A very small increase occurs in the GICS sector – financials with four companies joining, making a total of 282 (15.22 per cent) for 2009. GICS sector – health care loses one company since 2007; there are 149 (8.04 per cent) companies in 2009. GICS sector – industrials gains seven additional companies, and has 193 or 10.42 per cent of the total companies in 2009. Twelve companies depart from the GICS sector – information technology, leaving 100 companies in 2009 (5.40 per cent). A loss of three companies from GICS sector – telecommunication services leaves 27 companies (1.46 per cent) in 2009. GICS sector – utilities grows by three companies to 32 in 2009 representing 1.73 per cent of total companies.

Big 4 auditors are engaged by 847 companies (45.71 per cent of all companies), a reduction of 25 in absolute terms in comparison to 2007. An additional 13 companies have foreign listing status in 2009, making this total 222 (11.98 per cent).

#### **4.8.4 Disaggregated descriptive statistics, 2009 (disclosing and non-disclosing companies)**

Discussion of Table 4-8 continues. The 2009 sample companies are split into disclosing and non-disclosing segments and their respective descriptive results are discussed here. There are 390 companies that make GHG disclosures in either or both annual reports and stand-alone sustainability reports and 1,463 companies that do not. The continuous variables are first discussed, then the categorical variables.

In 2009 the average borrowings next year for disclosing companies is 8.29 (minimum 0.00, maximum 24.03). Non-disclosers' mean borrowings next year is 4.58 (minimum 0.00, maximum 21.85). The biggest reduction in average borrowings occurs in the disclosing companies. Their average borrowings next year for 2009 are 40 per cent lower than in 2007. Non-disclosers' average borrowings next year follow the general trend and are down by around 22 per cent.

Both disclosers and non-disclosers' equity issued next year are similar in 2009 to their 2007 results. Disclosing companies' mean equity issued next year is 10.54

(minimum 0.00, maximum 21.33). Non-disclosing companies' average equity issued next year is 9.25 (minimum 0.00, maximum 20.48).

In contrast to 2007 results, non-disclosing companies have higher leverage than disclosing companies in 2009. The leverage variable for disclosures is determined to have a mean of 0.39 (minimum 0.00, maximum 1.24), a drop of around 75 per cent from their 2007 mean. Non-disclosers almost double their mean leverage value in 2009. Their mean leverage of 0.70 (minimum 0.00, maximum 109.78) is a 94 per cent increase over 2007.

Ownership concentration for disclosing companies remains steady in 2009. The mean value is 27.23 (minimum 0.00, maximum 100.00). Non-disclosing companies' ownership concentration rises by around 10 per cent in 2009 to a mean of 24.06 (minimum 0.00, maximum 100.00).

Both disclosing and non-disclosing companies have similar results with the competition variable in 2009. Both segments have a mean of 0.71 (minimum 0.00, maximum 1.00). However, disclosing companies' average competition is an almost 6 per cent increase from that in 2007. Non-disclosers' average competition dropped marginally from 2007.

Disclosing companies' ROA generally deteriorates in 2009 when compared to 2007. The 2009 mean ROA for disclosers is -0.14 (minimum -18.89, maximum 1.10). It is 0.00 (minimum -2.10, maximum 0.85) in 2007. Non-disclosing companies are on average worse performers by this measure, although they do improve from 2007 results. Non-disclosers' mean ROA is -0.28 (minimum -18.63, maximum 2.76) in 2009. In 2007, a mean of -0.42 (minimum -77.19, maximum 23.52) is achieved.

The market-based performance measure, Tobin's Q undergoes a decline of 31 per cent in disclosing companies in 2009 when measured against 2007. Disclosing companies' Tobin's Q has a mean of 1.80 (minimum 0.05, maximum 40.06). Non-disclosers experience a 5 per cent increase over 2007. Their Tobin's Q mean is 3.07 (minimum 0.02, maximum 455.21).

Disclosing companies have newer assets in 2009 than they do in 2007, and they have newer assets in 2009 than non-disclosers have in that year. The mean age of fixed

assets for disclosing companies in 2009 is 0.28 (minimum 0.00, maximum 1.00). It is 0.32 (minimum 0.00, maximum 0.92) in 2007. Non-disclosing companies' average age of fixed assets grows in 2009 to 0.30 (minimum 0.00, maximum 1.00) from 0.29 (minimum 0.00, maximum 1.00) in 2007.

Both disclosers and non-disclosers are slightly smaller in 2009 than they are in 2007. Disclosing companies' mean size is 19.15 (minimum 12.44, maximum 27.21). In 2007 it is 20.42 (minimum 12.93, maximum 27.06). Non-disclosers' have a mean size of 16.90 (minimum 9.43, maximum 24.25) in this latest year. They have a mean of 17.19 (minimum 10.55, maximum 25.56) in 2007.

Membership in all ten GICS sectors increases in 2009 for disclosing companies. An opposite result occurs for non-disclosing companies. GICS sector – materials grows by 69 new constituents in 2009, all of which are disclosing companies. Some 124 (31.79 per cent) companies making GHG disclosures in 2009 belong to this sector. Non-disclosing companies belonging to this sector number the same as in 2007, 515, which in 2009, is 35.20 per cent of non-disclosing companies. Six disclosing companies join the GICS sector – consumer discretionary in 2009, making a total of 27 (6.92 per cent) out of the 390 disclosing companies. In contrast, 13 companies that do not disclose leave this sector after 2007. By 2009 there remain 133 non-disclosers, or 9.09 per cent of the total of non-disclosing companies. GICS sector – consumer staples also experiences 6 new members from the disclosing group of companies, making the total disclosing companies for this sector 17 in 2009. This represents 4.36 per cent of disclosing companies. Some 8 non-disclosing companies leave this sector post-2007, and there remain 28 non-disclosing companies or 1.91 per cent of the total of non-disclosing companies in 2009. Disclosing companies join the GICS sector – energy at a rate of 34 companies by 2009, while some 15 non-disclosing companies quit it. Thus in 2009, there are 64 disclosing companies (16.41 per cent of total disclosers) and 162 non-disclosing companies (11.07 per cent of total non-disclosers) in the GICS sector – energy. Eight disclosing companies enter the GICS sector – financials after 2007, bringing the total disclosing companies in this sector to 51 (13.08 per cent of total disclosers). This sector experiences a loss of four non-disclosing companies over the two years, leaving 231 non-disclosers at 2009, or 15.79 per cent of the total non-

disclosers. GICS sector – health care gains three additional disclosing companies by 2009, finishing with 8 disclosers (2.05 per cent of the disclosing segment). This gain, however, is offset by a loss of four of the non-disclosing companies during that time. By 2009 there are 141 non-disclosing companies in the GICS sector – health care, or 9.64 per cent of the total companies that do not disclose. GICS sector – industrials has an extra 27 disclosing companies within its constituents in comparison to 2007. In 2009, there are 64 disclosing companies or 16.41 per cent of total disclosers. In contrast, there is a deficit of 20 non-disclosing companies when comparing the two years. Some 129 companies that do not report about their GHG performance and management remain in the GICS sector – industrials (8.82 per cent of non-disclosing companies) in 2009. GICS sector – information technology, while suffering an overall reduction during the two years, had the greatest percentage influx of new disclosing companies than any other sector. Some 8 new disclosing companies, an increase of 160 per cent, come to this sector in 2009. At this time, there are 13 disclosing companies (3.33 per cent of the total disclosers). In comparison, 87 (5.95 per cent) non-disclosing companies remain in 2009, a drop of 20 companies from those observed in 2007. There are now 4 disclosing companies in the GICS sector telecommunication services (1.03 per cent of the total disclosers), an increase of 100 per cent from 2007. Some 23 non-disclosers (1.57 per cent) make up the balance in this sector, which is a decline of 5 from the last observation point. GICS sector – utilities expands its disclosing companies' membership by 9 companies, but loses 3 non-disclosing companies in the duration. Now there are 18 disclosing companies (4.62 per cent of total disclosers) and 14 non-disclosers (0.96 of total non-disclosing companies).

While Big 4 auditors lose some 25 corporate clients in the intervening two years, more of their clients begin to disclose GHG information. By 2009, some 232 companies are classified as disclosers, an increase of 51 since 2007, and representing 59.49 per cent of total disclosing companies. The exit (or change in disclosure behaviour) of 76 companies considered to be non-disclosers from the Big 4 auditors' client lists leaves 615 non-disclosers or 42.04 per cent of the total non-disclosing companies at 2009.

Some 13 more companies list on another exchange outside of Australia by 2009. This number comprises an increase of 20 disclosing companies and a decrease of 7 non-

disclosing companies. At 2009, there are 65 disclosing companies (16.67 per cent of total disclosers) and 157 non-disclosing companies (10.73 per cent of the total non-disclosers) that hold a foreign listing status.

**Table 4-8 2009 Descriptive statistics for the independent & control variables**

Variable	Panel A - Continuous Variables														
	2009 All Companies, <i>n</i> = 1853					2009 Disclosing Companies, <i>n</i> = 390					2009 Non-Disclosing Companies, <i>n</i> = 1463				
	n	Mean	Std. Dev.	Min.	Max.	n	Mean	Std. Dev.	Min.	Max.	n	Mean	Std. Dev.	Min.	Max.
Borrowings next year	1853	5.36	7.64	0.00	24.03	390	8.29	9.03	0.00	24.03	1463	4.58	7.03	0.00	21.85
Equity issued next year	1853	9.52	7.54	0.00	21.33	390	10.54	7.82	0.00	21.33	1463	9.25	7.44	0.00	20.48
Leverage	1853	0.64	3.77	0.00	109.78	390	0.39	0.28	0.00	1.24	1463	0.70	4.23	0.00	109.78
Ownership concentration	1853	24.73	24.39	0.00	100.00	390	27.23	23.82	0.00	100.00	1463	24.06	24.51	0.00	100.00
Competition	1853	0.71	0.22	0.00	1.00	390	0.71	0.20	0.00	1.00	1463	0.71	0.22	0.00	1.00
ROA	1853	-0.25	0.95	-18.89	2.76	390	-0.14	1.02	-18.89	1.10	1463	-0.28	0.93	-18.63	2.76
Tobin's Q	1853	2.80	14.22	0.02	455.21	390	1.80	3.14	0.05	40.06	1463	3.07	15.92	0.02	455.21
Age of fixed assets	1853	0.30	0.29	0.00	1.00	389	0.28	0.23	0.00	1.00	1463	0.30	0.30	0.00	1.00
Size	1853	17.37	2.45	9.43	27.21	390	19.15	2.92	12.44	27.21	1463	16.90	2.07	9.43	24.25
Variable	Panel B – Categorical Variables														
	2009 All Companies, <i>n</i> = 1853		2009 Disclosing Companies, <i>n</i> = 390			2009 Non-Disclosing Companies, <i>n</i> = 1463									
	Yes	Percentage	Yes	Percentage	Yes	Percentage									
GICS Sector - Materials	639	34.48	124	31.79	515	35.20									
GICS Sector – Consumer Discretionary	160	8.63	27	6.92	133	9.09									
GICS Sector – Consumer Staples	45	2.43	17	4.36	28	1.91									
GICS Sector – Energy	226	12.20	64	16.41	162	11.07									
GICS Sector – Financials	282	15.22	51	13.08	231	15.79									
GICS Sector – Health Care	149	8.04	8	2.05	141	9.64									
GICS Sector – Industrials	193	10.42	64	16.41	129	8.82									
GICS Sector – Information Technology	100	5.40	13	3.33	87	5.95									
GICS Sector – Telecommunication Services	27	1.46	4	1.03	23	1.57									
GICS Sector – Utilities	32	1.73	18	4.62	14	0.96									
Audit quality	847	45.71	232	59.49	615	42.04									
Foreign listing status	222	11.98	65	16.67	157	10.73									

#### **4.8.5 Descriptive statistics after winsoration**

If consideration is given to the discussion of descriptive statistics in the previous four sections, it is apparent that the range of some continuous variables is extensive. Table 4-7 and Table 4-8 include the standard deviations of each continuous variable. Extreme measurements, or outliers, make a substantial contribution to these standard deviations. Violations of the assumption of normality distributions for all continuous variables are revealed for both years in the conduct of descriptive analysis. Normality violations are common in larger samples and should not be problematic (Pallant, 2011).

This research aims to examine the GHG disclosing behaviour of the entire population of ASX-listed public companies in 2007 and 2009, and therefore the retention of that population is a key objective. Given that non-normality is an inevitable feature in this population, the impact of outliers is lessened by winsorising the more extreme cases using Tukey's Hinges. Tukey's Hinges calculate outlier boundaries based on the spread of values across the 25 to 75 per centiles. Application of this process results in the winsorisation of six continuous variables. These are equity next year (upper level only), leverage (upper level only), ownership concentration (upper level only), Tobin's Q (upper level only), ROA and size. The consequent descriptive data for 2007 and 2009 continuous variables after winsoration are presented in bold in Panels A, Table 4-9. The winsorised variables are discussed here, beginning with the 2007 sample.

The 2007 sample comprises 218 companies that make GHG disclosures and 1,558 that do not, summing to a total of 1,776 companies. Equity issued next year, after winsorisation has a mean of 9.60 (minimum 0.00, maximum 20.56) for the whole sample. For disclosing (non-disclosing) companies these statistics are mean 10.11 (9.52), minimum 0.00 (0.00) and maximum 20.56 (20.56). Leverage is restricted to a maximum of 1.23. This is achieved for both disclosers and non-disclosers. The mean leverage value for the whole sample is 0.34. This value is 0.50 (0.32) for the disclosing (non-disclosing) companies. The upper limit for ownership concentration is set at 90.40, a value that is reached by both disclosing and non-disclosing companies. The mean value for the whole sample is 22.33, for disclosing sample it is 27.13 and for the non-disclosing sample it is 21.66. ROA's boundaries are set to range from -0.91 to

0.70. Both disclosing and non-disclosing samples meet this range. The mean ROA for the whole sample is -0.13. In the disclosing companies, the mean is 0.02. The non-disclosing companies have a mean ROA of -0.15. The Tobin's Q variable is limited to a maximum of 6.31, a value reached by both disclosers and non-disclosers. The mean value for Tobin's Q is 2.33 for the whole sample, 2.12 for the disclosing companies and 2.36 for the non-disclosing companies. The last continuous variable to undergo extreme value limits is size. The minimum is set at 11.32; the maximum is set at 23.49. The whole sample's mean size after winsorisation is 17.57. The disclosing companies' mean size is 20.28 (minimum 12.93, maximum 23.49), while the non-disclosing companies have a mean size of 17.19 (minimum 11.32, maximum 23.49).

The application of winsorisation techniques in 2009 results in setting equity issued next year to a maximum of 20.36. This value is reached by disclosers and non-disclosers. The mean equity issued next year for the whole sample is 9.55. For the disclosing sample the mean is 10.55, while the non-disclosing sample has a mean of 9.28. Leverage is allowed to peak at 1.30. The whole sample mean for leverage is 0.36. The disclosing sample's mean leverage is 0.39 (minimum 0.00, maximum 1.24). The non-disclosers' mean leverage is 0.35 (minimum 0.00, maximum 1.30). The upper limit for ownership concentration is put at 98.70, a value achieved by both disclosers and non-disclosing companies. The whole sample mean for ownership concentration is 24.71. This statistic is 27.22 for the disclosing companies and 24.04 for the non-disclosing companies. ROA is set to range from -0.88 to 0.59. This spread is achieved by both disclosing and non-disclosing companies. The mean ROA for the whole sample is -0.17. This value is -0.08 for disclosing companies and -0.19 for non-disclosing companies. Tobin's Q is constrained to a maximum of 3.64. The mean value of Tobin's Q for the whole sample is 1.50. The disclosing companies' mean Tobin's Q is 1.39 (minimum 0.00, maximum 3.64). Non-disclosers have a mean Tobin's Q of 1.52 (minimum 0.02, maximum 3.64). Size is limited to extend from 10.83 to 23.71. The mean size for the whole sample is 17.36. Disclosers' mean size is 19.08 (minimum 12.44, maximum 23.71). Non-disclosers' mean size is 16.90 (minimum 10.83, maximum 23.71).

Winsorised variables are used for linear, Tobit and logistic regression analyses.

**Table 4-9 Descriptive statistics for continuous independent & control variables after winsorisation**

Variable	Panel A - Continuous Variables after Winsorisation (The variables in bold have been subjected to the winsorisation process.)														
	2007 All Companies, n = 1776					2007 Disclosing Companies, n = 218					2007 Non-Disclosing Companies, n = 1558				
	n	Mean	Std. Dev.	Min.	Max.	n	Mean	Std. Dev.	Min.	Max.	n	Mean	Std. Dev.	Min.	Max.
Borrowings next year	1776	6.83	8.30	0.00	24.24	218	13.62	8.72	0.00	24.24	1558	5.88	7.78	0.00	23.16
<b>Equity issued next year</b>	1776	9.60	7.43	0.00	<b>20.56</b>	218	10.11	8.09	0.00	<b>20.56</b>	1558	9.52	7.33	0.00	<b>20.56</b>
<b>Leverage</b>	1776	0.34	0.30	0.00	<b>1.23</b>	218	0.50	0.24	0.02	<b>1.23</b>	1558	0.32	0.30	0.00	<b>1.23</b>
<b>Ownership concentration</b>	1776	22.33	23.44	0.00	<b>90.40</b>	218	27.13	24.22	0.00	<b>90.40</b>	1558	21.66	23.26	0.00	<b>90.40</b>
Competition	1776	0.71	0.22	0.00	1.00	218	0.67	0.24	0.00	1.00	1558	0.72	0.21	0.00	1.00
<b>ROA</b>	1776	-0.13	0.38	<b>-0.91</b>	<b>0.70</b>	218	0.02	0.26	<b>-0.91</b>	<b>0.70</b>	1558	-0.15	0.39	<b>-0.91</b>	<b>0.70</b>
<b>Tobin's Q</b>	1776	2.33	1.73	0.00	<b>6.31</b>	218	2.12	1.49	0.12	<b>6.31</b>	1558	2.36	1.76	0.00	<b>6.31</b>
Age of fixed assets	1776	0.29	0.28	0.00	1.00	218	0.32	0.23	0.00	0.92	1558	0.29	0.29	0.00	1.00
<b>Size</b>	1776	17.57	2.28	<b>11.32</b>	<b>23.49</b>	218	20.28	2.46	<b>12.93</b>	<b>23.49</b>	1558	17.19	1.98	<b>11.32</b>	<b>23.49</b>
Variable	2009 All Companies, n = 1853					2009 Disclosing Companies, n = 390					2009 Non-Disclosing Companies, n = 1463				
	n	Mean	Std. Dev.	Min.	Max.	n	Mean	Std. Dev.	Min.	Max.	n	Mean	Std. Dev.	Min.	Max.
	Borrowings next year	1853	5.36	7.64	0.00	24.03	390	8.29	9.03	0.00	24.03	1463	4.58	7.03	0.00
<b>Equity issued next year</b>	1183	9.55	7.53	0.00	<b>20.36</b>	390	10.55	7.80	0.00	<b>20.36</b>	1463	9.28	7.44	0.00	<b>20.36</b>
<b>Leverage</b>	1853	0.36	0.33	0.00	<b>1.30</b>	390	0.39	0.28	0.00	<b>1.24</b>	1463	0.35	0.34	0.00	<b>1.30</b>
<b>Ownership concentration</b>	1853	24.71	24.35	0.00	<b>98.70</b>	390	27.22	23.78	0.00	<b>98.70</b>	1463	24.04	24.47	0.00	<b>98.70</b>
Competition	1853	0.71	0.22	0.00	1.00	390	0.71	0.20	0.00	1.00	1463	0.71	0.22	0.00	1.00
<b>ROA</b>	1853	-0.17	0.31	<b>-0.88</b>	<b>0.59</b>	390	-0.08	0.29	<b>-0.88</b>	<b>0.59</b>	1463	-0.19	0.31	<b>-0.88</b>	<b>0.59</b>
<b>Tobin's Q</b>	1853	1.50	1.03	0.02	<b>3.64</b>	390	1.39	0.91	0.05	<b>3.64</b>	1463	1.52	1.06	0.02	<b>3.64</b>
<b>Size</b>	1853	17.36	2.40	<b>10.83</b>	<b>23.71</b>	390	19.08	2.77	<b>12.44</b>	<b>23.71</b>	1463	16.90	2.06	<b>10.83</b>	<b>23.71</b>
Age of fixed assets	1853	0.30	0.29	0.00	1.00	389	0.28	0.23	0.00	1.00	1463	0.30	0.30	0.00	1.00

#### 4.8.6 Correlations

In recognition of the non-normal distribution of the data, the bivariate correlation matrices reported in Table 4-10 and Table 4-11 for 2007 and 2009, respectively, present Pearson Correlation Coefficients and Spearman's rho Correlation Coefficients for the base model independent variables. Pearson statistics are discussed first.

Pearson product-moment correlation coefficients reveal that in 2007 there are strong positive relationships between size and borrowings next year ( $r = 0.82, p < 0.01$ ), Audit quality and borrowings next year ( $r = 0.54, p < 0.01$ ), and audit quality and size ( $r = 0.50, p < 0.01$ ). Medium positive relationships are found between equity issued next year and borrowings next year ( $r = 0.46, p < 0.01$ ), size and equity issued next year ( $r = 0.39, p < 0.01$ ), size and leverage ( $r = 0.35, p < 0.01$ ) and age of fixed assets and GICS sector ( $r = 0.31, p < 0.01$ ).

Similar relationships are in evidence in the 2009 data. The Pearson product-moment correlation coefficient determines strong positive relationships between size and borrowings next year ( $r = 0.79, p < 0.01$ ), audit quality and borrowings next year ( $r = 0.51, p < 0.01$ ), and audit quality and size ( $r = 0.50, p < 0.01$ ). Medium positive correlations are found between equity issued next year and borrowings next year ( $r = 0.46, p < 0.01$ ), size and equity issued next year ( $r = 0.42, p < 0.01$ ), ROA and size ( $r = 0.31, p < 0.01$ ), and age of fixed assets and GICS sector ( $r = 0.30, p < 0.01$ ). A medium negative correlation is found between Tobin's Q and ROA ( $r = -0.37, p < 0.01$ ).

In comparing 2007 and 2009 Pearson correlation statistics, most coefficients maintain the strength and direction of their relationships over this duration. An exception is the association between leverage and equity issued next year, which loses its significant relationship in 2009. In 2009 other relationships develop significance. A positive and significant relationship between ROA and ownership concentration ( $r = 0.10, p < 0.01$ ) and between Tobin's Q and leverage ( $r = 0.20, p < 0.01$ ) result in 2009. Negative and significant associations between ROA and leverage ( $r = -0.10, p < 0.01$ ), Tobin's Q and ROA ( $r = -0.37, p < 0.01$ ) and foreign listing and ROA ( $r = -0.07, p < 0.01$ ) are observed.

Spearman's rho correlations, a nonparametric technique, does not make assumptions about the underlying population distribution and is useful for analysing categorical data (Pallant, 2011). For 2007 data, strong positive correlations are found between borrowings next year and size ( $r = 0.84, p < 0.01$ ), borrowings next year and audit quality ( $r = 0.56, p < 0.01$ ), size and ROA ( $r = 0.60, p < 0.01$ ) and between size and audit quality ( $r = 0.51, p < 0.01$ ). Medium positive correlations are determined for borrowings next year and equity issued next year ( $r = .49, p < 0.01$ ), borrowings next year and ROA ( $r = 0.43, p < 0.01$ ), equity issued next year and size ( $r = 0.37, p < 0.01$ ), leverage and GICS sector ( $r = 0.36, p < 0.01$ ), leverage and size ( $r = 0.44, p < 0.01$ ), leverage and age of fixed assets ( $r = 0.34, p < 0.01$ ), and GICS sector and age of fixed assets ( $r = 0.32, p < 0.01$ ). A medium negative correlation is found between size and Tobin's Q ( $r = -0.31, p < 0.01$ ).

In 2009, the Spearman's rho correlations determine strong positive relationships between borrowings next year and size ( $r = 0.79, p < 0.01$ ), borrowings next year and audit quality ( $r = 0.52, p < 0.01$ ), size and ROA ( $r = 0.66, p < 0.01$ ), and size and audit quality ( $r = .50, p < 0.01$ ). Medium positive correlations are found for borrowings next year and equity issued next year ( $r = .48, p < 0.01$ ), borrowings next year and ROA ( $r = 0.43, p < 0.01$ ), equity issued next year and size ( $r = 0.43, p < 0.01$ ), leverage and GICS sector ( $r = 0.37, p < 0.01$ ), leverage and age of fixed assets ( $r = 0.33, p < 0.01$ ), GICS sector and age of fixed assets ( $r = 0.30, p < 0.01$ ), and ROA and audit quality ( $r = 0.33, p < 0.01$ ).

Comparisons between Spearman's statistics for the two years of this study show four relationships between pairs of variables drop from significance in 2009. These are ownership concentration and competition, ownership concentration and Tobin's Q, GICS sector and Tobin's Q and Tobin's Q and audit quality. All other significant relationships retain that status.

#### **4.9 Summary**

This chapter has described the disclosure index findings and intercoder reliability tests of the indexation results. It provided descriptive statistics of the sample

being studied. In the next chapter, results of statistical testing are presented and discussed.

**Table 4-10 Bivariate correlation matrices 2007 (n = 1776)**

(Pearson Correlation Coefficients are displayed in bold in the upper diagonal, Spearman's rho Correlation Coefficients are displayed in the lower diagonal)												
	Borrowings Next Year	Equity Issued Next Year	Leverage	Ownership Concentration	Competition	GICS Sector	Size	ROA	Tobin's Q	Audit Quality	Age of Fixed Assets	Foreign Listing
Borrowings Next Year		<b>0.46**</b>	<b>0.25**</b>	<b>0.07*</b>	<b>-0.03</b>	<b>0.05</b>	<b>0.82**</b>	<b>0.16**</b>	<b>-0.18**</b>	<b>0.54**</b>	<b>-0.06</b>	<b>0.14**</b>
Equity Issued Next Year	0.49**		<b>0.15**</b>	<b>0.04</b>	<b>0.04</b>	<b>-0.04</b>	<b>0.39**</b>	<b>0.06</b>	<b>0.04</b>	<b>0.21**</b>	<b>-0.06*</b>	<b>0.09**</b>
Leverage	0.32**	0.15**		<b>0.03</b>	<b>-0.08**</b>	<b>0.29**</b>	<b>0.35**</b>	<b>0.02</b>	<b>-0.01</b>	<b>0.17**</b>	<b>0.26**</b>	<b>-0.04</b>
Ownership Concentration	0.07*	0.03	0.03		<b>-0.04</b>	<b>0.05*</b>	<b>0.13**</b>	<b>0.04</b>	<b>0.01</b>	<b>0.10**</b>	<b>0.08**</b>	<b>0.03</b>
Competition	-0.03	0.03	-0.09**	-0.05*		<b>-0.24**</b>	<b>-0.08**</b>	<b>-0.03</b>	<b>0.02</b>	<b>-0.05*</b>	<b>-0.05*</b>	<b>-0.01</b>
GICS Sector	0.04	-0.04	0.36**	0.03	-0.21**		<b>0.13**</b>	<b>0.02</b>	<b>-0.03</b>	<b>0.10**</b>	<b>0.31**</b>	<b>-0.10**</b>
Size	0.84**	0.37**	0.44**	0.09**	-0.04	0.17**		<b>0.13**</b>	<b>-0.24**</b>	<b>0.50**</b>	<b>0.01</b>	<b>0.11**</b>
ROA	0.43**	0.08**	0.28**	0.12**	0.05	0.21**	0.60**		<b>-0.02</b>	<b>0.06**</b>	<b>0.05*</b>	<b>0.02</b>
Tobin's Q	-0.09*	0.05	-0.14**	0.14**	-0.01	-0.10**	-0.31**	-0.24**		<b>-0.06*</b>	<b>0.03</b>	<b>0.09**</b>
Audit Quality	0.56**	0.23**	0.23**	0.08**	-0.04	0.10**	0.51**	0.29**	-0.06**		<b>0.10**</b>	<b>0.04</b>
Age of Fixed Assets	-0.04	-0.07*	0.34**	0.07**	-0.08**	0.32**	0.05*	0.12**	0.07**	0.11**		<b>0.02</b>
Foreign Listing	0.13**	0.10**	-0.04	0.04	-0.01	-0.11**	0.08**	-0.05	0.05*	0.04	0.03	

"Note: \*\*, Correlation is significant at the 0.01 level (2-tailed); \*, Correlation is significant at the 0.05 level (2-tailed).

**Table 4-11 Bivariate correlation matrices 2009 (n = 1853)**

(Pearson Correlation Coefficients are displayed in bold in the upper diagonal, Spearman's rho Correlation Coefficients are displayed in the lower diagonal)												
	Borrowings Next Year	Equity Issued Next Year	Leverage	Ownership Concentration	Competition	GICS Sector	Size	ROA	Tobin's Q	Audit Quality	Age of Fixed Assets	Foreign Listing
Borrowings Next Year		<b>0.46**</b>	<b>0.09*</b>	<b>0.12**</b>	<b>-0.07</b>	<b>0.08</b>	<b>0.79**</b>	<b>0.23**</b>	<b>-0.12**</b>	<b>0.51**</b>	<b>-0.03</b>	<b>0.18**</b>
Equity Issued Next Year	0.48**		<b>0.05</b>	<b>0.01</b>	<b>-0.03</b>	<b>-0.01</b>	<b>0.42**</b>	<b>0.05</b>	<b>-0.05</b>	<b>0.21**</b>	<b>-0.09**</b>	<b>0.14**</b>
Leverage	0.15**	0.06*		<b>-0.03</b>	<b>-0.11**</b>	<b>0.28**</b>	<b>0.17**</b>	<b>-0.10**</b>	<b>0.20**</b>	<b>0.13**</b>	<b>0.25**</b>	<b>-0.01</b>
Ownership Concentration	0.15**	0.02	-0.02		<b>-0.04</b>	<b>0.05*</b>	<b>0.15**</b>	<b>0.10**</b>	<b>-0.05*</b>	<b>0.11**</b>	<b>0.11**</b>	<b>0.03</b>
Competition	-0.05	-0.02	-0.11**	-0.04		<b>-0.18**</b>	<b>-0.09**</b>	<b>-0.04</b>	<b>0.01</b>	<b>-0.07**</b>	<b>-0.10**</b>	<b>-0.04</b>
GICS Sector	0.07	-0.03	0.37**	0.04	-0.17**		<b>0.17**</b>	<b>0.04</b>	<b>0.04</b>	<b>0.13**</b>	<b>0.30**</b>	<b>-0.10**</b>
Size	0.79**	0.43**	0.29**	0.14**	-0.04	0.20**		<b>0.31**</b>	<b>-0.22**</b>	<b>0.50**</b>	<b>0.01</b>	<b>0.15**</b>
ROA	0.43**	0.13**	0.17**	0.16**	0.01	0.26**	0.66**		<b>-0.37**</b>	<b>0.14**</b>	<b>0.01</b>	<b>-0.07**</b>
Tobin's Q	-0.11**	0.02	0.21**	-0.01	-0.02	-0.01	-0.25**	-0.22**		<b>-0.05*</b>	<b>0.03</b>	<b>-0.01</b>
Audit Quality	0.52**	0.21**	0.21**	0.10**	-0.04	0.14**	0.50**	0.33**	-0.03		<b>0.11**</b>	<b>0.06*</b>
Age of Fixed Assets	-0.01	-0.06*	0.33**	0.11**	-0.11**	0.30**	0.05*	0.18**	0.17**	0.12**		<b>0.01</b>
Foreign Listing	0.15**	0.12**	0.01	0.01	-0.04	-0.11**	0.11**	-0.01	0.06*	0.06*	0.02	

"Note: \*\*, Correlation is significant at the 0.01 level (2-tailed); \*, Correlation is significant at the 0.05 level (2-tailed).

## Chapter 5 Results and Analysis

### 5.1 Empirical Tests

Recall that the NGER Act 2007 (Cth) became operational in 2008. This research studies the voluntary GHG disclosures made in 2007 and 2009 in ASX-listed companies' annual and stand-alone sustainability reports and therefore it is possible to identify how they have progressed during that period. Independent-samples T-tests are performed on the disclosure scores for the whole sample. Similar tests are carried out on the disclosure scores of the disclosing companies and on the ratio of hard to total disclosures of those same companies. Results are presented in Table 5-1 and are discussed in the two sections following.

#### 5.1.1 Whole sample

An independent-samples t-test is carried out to compare the disclosure scores of the full sample for 2007 and 2009. There is a significant difference in disclosure scores for 2007 ( $M = 0.80$ ,  $SD = 2.88$ ) and 2009 ( $M = 1.07$ ,  $SD = 3.25$ );  $t(3605.51) = -2.66$ ,  $p < 0.01$  (two-tailed). However, the effect size of the differences in the means (mean difference =  $-0.27$ , 95.00 per cent CI:  $-0.47$  to  $-0.07$ ) is very small ( $\eta^2 = 0.00$ ). A Mann-Whitney U Test reveals a significant difference in the GHG disclosure levels of companies in 2007 ( $Md = 0.00$ ,  $n = 1776$ ) and 2009 ( $Md = 0.00$ ,  $n = 1853$ ).

#### 5.1.2 Disclosing companies

Applying the same testing procedure to the disclosing companies' scores for 2007 and 2009 reveals a significant difference in disclosure scores for 2007 ( $M = 6.54$ ,  $SD = 5.49$ ) and 2009 ( $M = 5.10$ ,  $SD = 5.44$ );  $t(606) = 3.12$ ,  $p = 0.00$  (two-tailed). There is a small effect size ( $\eta^2 = 0.02$ ) of the differences in the means (mean difference =  $1.44$ , 95.00 per cent CI:  $0.53$  to  $2.35$ ). A Mann-Whitney U Test reveals a significant difference in the GHG disclosure levels of companies in 2007 ( $Md = 5.00$ ,  $n = 218$ ) and 2009 ( $Md = 3.00$ ,  $n = 390$ ).

The performance of an independent-samples t-test on the disclosing companies' hard to total disclosure ratios for 2007 and 2009 reveals the following. There is a

significant difference in the hard to total disclosure ratios for 2007 (M = .41, SD = .26) and 2009 (M = .28, SD = .29);  $t(490.70) = 5.86$ ,  $p = 0.00$  (two-tailed). The magnitude of the differences in the means (mean difference = .13, 95.00 per cent CI: 0.09 to 0.18) approaches a moderate effect ( $\eta^2 = 0.05$ ). A Mann-Whitney U Test also reveals a significant difference in the hard to total ratio of GHG disclosures of companies in 2007 (Md = .48, n = 218) and 2009 (Md = .25, n = 390).

It is possible to conclude that while some companies' actions in providing superior GHG information to interested users undergo a change after the NGER legislation becomes effective, and more companies make voluntary GHG disclosures in their annual reports and/or stand-alone sustainability reports, the quality of disclosures does not improve overall.

**Table 5-1 Results of Statistical Tests Comparing 2007 and 2009 Disclosure Index Scores**

Variable	Sample	Category	N	Mean	Std. Dev.	t	p	Mann-Whitney P
Total number of disclosures	Whole sample	2007	1776	.80	2.88	-2.66	<0.01	0.00
		2009	1853	1.07	3.25			
Total number of disclosures	Disclosing companies	2007	218	6.54	5.49	3.12	0.00	0.00
		2009	390	5.10	5.44			
Ratio of hard to total disclosures	Disclosing companies	2007	218	.41	.26	5.86	0.00	0.00
		2009	390	.28	.29			

A Mann-Whitney U Test reveals a significant difference in the age of fixed assets in 2007 disclosing companies (Md = .29, n = 218) and in 2007 non-disclosing companies (Md = .21, n = 1558),  $U = 149426$ ,  $z = -2.88$ ,  $p = .004$ ,  $r = .07$ . The  $r$  value of .07 is considered a small effect size (Pallant, 2011). In 2009, this test reveals no significant differences between disclosing companies (Md = .27, n = 390) and non-disclosing companies (Md = .24, n = 1463),  $z = 283489$ ,  $p = .85$ ,  $r = .00$ .

## 5.2 Specification of models

This study initially tests four models. While multiple dependent variables are tested, independent and control variables remain the same throughout. The base models are provided in Chapter 3, Section 3.15

The predicted signs of association for the independent and control variables are included in all tables. Positive signs are expected for the forward looking financing proxies associated with information asymmetry theory (borrowings next year, and equity issued next year). Agency theory variables, leverage and ownership concentration, are predicted to be positive and negative, respectively, reflecting the varying accessibility to additional information by these groups. A negative sign is predicted for the proprietary cost variable, competition. Signs for the GICS sectors energy, utilities, materials and industrials are expected to be positive. Signs for GICS sectors consumer discretionary, consumer staples, financial, health care, information technology and telecommunication services are not forecast. Positive signs are predicted for the control variables, ROA, Tobin's Q, audit quality, age of fixed assets, foreign listing status, and size.

## 5.3 Statistical Tests of the Hypotheses (whole sample)

Archival financial data is combined for hypotheses testing in linear, Tobit and logistic regression analyses. Two models testing the whole sample are first presented for analysis, and are as follow:

$$\begin{aligned} VD_{1,2} = & \beta_0 + \beta_1 \text{ Borrowings next year} + \beta_2 \text{ Equity issued next year} + \beta_3 \text{ Leverage} \\ & + \beta_4 \text{ Ownership Concentration} + \beta_5 \text{ Competition} + \beta_6 \text{ Industry} + \beta_7 \text{ ROA} + \beta_8 \text{ Tobin's Q} \\ & + \beta_9 \text{ Audit Quality} + \beta_{10} \text{ Age of Fixed Assets} + \beta_{11} \text{ Foreign Listing Status} + \beta_{12} \text{ Size} + e \end{aligned}$$

Note that  $VD_1$  is a continuous variable, while  $VD_2$  is dichotomous and based on disclosure behaviour.

### 5.3.1 Model 1

The dependent variable for Model 1 is the index of the quality of GHG disclosures made by all ASX-listed companies in their 2007 (2009) annual reports and stand-alone sustainability reports. Linear and Tobit regression techniques are applied to this model.

Table 5-2 shows the multiple linear regression results for both years. The 2007 model is significant at  $p < 0.00$  and the  $R^2$  is 25.46 per cent.

Hypotheses 1 and 2 are concerned with information asymmetry theory and the information problem. Hypothesis 1 predicts that companies provide better quality GHG disclosures when they seek additional debt finance. The analysis supports this hypothesis. Borrowings next year is positive and significant ( $t = 4.95$ ,  $p = 0.00$ ). This suggests that companies make voluntary greenhouse gas emission disclosures in their annual reports and stand-alone reports when they seek additional debt finance. Support, however, is missing for hypothesis 2, which predicts that companies provide better quality GHG disclosures when they seek additional equity finance ( $t = -1.00$ ,  $p = 0.32$ ).

Hypotheses 3 and 4 are represented by agency proxies, leverage and ownership concentration. Leverage is statistically significant and positive ( $t = 1.86$ ,  $p = 0.03$ ), providing support for hypothesis 3 that companies with higher debt levels provide higher quality voluntary GHG emission disclosures. Hypothesis 4's proposal that firms with high concentrated ownership disclose less voluntary information about their GHG emission disclosures is not supported by the 2007 analysis ( $t = 0.61$ ,  $p = 0.54$ ).

Proprietary costs are thought to influence a company's decision not to disclose GHG emission information. Hypothesis 5 proposes that companies in highly competitive product markets disclose less and divulge lower quality information relating to GHG emissions than those in less competitive product markets. Results do not support this hypothesis. The sign of the coefficient is negative, but significance is not achieved ( $t = -0.93$ ,  $p = 0.35$ ).

Hypothesis 6 relates to political cost theory and conjectures that companies disclose more to avoid scrutiny from which additional costs may be imposed. This

hypothesis is concerned with the climate change-sensitivity associated with GICS sector membership. GICS sector – materials is the reference group for industry fixed effects. The partial effects of the GICS sector categorical variable, controlling for the other variables in the model, is statistically significant (F Change = 7.24,  $p = 0.00$ ), thus implying significance as predicted. When referred to the reference group (GICS sector – materials) some seven GICS sectors have significant, but negative associations. Negative, but significant, coefficients for GICS sector – consumer discretionary ( $p = 0.00$ ), GICS sector – financials ( $p = 0.00$ ), GICS sector – health care ( $p = 0.00$ ), GICS sector – industrials ( $p = 0.00$ ), GICS sector – information technology ( $p = 0.00$ ), GICS sector – telecommunication services ( $p = 0.00$ ), and GICS sector – utilities ( $p = 0.08$ ) suggest that these sectors are inclined to make fewer GHG disclosures than GICS sector – materials. The climate change-sensitivity nature of energy, utilities, industrials and materials GICS sectors lead to the assumption that they make more GHG disclosures than those in other sectors. Partial support for this hypothesis is therefore found.

**Table 5-2 Results Model 1 (Linear Regression)**

		2007, n = 1776				2009, n = 1853			
		B	t	Sig*	VIF	B	t	Sig*	VIF
Constant		-9.56	-12.99	0.00		-11.95	-14.96	0.00	
Borrowings next year	+	0.04	4.95	0.00	1.54	0.03	2.69	0.00	1.40
Equity issued next year	+	-0.01	-1.00	0.32	1.18	0.00	0.20	0.84	1.18
Leverage	+	0.46	1.86	0.03	1.56	0.19	0.78	0.43	1.48
Ownership concentration	-	0.00	0.61	0.54	1.08	0.00	0.53	0.60	1.07
Competition	-	-0.28	-0.93	0.35	1.24	-0.23	-0.72	0.47	1.14
GICS Sector – Consumer Discretionary		-1.51	-6.05	0.00	1.51	-1.40	-5.01	0.00	1.46
GICS Sector – Consumer Staples		-0.12	-0.30	0.77	1.14	0.37	0.84	0.40	1.11
GICS Sector – Energy	+	-0.01	-0.05	0.96	1.29	-0.08	-0.38	0.70	1.21
GICS Sector – Financials		-1.23	-5.79	0.00	1.69	-1.29	-5.65	0.00	1.60
GICS Sector – Health Care		-1.09	-4.24	0.00	1.44	-1.20	-4.30	0.00	1.37
GICS Sector – Industrials	+	-0.76	-3.17	0.00	1.51	-0.44	-1.70	0.09	1.50
GICS Sector – Information Technology		-1.01	-3.54	0.00	1.36	-0.73	-2.23	0.03	1.30
GICS Sector – Telecommunication Services		-1.41	-2.88	0.00	1.13	-1.43	-2.55	0.01	1.08
GICS Sector – Utilities	+	-0.85	-1.73	0.08	1.11	-0.52	-0.99	0.32	1.09
ROA	+	-0.44	-2.26	0.02	1.55	-0.70	-2.37	0.02	1.86
Tobin’s Q	+	0.10	2.57	0.00	1.30	0.30	4.04	0.00	1.38
Audit Quality	+	-0.10	-0.74	0.46	1.40	-0.14	-0.89	0.38	1.38
Age of Fixed Assets	+	0.94	3.82	0.00	1.35	0.64	2.45	0.01	1.37
Foreign Listing Status	+	0.56	2.92	0.00	1.07	0.44	2.11	0.02	1.08
Size	+	0.58	14.41	0.00	2.39	0.73	16.77	0.00	2.61
<p>2007: <math>R^2 = 0.25</math>; adjusted <math>R^2 = 0.25</math>; <math>F = 29.96</math>; <math>p = 0.00</math>                  2009: <math>R^2 = 0.27</math>; adjusted <math>R^2 = 0.26</math>; <math>F = 33.60</math>; <math>p = 0.00</math></p>									
<p><i>Dependent variable = the score of voluntary GHG disclosures based on annual reports and sustainability reports for 2007 (2009); Borrowings next year = the natural log of proceeds from borrowings in the following year; Leverage = the ratio of total liabilities to total assets; Ownership Concentration = the per centage of shares held by those who own more than 5 per cent; Competition = the degree of competition in the industry sub-sector calculated as one minus the Herfindahl Index; Industry = fixed industry effects 1 = if the company is a member of the GICS sector - consumer discretionary, 0 otherwise; 1 = if the company is a member of the GICS sector - consumer staples, 0 otherwise; 1 = if the company is a member of the GICS sector - energy, 0 otherwise; 1 = if the company is a member of the GICS sector - financials, 0 otherwise; 1 = if the company is a member of the GICS sector - health care, 0 otherwise; 1 = if the company is a member of the GICS sector - industrials, 0 otherwise; 1 = if the company is a member of the GICS sector - information technology, 0; 1 = if the company is a member of the GICS sector - telecommunication services consumer staples, 0 otherwise; ROA = income before abnormal items at the end of the year (either 2007 or 2009) divided by total assets at the end of the previous financial year (either 2006 or 2008); Tobin’s Q = the sum of market value of common equity, book value of preferred stock and book value of total debt, all divided by book value of total assets; Audit Quality = a dichotomous variable where 1 equals the engagement of a Big 4 auditor, 0 otherwise; Age of Fixed Assets = accumulated depreciation of property plant and equipment divided by gross property plant and equipment; Foreign Listing Status = a dichotomous variable where 1 equals a listing on an overseas stock exchange in addition to the ASX, 0 otherwise; Size = the natural log of total assets.</i></p>									
<p><i>Note: Two-tailed tests unless a direction is predicted.</i></p>									

The control variables, ROA, Tobin’s Q, audit quality, age of fixed assets, foreign listing status and size have mixed results.

ROA is statistically significant, but has the opposite sign to that predicted (t = -2.26, p = .02). This suggests, contrary to expectations that voluntary GHG disclosures

are made when firms are underperforming financially. Tobin's Q is positive as predicted and statistically significant ( $t = 2.57$ ,  $p = 0.00$ ). This allows the conclusion to be drawn that voluntary greenhouse gas disclosures in annual reports and stand-alone sustainability reports are of relevance to stock market participants.

Audit quality is both negative contrary to expectations, and non-significant ( $t = -0.74$ ,  $p = 0.46$ ). Thus it cannot be concluded that the presence of a Big 4 auditor is a motivating factor for the making of voluntary GHG disclosures.

Age of fixed assets is found to be statistically significant and positive ( $t = 3.82$ ,  $p = 0.00$ ). It is possible to conclude that firms with older fixed assets, and thus emitters of more pollution, disclose more about their GHG emissions.

Foreign listing status is positive as predicted, and statistically significant ( $t = 2.92$ ,  $p = 0.00$ ). This suggests that firms are likely to disclose more voluntary greenhouse gas emission information because of overseas listing requirements.

Voluntary GHG emission disclosures are positively associated with the size of the disclosing corporation ( $t = 14.41$ ,  $p = 0.00$ ). This positive statistical significance suggests that large firms disclose more voluntary greenhouse gas emission information.

The 2009 multiple regression results, shown also at Table 5-2 are similar. The total variance explained by this model is 26.83 per cent ( $R^2 = 0.27$ ). The statistical significance of the result is 0.00.

Hypotheses 1 and 2 are concerned with information asymmetry theory and the information problem. As in 2007, hypothesis 1 finds support to the exclusion of hypothesis 2. Borrowings next year (hypothesis 1) is positive and significant ( $t = 2.69$ ,  $p = 0.00$ ). It is concluded that companies provide better quality GHG disclosures when they seek additional debt finance. Equity issued next year is positive but not significant ( $t = 0.20$ ,  $p = 0.84$ ). Therefore, no support is found for hypothesis 2 that companies provide higher quality GHG disclosures when they seek additional equity finance.

Hypothesis 3 purports that companies with higher debt levels provide higher quality voluntary GHG emission disclosures. It is not supported by 2009 analysis.

While leverage, an agency proxy, is of the predicted sign, it fails to achieve significance ( $t = 0.78$ ,  $p = 0.43$ ). The second agency proxy variable is ownership concentration. It is central to hypothesis 4 that firms with high concentrated ownership disclose less voluntary information about their GHG emission disclosures. As in 2007, concentrated ownership is not significant ( $t = 0.53$ ,  $p = 0.60$ ) and so does not support hypothesis 4.

Hypothesis 5, that companies in highly competitive product markets disclose less and disclose lower quality GHG information is not supported. Competition, while negative, is not significant ( $t = -0.72$ ,  $p = 0.47$ ).

Support is partly found for the political cost hypothesis, hypothesis 6. This hypothesis proposes that companies in climate change-sensitive GICS sectors, and therefore energy, utilities, materials and industrials, are likely to disclose more GHG information because of the political sensitivity of their operations in regard to climate change. Results for companies in the GICS sector - materials and GICS sector - industrials are significant. The partial effects of the GICS sector categorical variable, controlling for the other variables in the model, is statistically significant (F Change = 6.65,  $p = 0.00$ ), thus implying significance as predictor. Negative, but significant coefficients for each of the following GICS sectors, GICS sector – consumer discretionary ( $p = 0.00$ ), GICS sector – financials ( $p = 0.00$ ), GICS sector – health care ( $p = 0.00$ ), GICS sector – industrials ( $p = 0.09$ ), GICS sector – information technology ( $p = 0.03$ ), and GICS sector – telecommunication services ( $p = 0.01$ ), indicate that these sectors make fewer GHG disclosures than GICS sector – materials.

Similar results are again found among the control variables' associations with voluntary GHG emission disclosures in this latest year of study. ROA, Tobin's Q, audit quality, age of fixed assets, foreign listing status and size again have mixed results. ROA is statistically significant, but the opposite sign to that predicted recurs in 2009 ( $t = -2.37$ ,  $p = .02$ ). Tobin's Q is positive as predicted and statistically significant ( $t = 4.04$ ,  $p = 0.00$ ). Audit quality is both negative and non-significant ( $t = -0.89$ ,  $p = 0.38$ ), against expectations. Age of fixed assets is again statistically significant and positive ( $t = 2.45$ ,  $p = 0.01$ ). Foreign listing status is again positive and statistically significant ( $t = 2.11$ ,  $p = 0.02$ ). Size is once more positive and significant ( $t = 16.77$ ,  $p = 0.00$ ).

In summary, results indicate that the stock market's interest in GHG emission information, companies holding older fixed assets and therefore conjectured to have less pollution controls, being listed on a stock exchange outside of Australia, and the size of the company influence the making of voluntary GHG disclosures.

Model 1 is further subjected to Tobit regression analysis, using a Newton-Raphson algorithm (see Table 5-3). Tobit models are suitable when the dependent variable is continuous but its range is constrained (Verbeek, 2004). This is often in evidence when a substantial part of the population has a zero dependent variable and the balance of the population has positive dependent variables with many different outcomes. In this study, zero voluntary GHG disclosures are observed for the majority of the population (2007  $n = 1,558$ , 2009  $n = 1,463$ ) with the remainder (2007  $n = 218$ , 2009  $n = 390$ ) making disclosures.

Tobit models are usually estimated using maximum likelihood and coefficients have dual interpretations (Verbeek, 2004). Firstly, the coefficient indicates the impact of a change in the variable on the probability of a non-zero disclosure. Secondly, it estimates the impact of a change in the variable on the level of the disclosure. Interpreting Tobit coefficients is not obvious (Roncek, 1992) so this study follows Cormier & Magnan's (1999) environmental disclosures study and discusses only the predicted direction and significance of coefficient estimates.

Table 5-3 describes the Tobit regression results for 2007 and 2009 whole sample. The 2007 results are the first discussed. Under this analysis technique, the model for 2007 data is significant at  $p = 0.00$  and a pseudo  $R^2$  of 33.59 per cent (Veall & Zimmermann, 1994). The 2007 results are mostly similar to the OLS regression results in terms of direction and significance<sup>51</sup>. In 2007, borrowings next year is statistically significant and positive as predicted ( $z = 3.55$ ,  $p = 0.00$ ). This result supports hypothesis 1 that companies provide higher quality GHG disclosures when they seek additional debt finance.

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<sup>51</sup> The exception is competition, which enters into significance under Tobit regression in this year.

Equity issued next year is negative and insignificant ( $z = -1.29$ ,  $p = 0.20$ ). Therefore, hypothesis 2, that companies provide higher quality GHG disclosures when they seek additional equity finance, remains unsubstantiated.

Leverage is significant and in the predicted sign ( $z = 1.49$ ,  $p = 0.07$ ). This supports hypothesis 3 that companies with higher debt are more forthcoming with their GHG information. Ownership concentration again fails to achieve significance ( $z = 0.31$ ,  $p = 0.76$ ), thus rejecting hypothesis 4's proposal of a negative relationship existing between ownership concentration and GHG emission disclosures.

Companies in more competitive product markets are found to disclose less GHG emission information ( $z = -2.03$ ,  $p = 0.04$ ), thus providing support for hypothesis 5.

Hypothesis 6 asserts that companies in climate change-sensitive GICS sectors of materials, energy, utilities and industrials, are likely to disclose more voluntary GHG information in order to minimise the imposition of political costs. Indirect support is forthcoming from this statistical test. Significant results are achieved for GICS Sector – consumer discretionary ( $z = -3.37$ ,  $p = 0.00$ ), GICS sector – financials ( $z = -4.05$ ,  $p = 0.00$ ), GICS sector – health care ( $z = -3.91$ ,  $p = 0.00$ ), GICS sector – information technology ( $z = -2.30$ ,  $p = 0.02$ ) and GICS sector – telecommunication services ( $z = -2.74$ ,  $p = 0.01$ ). These results indicate that these sectors disclose less than the reference group, GICS sector – materials. The non-significance of the other GICS sectors indicates that these disclose much the same as the reference group.

The control variables conform to their OLS results in 2007. ROA is again significant, but has the unpredicted sign ( $z = -1.72$ ,  $p = 0.09$ ), and audit quality has the correct sign but is not significant ( $z = 1.24$ ,  $p = 0.22$ ). Tobin's Q ( $z = 4.43$ ,  $p = 0.00$ ), age of fixed assets ( $z = 2.63$ ,  $p = 0.00$ ), foreign listing status ( $z = 1.45$ ,  $p = 0.07$ ) and size ( $z = 10.76$ ,  $p = 0.00$ ) are found to influence voluntary GHG disclosures.

The 2009 results, also shown in Table 5-3, are significant at  $p = 0.00$ , with pseudo  $R^2$  of 29.21 per cent (Veall & Zimmermann, 1994), but no hypotheses find support under this technique. The 2009 Tobit results differ from their OLS results in that borrowings next year ( $z = 1.17$ ,  $p = 0.24$ ) is not significant in the Tobit analysis, audit

quality makes a contribution to the model, although not in the direction predicted, ( $z = -2.39$ ,  $p = 0.02$ ), and neither age of fixed assets ( $z = 0.62$ ,  $p = 0.27$ ) nor foreign listing status ( $z = 0.37$ ,  $p = 0.71$ ) are significant. The control variables that influence the making of voluntary GHG disclosures are ROA ( $z = -1.98$ ,  $p = 0.05$ ), Tobin's Q ( $z = 2.70$ ,  $p = 0.01$ ), audit quality ( $z = -2.39$ ,  $p = 0.02$ ), and size ( $z = 14.18$ ,  $p = 0.00$ ). Of these, only Tobin's Q and size matches expectations, and it appears that larger companies make GHG disclosures because they are of relevance to stock market participants.

**Table 5-3 Results Model 1 (Tobit Regression)**

		2007			2009		
		n = 1776			n = 1853		
		B	z-Statistic	Sig*	B	z-Statistic	Sig*
Constant		-66.75	-12.21	0.00	-49.67	-14.82	0.00
Borrowings next year	+	0.18	3.55	0.00	0.04	1.17	0.24
Equity issued next year	+	-0.06	-1.29	0.20	0.03	0.84	0.40
Leverage	+	2.51	1.49	0.07	-1.03	-1.04	0.30
Ownership concentration	-	0.00	0.31	0.76	0.01	0.64	0.52
Competition	-	-3.55	-2.03	0.04	0.04	0.03	0.98
GICS Sector – Consumer Discretionary		-4.96	-3.37	0.00	-4.11	-3.78	0.00
GICS Sector – Consumer Staples		-1.80	-0.86	0.39	0.52	0.36	0.72
GICS Sector – Energy	+	1.50	-1.17	0.24	0.81	1.08	0.28
GICS Sector – Financials		-5.12	-4.05	0.00	-4.80	-5.39	0.00
GICS Sector – Health Care		-8.88	-3.91	0.00	-7.09	-4.81	0.00
GICS Sector – Industrials	+	-1.05	-0.83	0.41	-0.29	-0.33	0.74
GICS Sector – Information Technology		-4.95	-2.30	0.02	-2.20	-1.64	0.10
GICS Sector – Telecommunication Services		-12.07	-2.74	0.01	-5.88	-2.35	0.02
GICS Sector – Utilities	+	-1.94	-0.84	0.40	0.71	0.46	0.64
ROA	+	-2.41	-1.72	0.09	-2.20	-1.98	0.05
Tobin's Q	+	1.19	4.43	0.00	0.75	2.70	0.01
Audit Quality	+	1.20	1.24	0.22	-1.44	-2.39	0.02
Age of Fixed Assets	+	4.25	2.63	0.00	0.66	0.62	0.27
Foreign Listing Status	+	1.50	1.45	0.07	0.26	0.37	0.71
Size	+	2.95	10.76	0.00	2.48	14.18	0.00
2007: Pseudo R <sup>2</sup> = 0.34							
2009: Pseudo R <sup>2</sup> = 0.29							
<p><i>Dependent variable = the score of voluntary GHG disclosures based on annual reports and sustainability reports for 2007 (2009); Borrowings next year = the natural log of proceeds from borrowings in the following year; Leverage = the ratio of total liabilities to total assets; Ownership Concentration = the per centage of shares held by those who own more than 5 per cent; Competition = the degree of competition in the industry sub-sector calculated as one minus the Herfindahl Index; Industry = fixed industry effects 1= if the company is a member of the GICS sector - consumer discretionary, 0 otherwise; 1 = if the company is a member of the GICS sector - consumer staples, 0 otherwise; 1 = if the company is a member of the GICS sector - energy, 0 otherwise; 1 = if the company is a member of the GICS sector - financials, 0 otherwise; 1 = if the company is a member of the GICS sector - health care, 0 otherwise; 1 = if the company is a member of the GICS sector - industrials, 0 otherwise; 1 = if the company is a member of the GICS sector - information technology, 0; 1 = if the company is a member of the GICS sector - telecommunication services consumer staples, 0 otherwise; ROA = income before abnormal items at the end of the year (either 2007 or 2009) divided by total assets at the end of the previous financial year (either 2006 or 2008); Tobin's Q = the sum of market value of common equity, book value of preferred stock and book value of total debt, all divided by book value of total assets; Audit Quality = a dichotomous variable where 1 equals the engagement of a Big 4 auditor, 0 otherwise; Age of Fixed Assets = accumulated depreciation of property plant and equipment divided by gross property plant and equipment; Foreign Listing Status = a dichotomous variable where 1 equals a listing on an overseas stock exchange in addition to the ASX, 0 otherwise; Size = the natural log of total assets.</i></p>							
<i>Note: Two-tailed tests unless a direction is predicted.</i>							

### 5.3.2 Model 2

The dependent variable for Model 2 is a categorical variable of disclosers and non-disclosers, and is determined according to whether or not an ASX-listed company makes voluntary GHG disclosures in their 2007 (2009) annual reports and stand-alone

sustainability reports. Independent variables remain the same. Logistic regression is performed on this model to assess the likelihood that companies disclose their GHG information. The results for 2007, shown in Table 5-4, are discussed first.

The model is statistically significant, Chi-square (20, N = 1776) = 425.61,  $p < 0.00$ , indicating that the model is able to distinguish between companies that make voluntary GHG disclosures and those that do not. The model as a whole explains between 21.34 per cent (Cox and Snell R square) and 40.58 per cent (Nagelkerke R squared) of the variance in disclosures, and correctly classifies 90.09 per cent of cases. The Hosmer and Lemeshow Test reveals a Chi-square value of 9.92 and a significance level of 0.27<sup>52</sup>, indicative of support for this model.

Model 2 provides support for only three hypotheses. This model marginally supports hypothesis 3 that companies with higher debt levels provide higher quality voluntary GHG emission disclosures (wald = 1.64,  $p = 0.10$ ). Evidence is provided for hypothesis 5 that companies in highly competitive product markets disclose less and divulge lower quality information relating to GHG emissions than those in less competitive product markets (wald = 5.64,  $p = 0.02$ ). The influence of membership of climate-change sensitive GICS sectors on GHG emission disclosures (hypothesis 6) is partially supported. GICS sector – materials is significant (wald = 35.59,  $p = 0.00$ ), and GICS sector – energy is likely to make more disclosures than GICS sector - materials (wald = 2.78,  $p = 0.10$ ). GICS sectors – industrials and utilities are not significant (wald = 0.26,  $p = 0.61$ , wald = 0.46,  $p = 0.50$ , respectively). GICS sectors – consumer discretionary (wald = 6.46,  $p = 0.01$ ), financials (wald = 10.42,  $p = 0.00$ ), health care (wald = 10.24,  $p = 0.09$ ), information technology (wald = 2.82,  $p = 0.09$ ) and telecommunication services (wald = 5.54,  $p = 0.02$ ) are significant and less probable to make GHG disclosures in comparison to the GICS sector – materials.

Four control variables are supported in the model. These are Tobin's Q (wald = 17.32,  $p = 0.00$ ), audit quality (wald 1.75,  $p = 0.09$ ), age of fixed assets (wald 5.45,  $p = 0.01$ ), and size (wald = 102.70,  $p = 0.00$ ). This permits the conclusion that voluntary GHG emission disclosures are more likely to be made by larger firms because market

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<sup>52</sup> The Hosmer-Lemeshow Goodness of Fit Test requires a value of  $> 0.05$  for significance.

participants find this information useful; a Big 4 audit firm influences the disclosures; and because fixed assets are older and thus have less pollution controls, leaving the company more susceptible to the imposition of political costs.

The 2009 model is also statistically significant and results are also presented in Table 5-4. This model results in a Chi-square (20, N = 1853) = 364.96,  $p < 0.00$ , indicating that the model is able to distinguish between companies that make voluntary GHG disclosures and those that do not. The model as a whole explains between 17.88 per cent (Cox and Snell R square) and 27.82 per cent (Nagelkerke R squared) of the variance in disclosures, and correctly classifies 82.62 per cent of cases.

Table 5-4 shows results that are less satisfactory than those in 2007. Only GICS sector – materials (wald = 63.59,  $p = 0.00$ ), GICS sector – energy (wald = 3.98,  $p = 0.05$ ) and GICS sector – utilities (wald = 4.88,  $p = 0.03$ ) are significant. Therefore, partial support is found for hypothesis 6, that membership in a climate-change sensitive GICS sector influences voluntary GHG disclosures. Of the control variables, only Tobin's Q (wald = 5.04,  $p = 0.02$ ) and size (wald = 139.90,  $p = 0.00$ ) are in keeping with predictions.

**Table 5-4 Results Model 2 (Logistic Regression)**

		2007			2009		
		n = 1776			n = 1853		
		B	Wald	Sig.*	B	Wald	Sig.*
Constant		-14.49	145.87	0.00	-11.17	169.18	0.00
Borrowings next year	+	-0.04	3.32	0.07	0.00	0.32	0.57
Equity issued next year	+	0.00	0.22	0.64	0.01	0.73	0.39
Leverage	+	0.50	1.64	0.10	-0.33	1.55	0.21
Ownership concentration	-	0.00	0.00	0.95	0.00	0.13	0.72
Competition	-	-0.96	5.64	0.02	0.08	0.06	0.81
GICS Sector – Materials	+		35.59	0.00		63.59	0.00
GICS Sector – Consumer Discretionary		-0.89	6.46	0.01	-0.64	4.99	0.03
GICS Sector – Consumer Staples		-0.39	0.60	0.44	0.43	1.16	0.28
GICS Sector – Energy	+	0.51	2.78	0.10	0.39	3.98	0.05
GICS Sector – Financials		-0.97	10.42	0.00	-1.02	18.27	0.00
GICS Sector – Health Care		-1.71	10.24	0.09	-1.54	14.02	0.00
GICS Sector – Industrials	+	-0.16	0.26	0.61	0.20	0.74	0.39
GICS Sector – Information Technology		-0.90	2.82	0.09	-0.22	0.36	0.55
GICS Sector – Telecommunication Services		-2.21	5.54	0.02	-0.87	1.83	0.18
GICS Sector – Utilities	+	-0.38	0.46	0.50	0.99	4.88	0.03
ROA	+	-0.43	1.71	0.19	-0.61	4.14	0.04
Tobin's Q	+	0.26	17.32	0.00	0.17	5.04	0.02
Audit Quality	+	0.31	1.75	0.09	-0.41	6.83	0.01
Age of Fixed Assets	+	0.91	5.45	0.01	-0.07	0.06	0.40
Foreign Listing Status	+	0.16	0.39	0.53	-0.11	0.29	0.59
Size	+	0.64	102.70	0.00	0.55	139.90	0.00
<p>2007: Chi-square = 425.61 (20, N = 1776), p = 0.00; Cox and Snell R Square = 0.21; Nagelkerke R Square = 0.41; correctly classifying 90.09% of cases; Hosmer-Lemeshow Goodness of Fit Test = &gt; 0.05</p> <p>2009: Chi-square = 364.94 (20, N = 1853), p = 0.00; Cox and Snell R Square = 0.18; Nagelkerke R Square = 0.28; correctly classifying 82.63% of cases; Hosmer-Lemeshow Goodness of Fit Test = &lt; 0.05</p> <p>Dependent variable = a dichotomous variable, 1 = voluntary GHG disclosures are made, 0 otherwise for 2007 (2009); Borrowings next year = the natural log of proceeds from borrowings in the following year; Leverage = the ratio of total liabilities to total assets; Ownership Concentration = the per centage of shares held by those who own more than 5 per cent; Competition = the degree of competition in the industry sub-sector calculated as one minus the Herfindahl Index; Industry = fixed industry effects 1= if the company is a member of the GICS sector - consumer discretionary, 0 otherwise; 1 = if the company is a member of the GICS sector - consumer staples, 0 otherwise; 1 = if the company is a member of the GICS sector - energy, 0 otherwise; 1 = if the company is a member of the GICS sector - financials, 0 otherwise; 1 = if the company is a member of the GICS sector - health care, 0 otherwise; 1 = if the company is a member of the GICS sector - industrials, 0 otherwise; 1 = if the company is a member of the GICS sector - information technology, 0; 1 = if the company is a member of the GICS sector - telecommunication services consumer staples, 0 otherwise; ROA = income before abnormal items at the end of the year (either 2006 or 2008) divided by total assets at the end of the previous financial year (either 2006 or 2008); Tobin's Q = the sum of market value of common equity, book value of preferred stock and book value of total debt, all divided by book value of total assets; Audit Quality = a dichotomous variable where 1 equals the engagement of a Big 4 auditor, 0 otherwise; Age of Fixed Assets = accumulated depreciation of property plant and equipment divided by gross property plant and equipment; Foreign Listing Status = a dichotomous variable where 1 equals a listing on an overseas stock exchange in addition to the ASX, 0 otherwise; Size = the natural log of total assets.</p>							
<p>Note: Two-tailed tests unless a direction is predicted.</p>							

#### 5.4 Statistical Tests of the Hypotheses (subsample of disclosing companies)

A better understanding of the factors that influence the voluntary disclosure of GHG information is possible by isolating the disclosing companies and applying statistical tests. Models 3 and 4 concern only the disclosing companies.

### 5.4.1 Model 3

Some 218 (390) companies make voluntary greenhouse gas emission disclosures in 2007 (2009). Ordinary least square linear regression is applied to the subsample of disclosing companies, and tested as Model 3:

$$VD = \beta_0 + \beta_1 \text{ Borrowings next year} + \beta_2 \text{ Equity issued next year} + \beta_3 \text{ Leverage} + \beta_4 \text{ Ownership Concentration} + \beta_5 \text{ Competition} + \beta_6 \text{ Industry} + \beta_7 \text{ ROA} + \beta_8 \text{ Tobin's Q} + \beta_9 \text{ Audit Quality} + \beta_{10} \text{ Age of Fixed Assets} + \beta_{11} \text{ Foreign Listing Status} + \beta_{12} \text{ Size} + e$$

Results of linear regression are presented in Table 5-5. The 2007 results are discussed first. It is seen that this model explains a total variance of 29.54 per cent and has a statistical significance of 0.00. Only one hypothesis is fully supported by this model, another receives partial support. Hypothesis 1 predicts that companies provide higher quality GHG disclosures than companies when they seek additional debt finance. Evidence is found in support of this hypothesis. The sign of borrowings next year is positive, as predicted ( $t = 1.65$ ,  $p = 0.05$ ).

Partial support is found for hypothesis 6, that climate-change sensitivity influences disclosures. The partial effects of the GICS sector categorical variable, controlling for the other variables in the model, is statistically significant (F Change = 2.14,  $p = 0.03$ ), thus implying significance as predictor. When referred to the reference group, GICS sector – materials, some four GICS sectors have significant, but negative effects. GICS sector – consumer discretionary ( $p = 0.00$ ), GICS sector – financials ( $p = 0.00$ ), GICS sector – health care ( $p = 0.05$ ), and GICS sector – telecommunication services ( $p = 0.06$ ) all show negative but significant coefficients. This indicates that companies in these GICS sectors make GHG disclosures, but provide fewer voluntary GHG disclosures than companies in the reference group, GICS sector – materials. It was forecast that membership of GICS sector – energy, GICS sector – industrials, and GICS sector – utilities would influence GHG disclosures, but this relationship is unsubstantiated in this model.

Age of fixed assets is positive and significant ( $t = 1.72$ ,  $p = 0.05$ ), allowing the conclusion that as fixed assets age, companies are inclined to make more voluntary GHG disclosures. It is conjectured that this relationship is to explain pollution performance as older assets are likely to produce more emissions. Size, predicted to be positively associated with disclosures, is positive and significant ( $t = 3.98$ ,  $p = 0.00$ ).

The 2009 results explain a total variance of 38.15 per cent and is significant ( $p = 0.00$ ), but is dissimilar to the 2007 results in that borrowings next year is not significant.

Hypothesis 6 predicts that companies in climate change-sensitive GICS sectors, specifically materials, energy, industrials and utilities, disclose more than others. The partial effects of the GICS sector categorical variable, controlling for the other variables in the model, is statistically significant ( $F \text{ Change} = 3.12$ ,  $p = 0.00$ ), thus implying significance as predictor. When referring these results to the reference group, GICS sector – materials, eight GICS sectors have significant, but negative effects. These are GICS sector – consumer discretionary ( $p = 0.00$ ), GICS sector – energy ( $p = 0.09$ ), GICS sector – financials ( $p = 0.00$ ), GICS sector – health care ( $p = 0.01$ ), GICS sector – industrials ( $p = 0.03$ ), GICS sector – information technology ( $p = 0.03$ ), GICS sector – telecommunication services ( $p = 0.01$ ), GICS sector – utilities ( $p = 0.01$ ). As energy, industrials, and utilities are included in here, this hypothesis is supported.

Of the control variables, only foreign listing status ( $t = 1.58$ ,  $p = 0.06$ ), age of fixed assets ( $t = 1.37$ ,  $p = 0.09$ ) and size ( $t = 7.11$ ,  $p = 0.00$ ) are also found to influence GHG disclosures in 2009.

**Table 5-5 Results Model 3 (Linear Regression) Disclosing Companies 2007 & 2009**

		2007				2009			
		n = 218				n = 390			
		B	t	Sig*	VIF	B	t	Sig*	VIF
Constant		-14.99	-3.14	0.00		-15.83	-5.26	0.00	
Borrowings next year	+	0.08	1.65	0.05	1.50	0.04	1.16	0.25	1.66
Equity issued next year	+	0.02	0.44	0.66	1.22	0.00	0.15	0.88	1.14
Leverage	+	0.04	0.02	0.98	1.77	0.02	0.02	0.98	1.74
Ownership concentration	-	0.00	-0.23	0.82	1.14	0.01	0.94	0.35	1.12
Competition	-	0.70	0.46	0.65	1.25	-0.70	-0.59	0.55	1.18
GICS Sector – Consumer Discretionary		-4.27	-3.24	0.00	1.40	-3.88	-3.69	0.00	1.44
GICS Sector – Consumer Staples		-1.40	-0.83	0.41	1.25	-1.81	-1.49	0.14	1.23
GICS Sector – Energy	+	-1.03	-0.88	0.38	1.51	-1.15	-1.68	0.09	1.30
GICS Sector – Financials		-3.22	-3.02	0.00	1.68	-2.68	-3.18	0.00	1.63
GICS Sector – Health Care		-4.69	-2.00	0.05	1.15	-4.22	-2.56	0.01	1.10
GICS Sector – Industrials	+	-1.47	-1.35	0.18	1.57	-1.79	-2.26	0.03	1.74
GICS Sector – Information Technology		-3.01	-1.27	0.21	1.17	-2.95	-2.18	0.03	1.19
GICS Sector – Telecommunication Services		-6.82	-1.88	0.06	1.11	-6.46	-2.77	0.01	1.11
GICS Sector – Utilities	+	-2.47	-1.32	0.19	1.30	-3.39	-2.82	0.01	1.29
ROA	+	-0.58	-0.34	0.74	1.82	-0.36	-0.33	0.74	1.93
Tobin's Q	+	0.24	0.87	0.39	1.58	0.25	0.93	0.35	1.20
Audit Quality	+	0.44	-0.42	0.68	1.48	0.30	0.44	0.66	2.19
Age of Fixed Assets	+	2.81	1.72	0.05	1.36	1.52	1.37	0.09	1.34
Foreign Listing Status	+	1.03	1.17	0.24	1.18	1.03	1.58	0.06	1.19
Size	+	1.01	3.98	0.00	3.60	1.11	7.11	0.00	3.76
<p>2007: <math>R^2 = 0.30</math>; adjusted <math>R^2 = 0.22</math>; <math>F = 4.13</math>; <math>p = 0.00</math>                      2009: <math>R^2 = 0.38</math>; adjusted <math>R^2 = 0.35</math>; <math>F = 11.38</math>; <math>p = 0.00</math></p>									
<p><i>Dependent variable = the score of voluntary GHG disclosures based on annual reports and sustainability reports for 2007 (2009) for disclosing companies; Borrowings next year = the natural log of proceeds from borrowings in the following year; Leverage = the ratio of total liabilities to total assets; Ownership Concentration = the per centage of shares held by those who own more than 5 per cent; Competition = the degree of competition in the industry sub-sector calculated as one minus the Herfindahl Index; Industry = fixed industry effects 1= if the company is a member of the GICS sector - consumer discretionary, 0 otherwise; 1 = if the company is a member of the GICS sector - consumer staples, 0 otherwise; 1 = if the company is a member of the GICS sector - energy, 0 otherwise; 1 = if the company is a member of the GICS sector - financials, 0 otherwise; 1 = if the company is a member of the GICS sector - health care, 0 otherwise; 1 = if the company is a member of the GICS sector - industrials, 0 otherwise; 1 = if the company is a member of the GICS sector - information technology, 0; 1 = if the company is a member of the GICS sector - telecommunication services consumer staples, 0 otherwise; ROA = income before abnormal items at the end of the year (either 2007 or 2009) divided by total assets at the end of the previous financial year (either 2006 or 2008); Tobin's Q = the sum of market value of common equity, book value of preferred stock and book value of total debt, all divided by book value of total assets; Audit Quality = a dichotomous variable where 1 equals the engagement of a Big 4 auditor, 0 otherwise; Age of Fixed Assets = accumulated depreciation of property plant and equipment divided by gross property plant and equipment; Foreign Listing Status = a dichotomous variable where 1 equals a listing on an overseas stock exchange in addition to the ASX, 0 otherwise; Size = the natural log of total assets.</i></p>									
<p><i>Note: Two-tailed tests unless a direction is predicted.</i></p>									

#### 5.4.2 Model 4

Recall Model 4 takes as its dependent variable the ratio of hard to total disclosures, an indication of the quality of voluntary GHG disclosures made. Linear

regression is applied to the 218 (390) companies making voluntary disclosures in 2007 (2009). Results are presented in the following table.

**Table 5-6 Results Model 4 (Linear Regression) Ratio of Hard to Total Disclosures, Disclosing Companies 2007 & 2009**

		2007				2009			
		n = 218				n = 390			
		B	t	Sig*	VIF	B	t	Sig*	VIF
Constant		-0.42	-1.73	0.09		-0.58	-3.48	0.00	
Borrowings next year	+	0.00	0.12	0.91	1.50	0.00	-0.75	0.46	1.66
Equity issued next year	+	0.00	-0.66	0.51	1.22	0.00	0.72	0.47	1.14
Leverage	+	-0.15	-1.62	0.11	1.77	-0.04	-0.67	0.51	1.74
Ownership concentration	-	0.00	1.51	0.13	1.14	0.00	1.36	0.18	1.12
Competition	-	0.12	1.58	0.12	1.25	-0.05	-0.70	0.48	1.18
GICS Sector – Consumer Discretionary		-0.13	-1.91	0.06	1.40	-0.04	-0.68	0.50	1.44
GICS Sector – Consumer Staples		-0.11	-1.34	0.18	1.25	0.01	0.16	0.87	1.23
GICS Sector – Energy	+	-0.10	-1.68	0.10	1.51	-0.05	-1.20	0.23	1.30
GICS Sector – Financials		-0.04	-0.71	0.48	1.68	0.10	2.14	0.03	1.63
GICS Sector – Health Care		-0.15	-1.28	0.20	1.15	0.13	1.42	0.16	1.10
GICS Sector – Industrials	+	-0.07	-1.18	0.24	1.57	0.06	1.44	0.15	1.74
GICS Sector – Information Technology		-0.20	-1.62	0.11	1.17	-0.14	-1.93	0.06	1.19
GICS Sector – Telecommunication Services		-0.35	-1.86	0.06	1.12	-0.30	-2.31	0.02	1.11
GICS Sector – Utilities	+	0.07	0.71	0.48	1.30	0.11	1.70	0.09	1.29
ROA	+	-0.13	-1.48	0.14	1.82	0.09	1.55	0.06	1.93
Tobin's Q	+	0.00	-0.15	0.88	1.58	0.03	2.10	0.02	1.20
Audit Quality	+	-0.03	-0.63	0.53	1.49	0.03	0.72	0.47	2.19
Age of Fixed Assets	+	0.24	2.86	0.00	1.36	0.09	1.42	0.08	1.34
Foreign Listing Status	+	-0.05	-1.10	0.27	1.18	0.03	0.93	0.35	1.19
Size	+	0.04	3.18	0.00	3.60	0.04	4.79	0.00	3.78
2007: $R^2 = 0.18$ ; adjusted $R^2 = 0.09$ ; $F = 2.11$ ; $p = 0.00$ 2009: $R^2 = 0.34$ ; adjusted $R^2 = 0.30$ ; $F = 9.38$ ; $p = 0.00$									
<i>Dependent variable = the ratio of hard to total voluntary GHG disclosures based on annual reports and sustainability reports for 2007 (2009 for disclosing companies); Borrowings next year = the natural log of proceeds from borrowings in the following year; Leverage = the ratio of total liabilities to total assets; Ownership Concentration = the percentage of shares held by those who own more than 5 per cent; Competition = the degree of competition in the industry sub-sector calculated as one minus the Herfindahl Index; Industry = fixed industry effects 1 = if the company is a member of the GICS sector - consumer discretionary, 0 otherwise; 1 = if the company is a member of the GICS sector - consumer staples, 0 otherwise; 1 = if the company is a member of the GICS sector - energy, 0 otherwise; 1 = if the company is a member of the GICS sector - financials, 0 otherwise; 1 = if the company is a member of the GICS sector - health care, 0 otherwise; 1 = if the company is a member of the GICS sector - industrials, 0 otherwise; 1 = if the company is a member of the GICS sector - information technology, 0; 1 = if the company is a member of the GICS sector - telecommunication services consumer staples, 0 otherwise; ROA = income before abnormal items at the end of the year (either 2007 or 2009) divided by total assets at the end of the previous financial year (either 2006 or 2008); Tobin's Q = the sum of market value of common equity, book value of preferred stock and book value of total debt, all divided by book value of total assets; Audit Quality = a dichotomous variable where 1 equals the engagement of a Big 4 auditor, 0 otherwise; Age of Fixed Assets = accumulated depreciation of property plant and equipment divided by gross property plant and equipment; Foreign Listing Status = a dichotomous variable where 1 equals a listing on an overseas stock exchange in addition to the ASX, 0 otherwise; Size = the natural log of total assets.</i>									
<i>Note: Two-tailed tests unless a direction is predicted.</i>									

The 2007 (2009) analysis shows that this model explains a total variance of 17.66 (33.70) per cent and has a statistical significance of 0.00 (0.00). Contrary to expectations, this model provides limited support for the proffered hypotheses.

An unexpected result in 2007 is that the partial effects of the GICS sector categorical variable, controlling for the other variables in the model, falls from statistical significance (F Change = 1.39,  $p = 0.20$ ), thus eliminating GICS sector membership as a predictor for this model. In 2009, however, results for the GICS sector categorical variable are mostly as expected. When controlling for the other variables in the model, the partial effects of the GICS sector categorical variable is statistically significant (F Change = 3.03,  $p = 0.00$ ). However, of the climate change-sensitive GICS sectors, energy, industrials and utilities, only GICS sector – utilities ( $t = 1.70$ ,  $p = 0.09$ ) makes an impact, and therefore, hypothesis 6 is only partially supported in 2009. It is noted that when referred to the reference group, GICS sector – financials ( $t = 2.14$ ,  $p = 0.03$ ) makes a positive impact, while GICS sector – information technology ( $t = -1.93$ ,  $p = 0.06$ ) and GICS sector - telecommunication ( $t = -2.31$ ,  $p = 0.02$ ) provide a negative impact.

In 2007 age of fixed assets ( $t = 2.86$ ,  $p = 0.00$ ) provides evidence that older fixed assets are an influencing factor for companies' GHG disclosure behaviour. This relationship is also found in 2009 ( $t = 1.42$ ,  $p = 0.08$ ). Both financial performance control variables present as significant in 2009 but not in 2007. In 2009, ROA is positive and significant ( $t = 1.55$ ,  $p = 0.06$ ) and Tobin's Q also has these attributes ( $t = 2.10$ ,  $p = 0.02$ ). From this, it is possible to conclude that in 2009, companies performing better financially in terms of accounting and market metrics are inclined to disclose better quality GHG emission information voluntarily. Companies in the GICS sector - utilities and GICS sector – financials make better quality disclosures after the NGER Act is enacted. Size is positive and significant in both years (2007:  $t = 3.18$ ,  $p = 0.00$ ; 2009:  $t = 4.79$ ,  $p = 0.00$ ), permitting the conjecture that the larger the company, the better is its quality of voluntary GHG information.

## 5.5 Summary of Results

In summary, the 2007 and 2009 voluntary GHG disclosures of ASX-listed companies are tested using four models and five statistical techniques. Models 1 and 2 test the entire population for 2007 and 2009; Models 3 and 4 are restricted to disclosing companies. The independent and control variables are the same in all models.

Table 5-2, Table 5-3, Table 5-4, Table 5-5 and Table 5-6 indicate the predicted signs of association for the independent and control variables. Positive signs are expected for the forward looking financing proxies associated with information asymmetry theory (borrowings next year, and equity issued next year). Agency theory variables, leverage and ownership concentration, are predicted to be positive and negative, respectively, reflecting the varying accessibility to additional information by these groups. A negative sign is predicted for the proprietary cost variable, competition. The political cost variables associated with GICS membership is expected to be an influencing factor, and signs for GICS sector – materials, GICS sector – energy, GICS sector – industrials, and GICS sector utilities are forecast as being positive. Positive signs are predicted for the control variables, ROA, Tobin's Q, audit quality, age of fixed assets, foreign listing status, and size. Models 1 and 2 are discussed first. Models 3 and 4 follow.

Models 1 and 2 are based on the entire population of ASX-listed companies in 2007 and 2009 and are tested by linear, Tobit and logistic regression. Support for hypothesis 1 is evidenced in Model 1 under multiple regression and under Tobit regression for 2007. Model 2 does not provide any support for this hypothesis. While results are mixed, it is possible that companies make voluntary greenhouse gas emission disclosures in their annual reports and stand-alone sustainability reports when they seek additional debt finance.

Neither Model 1 nor Model 2 provides support for hypothesis 2, the second information asymmetry conjecture. Equity issued next year is insignificant in all tests.

Hypotheses 3 and 4 are represented by agency proxies, leverage and ownership concentration. Leverage is statistically significant and positive only in Model 1 for 2007 under multiple regression and Tobit regression, and in Model 2 in 2007. Thus,

only limited support is perceptible for the agency theory that debtholders compel disclosures of greenhouse gas emission information to enable them to assess potential future liabilities. This result suggests that debtholders avail themselves of information from other sources with which to make their lending decisions. Ownership concentration is not statistically significant in this study. It is concluded, therefore, that a company's shareholding characteristics do not influence voluntary GHG disclosures.

The proprietary cost hypothesis, Hypothesis 5, is supported Model 1 in 2007 under the Tobit method of analysis, and in Model 2 in 2007. Therefore, in 2007 evidence exists that companies in highly competitive product markets disclose less GHG information.

Political cost theory is represented by Hypotheses 6, which is concerned with the climate change-sensitivity of GICS sector membership and its influence on voluntary GHG disclosure behaviour. A positive direction is predicted for GICS sector – materials, GICS sector – energy, GICS sector – industrials and GICS sector – utilities. Partial support is found for this hypothesis in Model 1 and Model 2.

The control variables, ROA, Tobin's Q, Big 4 auditor, age of fixed assets, foreign listing status and size have mixed results. ROA, while statistically significant in Model 1 (multiple regression and Tobit regression) and in Model 2 in 2009, is consistently of the wrong direction. This suggests that voluntary GHG disclosures are made when firms are underperforming financially.

Tobin's Q, a market-based financial performance variable is uniformly statistically significant and positive as predicted. This evidence permits the conclusion to be drawn that voluntary greenhouse gas disclosures in annual reports and stand-alone sustainability reports are of relevance to stock market participants.

Audit quality is only significant and positive as expected in Model 2 for 2007. Thus it cannot be concluded that Big 4 auditors are a motivating factor for voluntary GHG disclosures.

Age of fixed assets is found to be statistically significant and positive in Model 1 for both years when tested with multiple regression, and for 2007 under Tobit

regression. Model 2 supports the conjecture in 2007. This tends to suggest that firms with older fixed assets, and thus emitters of more pollution, disclose more.

Model 1 provides support for the influence on foreign listing status and voluntary GHG disclosure for both years under multiple regression, and for 2007 under Tobit regression. Model 2 finds no such support. Therefore, limited support is in evidence for the premise that firms are likely to disclose more voluntary greenhouse gas emission information because of overseas listing requirements.

The size variable is statistically significant in Model 1 (multiple regression and Tobin regression) and Model 2 for both years. The positive statistical significance provides support for conjectures that large firms disclose more voluntary greenhouse gas emission information. This is attributed to the costs of providing information being lower for larger firms (Clarkson *et al.*, 2008) and also has linkages with political cost theory.

Models 3 and 4 focus on the disclosing companies. Some 218 companies make GHG disclosures in 2007 and 380 companies do so in 2009. The dependent variable for Model 3 is the total GHG disclosure scores of the disclosing companies. In Model 4 this variable takes the form of the ratio of hard to total disclosures. Multiple regression is applied to both models. Independent t-tests reveal significant differences between the disclosure metrics for both models. Limited success is claimed for the specification of these models.

With regard to hypothesis 6, indications are found that membership in climate change-sensitive GICS sectors somewhat contributes to each model in both years with the exception of 2007 when it has no significance when analysing the hard to total disclosures ratio of disclosing companies.

Age of fixed assets is statistically significant and positive in 2007 and 2009 for both models. This suggests that companies with fixed assets that are older and therefore, more likely to have less pollution controls, make disclosures in anticipation of the NGER Act 2007 (Cth) to establish a baseline from which to measure future performance. Indeed, the mean age of fixed assets is .32 in 2007 and falls to .28 in

2009, indicating that older fixed assets are replaced around the time the NGER Act 2007 (Cth) comes into force.

Foreign listing status is found to influence the disclosing companies' behaviour only in 2009 for Model 3. The expected influence of size is borne out in both Model 3 and Model 4. For each year, size is statistically significant and positive, thus again testament to the established fact that large firms have the resources available to permit them to disclose additional information.

## **5.6 Tests of OLS regression residuals**

Results of evaluation of normality assumptions led to the winsorisation of continuous variables using Tukey's Hinges methodology<sup>53</sup>. Accordingly, equity issued next year (upper level only), leverage (upper level only), ownership concentration (upper level only), Tobin's Q (upper level only), size and ROA are truncated as a means of reducing the impact of outliers without losing cases.

Further tests for normality of the regression residuals include the Jaque-Bera test and the White test for heteroskedasticity. Tests of the regression residuals reveal large divergences from normality. As this study is concerned with the population of ASX-listed companies in 2007 and 2009, non-normality is expected.

No problematic variables are found in either 2007 or 2009 when testing Models 1, 3 and 4 for multicollinearity. The variance inflation factors (VIF) collinearity statistics accompanying the regression results reported in Table 5-2, Table 5-5 and Table 5-6 do not exceed the accepted ceiling of above 10 (Hair Jnr, Anderson, Tatham & Black, 1998; Pallant, 2011).

## **5.7 Robustness Tests**

Equity issued next year and ownership concentration have no statistical significance in any of the four models. Accordingly, prudence suggests that the

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<sup>53</sup> Tukey's method is a simple way of calculating quartiles. The formula for calculating Tukey's Hinges is 1.5 times the spread between the 25<sup>th</sup> and 75<sup>th</sup> per centiles, deducted from the 25<sup>th</sup> per centile value (added to the 75<sup>th</sup> per centile value) to set the lower (upper) bounds for data.

removal of these two variables is likely to produce better results while bringing more parsimony to the models. Thus Model 5 becomes:

$$\begin{aligned} VD = & \beta_0 + \beta_1 \text{ Borrowings next year} + \beta_2 \text{ Leverage} + \beta_3 \text{ Competition} + \beta_4 \text{ Industry} \\ & + \beta_5 \text{ ROA} + \beta_6 \text{ Tobin's Q} + \beta_7 \text{ Audit Quality} + \beta_8 \text{ Age of Fixed Assets} + \beta_9 \text{ Foreign} \\ & \text{Listing Status} + \beta_{10} \text{ Size} + e \end{aligned}$$

and similar modifications are made to Models 2, 3, and 4.

Consequently the four models are re-run under linear, Tobit and logistic regression techniques. No improvements are evidenced under any of the tests and so results for only linear regression analysis follow in Table 5-7.

**Table 5-7 Model 5 (Linear Regression)**

	2007				2009				
	n = 1776				n = 1853				
	B	t	Sig*	VIF	B	t	Sig*	VIF	
Constant		-9.57	-13.01	0.00		-11.95	-14.96	0.00	
Borrowings next year	+	0.04	4.93	0.00	1.51	0.03	2.76	0.00	1.39
Leverage	+	0.47	1.88	0.03	1.55	0.17	0.72	0.47	1.46
Competition	-	-0.28	-0.92	0.36	1.23	-0.25	-0.74	0.46	1.16
GICS Sector – Energy	+	-0.02	-0.07	0.79	1.13	-0.08	-0.39	0.70	1.20
GICS Sector – Financials		-1.21	-5.73	0.94	1.29	-1.30	-5.76	0.00	1.56
GICS Sector – Health Care		-1.06	-4.16	0.00	1.43	-1.20	-4.30	0.00	1.37
GICS Sector – Industrials	+	-0.74	-3.10	0.00	1.50	-0.44	-1.71	0.09	1.49
GICS Sector – Information Technology		-0.97	-3.44	0.00	1.34	-0.74	-2.26	0.02	1.29
GICS Sector – Telecommunication Services		-1.37	-2.81	0.01	1.12	-1.43	-2.55	0.01	1.08
GICS Sector – Utilities	+	-0.84	-1.71	0.09	1.11	-0.52	-1.01	0.31	1.09
ROA	+	-0.41	-2.14	0.03	1.53	-0.68	-2.40	0.02	1.81
Tobin's Q	+	0.09	2.49	0.00	1.20	0.30	4.13	0.00	1.36
Audit Quality	+	-0.10	-0.68	0.50	1.40	-0.14	-0.88	0.38	1.38
Age of Fixed Assets	+	0.96	3.90	0.00	1.35	0.65	2.49	0.00	1.35
Foreign Listing Status	+	0.55	2.87	0.00	1.07	0.44	2.13	0.02	1.08
Size	+	0.58	14.44	0.00	2.36	0.74	16.98	0.00	2.57
2007: $R^2 = 0.25$ ; adjusted $R^2 = 0.25$ ; $F = 33.26$ ; $p = 0.00$ 2009: $R^2 = 0.27$ ; adjusted $R^2 = 0.26$ ; $F = 37.34$ $p = 0.00$									
<i>Dependent variable = the score of voluntary GHG disclosures based on annual reports and sustainability reports for 2007 (2009); Borrowings next year = the natural log of proceeds from borrowings in the following year; Leverage = the ratio of total liabilities to total assets; Ownership Concentration = the per centage of shares held by those who own more than 5 per cent; Competition = the degree of competition in the industry sub-sector calculated as one minus the Herfindahl Index; Industry = fixed industry effects 1= if the company is a member of the GICS sector - consumer discretionary, 0 otherwise; 1 = if the company is a member of the GICS sector - consumer staples, 0 otherwise; 1 = if the company is a member of the GICS sector - energy, 0 otherwise; 1 = if the company is a member of the GICS sector - financials, 0 otherwise; 1 = if the company is a member of the GICS sector - health care, 0 otherwise; 1 = if the company is a member of the GICS sector - industrials, 0 otherwise; 1 = if the company is a member of the GICS sector - information technology, 0; 1 = if the company is a member of the GICS sector - telecommunication services consumer staples, 0 otherwise; ROA = income before abnormal items at the end of the year (either 2007 or 2009) divided by total assets at the end of the previous financial year (either 2006 or 2008); Tobin's Q = the sum of market value of common equity, book value of preferred stock and book value of total debt, all divided by book value of total assets; Audit Quality = a dichotomous variable where 1 equals the engagement of a Big 4 auditor, 0 otherwise; Age of Fixed Assets = accumulated depreciation of property plant and equipment divided by gross property plant and equipment; Foreign Listing Status = a dichotomous variable where 1 equals a listing on an overseas stock exchange in addition to the ASX, 0 otherwise; Size = the natural log of total assets.</i>									
<i>Note: Two-tailed tests unless a direction is predicted.</i>									

No new support is found for other hypotheses that were not supported by Model 1. Model 5 shows the same variables are significant as in non-restricted Model 1. Unexpectedly, a very slight weakening of results occurs. In 2007, Model 5 has an  $R^2$  of 25.25 per cent and is significant ( $p = 0.00$ ). Results in 2009 are  $R^2$  26.82 per cent ( $p = 0.00$ ). Table 5-7 shows support for hypothesis 1. In both years the coefficient for borrowings next year is positive as predicted and significant (2007:  $t = 4.93$ ,  $p = 0.00$ ; 2009:  $t = 2.76$ ,  $p = 0.00$ ). It is concluded that companies provide higher quality GHG disclosures when they seek additional debt finance. Support is found in 2007 for

hypothesis 3, that companies with higher debt levels provide higher quality voluntary GHG emission disclosures. The leverage variable is positive as predicted, and significant ( $t = 1.88, p = 0.03$ ).

Partial support is given to hypothesis 6 by the results for both years. In 2007, the partial effects of the GICS sector categorical variable, controlling for the other variables in the model, is statistically significant ( $F \text{ Change} = 7.11, p = 0.00$ ), thus still implying its significance as a predictor. When referred to the reference group, GICS sector – materials, some six GICS sectors have significant, but negative effects. These are GICS sector – consumer discretionary ( $p = 0.00$ ), GICS sector – health care ( $p = 0.00$ ), GICS sector – industrials ( $p = 0.00$ ), GICS sector – information technology ( $p = 0.00$ ), GICS sector – telecommunication services ( $p = 0.01$ ), and GICS sector – utilities ( $p = 0.09$ ). These results suggest that these sectors are inclined to make fewer GHG disclosures than GICS sector – materials in 2007. In 2009, the partial effects of the GICS sector categorical variable, controlling for the other variables in the model, is also statistically significant ( $F \text{ Change} = 6.84, p = 0.00$ ), and implies significance as predictor. Negative, but significant coefficients occurring for GICS sector – consumer discretionary ( $p = 0.00$ ), GICS sector – financials ( $p = 0.00$ ), GICS sector – health care ( $p = 0.00$ ), GICS sector – industrials ( $p = 0.09$ ), GICS sector – information technology ( $p = 0.02$ ), and GICS sector – telecommunication services ( $p = 0.01$ ), indicate that these sectors make fewer GHG disclosures than GICS sector – materials. Therefore partial support is claimed for hypothesis 6 in 2009.

In 2007 (2009), the control variable Tobin's Q is positive and significant (2007:  $t = 2.49, p = 0.00$ ; 2009:  $t = 4.13, p = 0.00$ ). These results indicate that voluntary GHG emission disclosures are made because stock market participants consider them important.

The age of fixed assets is a determinant for making voluntary GHG disclosures. Companies with older fixed assets make voluntary GHG disclosures. The age of fixed assets variable is positive and significant for both years (2007:  $t = 3.90, p = 0.00$ ; 2009:  $t = 2.49, p = 0.00$ ). Foreign listing status is found to influence voluntary GHG disclosures in both years (2007:  $t = 2.87, p = 0.00$ ; 2009:  $t = 2.13, p = 0.02$ ). Voluntary

GHG emission disclosures are positively associated with the size of the disclosing corporation as results for this variable are positive and significant (2007:  $t = 14.44$ ,  $p = 0.00$ ; 2009:  $t = 16.98$ ,  $p = 0.00$ ).

## **5.8 Conclusion**

This study is founded on information asymmetry, agency, political costs and proprietary cost theories to identify factors influencing the disclosure of voluntary greenhouse gas information by ASX-listed companies in their 2007 and 2009 annual and stand-alone sustainability reports. The population of ASX-listed companies in 2007 and 2009 is targeted, resulting in 1,776 companies being studied in 2007 and 1,853 in 2009.

Results suggest that voluntary greenhouse emission disclosures in ASX-listed companies' annual reports and stand-alone sustainability reports are motivated by companies that are seeking new debt finance, are more highly leveraged, participate in less competitive product-markets, are large, are currently underperforming financially but are held in good esteem in the stock market, have older assets and hold additional listing status on securities exchanges outside of Australia. Companies in the GICS sector - materials are likely to disclose more than those in GICS sector - consumer discretionary, GICS sector - consumer staples, GICS sector - energy, GICS sector - financials, GICS sector - health care, GICS sector - industrials, GICS sector - information technology or GICS sector - telecommunication services, but the quality of GHG emission disclosures improves in GICS sector - utilities and GICS sector - financials in 2009.

This chapter concludes with summary tables. Table 5-8 summarises the hypotheses tested and findings. Table 5-9 summarises the significance of the control variables within each model.

**Table 5-8 Summary of Hypotheses and Findings**

<b>Model</b>	<b>Hypothesis</b>	<b>Test</b>	<b>Findings 2007</b>	<b>Findings 2009</b>	
<b>1. Whole Sample</b> (VD = Continuous variable)	H1: Companies provide higher quality GHG disclosures when they seek additional debt finance.	Linear Regression	Supported	Supported	
		Tobit Regression	Supported	Not Supported	
	H2: Companies provide higher quality GHG disclosures when they seek additional equity finance.	Linear Regression	Not Supported	Not Supported	
		Tobit Regression	Not Supported	Not Supported	
	H3: Companies with higher debt levels provide higher quality voluntary GHG emission disclosures.	Linear Regression	Supported	Not Supported	
		Tobit Regression	Supported	Not Supported	
	H4: Firms with higher concentrated ownership disclose lower quality voluntary GHG emission disclosures.	Linear Regression	Not Supported	Not Supported	
		Tobit Regression	Not Supported	Not Supported	
	H5: Companies in highly competitive product markets disclose less information relating to GHG emissions than those in less competitive product markets.	Linear Regression	Not Supported	Not Supported	
		Tobit Regression	Supported	Not Supported	
	H6: Companies in climate change-sensitive GICS sectors voluntarily disclose more GHG emission information than those in other GICS sectors.	Linear Regression	Supported	Supported	
		Tobit Regression	Supported	Not Supported	
	<b>2. Whole Sample</b> (VD – Categorical variable)	H1: Companies provide higher quality GHG disclosures when they seek additional debt finance.	Logistic Regression	Not Supported	Not Supported
		H2: Companies provide higher quality GHG disclosures when they seek additional equity finance.	Logistic Regression	Not Supported	Not Supported
H3: Companies with higher debt levels provide higher quality voluntary GHG emission disclosures.		Logistic Regression	Supported	Not Supported	
H4: Firms with higher concentrated ownership disclose lower quality voluntary GHG emission disclosures.		Logistic Regression	Not Supported	Not Supported	
H5: Companies in highly competitive product markets disclose less information relating to GHG emissions than those in less competitive product markets.		Logistic Regression	Supported	Not Supported	
H6: Companies in climate change-sensitive GICS sectors voluntarily disclose more GHG emission information than those in other GICS sectors.		Logistic Regression	Supported	Supported	
<b>3. Disclosing Sub-sample</b> (VD – Continuous variable)	H1: Companies provide higher quality GHG disclosures when they seek additional debt finance.	Linear Regression	Supported	Not Supported	
	H2: Companies provide higher quality GHG disclosures when they seek additional equity finance.	Linear Regression	Not Supported	Not Supported	
	H3: Companies with higher debt levels provide higher quality voluntary GHG emission disclosures.	Linear Regression	Not Supported	Not Supported	
	H4: Firms with higher concentrated ownership disclose lower quality voluntary GHG emission disclosures.	Linear Regression	Not Supported	Not Supported	
	H5: Companies in highly competitive product markets disclose less information relating to GHG emissions than those in less competitive product markets.	Linear Regression	Not Supported	Not Supported	
	H6: Companies in climate change-sensitive GICS sectors voluntarily disclose more GHG emission information than those in other GICS	Linear Regression	Supported	Supported	

	sectors.			
4. Disclosing Sub-sample (VD = Ratio of hard to total disclosures)	H1: Companies provide higher quality GHG disclosures when they seek additional debt finance.	Linear Regression	Not Supported	Not Supported
	H2: Companies provide higher quality GHG disclosures when they seek additional equity finance.	Linear Regression	Not Supported	Not Supported
	H3: Companies with higher debt levels provide higher quality voluntary GHG emission disclosures.	Linear Regression	Not Supported	Not Supported
	H4: Firms with higher concentrated ownership disclose lower quality voluntary GHG emission disclosures.	Linear Regression	Not Supported	Not Supported
	H5: Companies in highly competitive product markets disclose less information relating to GHG emissions than those in less competitive product markets.	Linear Regression	Not Supported	Not Supported
	H6: Companies in climate change-sensitive GICS sectors voluntarily disclose more GHG emission information than those in other GICS sectors.	Linear Regression	Not Supported	Supported
5. Full Sample (DV = Continuous variable; restricted IVs )	H1: Companies provide higher quality GHG disclosures when they seek additional debt finance.	Linear Regression	Supported	Supported
	H3: Companies with higher debt levels provide higher quality voluntary GHG emission disclosures.	Linear Regression	Supported	Not Supported
	H5: Companies in highly competitive product markets disclose less information relating to GHG emissions than those in less competitive product markets.	Linear Regression	Not Supported	Not Supported
	H6: Companies in climate change-sensitive GICS sectors voluntarily disclose more GHG emission information than those in other GICS sectors.	Linear Regression	Supported	Supported

**Table 5-9 Significance of Control Variables**

Model	Year	ROA	Tobin's Q	Audit Quality	Age of Fixed Assets	Foreign Listing Status	Size
1 (Linear Regression)	2007	Significant	Significant	Not Significant	Significant	Significant	Significant
	2009	Significant	Significant	Not Significant	Significant	Significant	Significant
1 (Tobit Regression)	2007	Significant	Significant	Not Significant	Significant	Significant	Significant
	2009	Significant	Significant	Significant	Not Significant	Not Significant	Significant
2	2007	Not Significant	Significant	Significant	Significant	Not Significant	Significant
	2009	Significant	Significant	Significant	Not Significant	Not Significant	Significant
3	2007	Not Significant	Not Significant	Not Significant	Significant	Not Significant	Significant
	2009	Not Significant	Not Significant	Not Significant	Significant	Significant	Significant
4	2007	Not Significant	Not Significant	Not Significant	Significant	Not Significant	Significant
	2009	Significant	Significant	Not Significant	Significant	Not Significant	Significant
5	2007	Significant	Significant	Not Significant	Significant	Significant	Significant
	2009	Significant	Significant	Not Significant	Significant	Significant	Significant

## **Chapter 6 Conclusions and Discussion**

### **6.1 Introduction**

This thesis concludes with this chapter. Section 6.2 presents a summary of the motivation for this study, research questions and the contribution of the thesis. Results of the tests of hypotheses are summed up in Section 6.3. Furthermore, Section 6.4 acknowledges the limitations of the study and the implications for future research are presented in Section 6.5. Conclusions are presented in Section 6.6.

### **6.2 Summary of Research Motivation, Research Questions and Contribution**

Society, concerned by climate change risk, is demanding that companies account for their business activities' adverse impacts on the natural environment (Solomon, Solomon, Norton & Joseph, 2011). In Australia, a governmental response to the climate change issue is the enactment of the National Greenhouse and Energy Reporting Act 2007 (Cth). This legislation and consequential carbon tax proposal have propelled the issue of climate change to a prominent position in corporate considerations and decision-making. From 2008, companies exceeding certain GHG and energy threshold levels are required to report their greenhouse and energy performance data to the relevant Australian government body<sup>54</sup> responsible for administering carbon emission reduction legislation and clean energy usage. Reported information is made publicly available the following year. Companies are not required to reveal their GHG emission management and performance in their annual reports or sustainability reports (Cotter, Najah & Wang, 2011).

This research is motivated by the occurrence of corporate reporting of GHG performance and management information in non-mandated settings. It examines statements made about greenhouse gas emission performance and management in companies' annual reports and stand-alone sustainability reports for 2007 and 2009.

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<sup>54</sup> The Clean Energy Regulator took over this role from the Greenhouse and Energy Data Officer on 1<sup>st</sup> April 2012.

Questions arising from this research concern the nature of the disclosures, the reasons for the disclosures, and the changes in the disclosures from 2007 to 2009.

This research applies statements about GHG emissions management and performance to an index to determine the nature of disclosures being made in these reports. The index measures the quality of those disclosures by reference to their being *soft*, unverifiable statements, or *hard* disclosures, where supporting evidence is possible. Influential factors considered for the incidence of these disclosures come from information asymmetry, agency, political cost and proprietary cost theories. Examining the disclosures from points of time on either side of the enforcement of the NGER Act 2007 (Cth) establishes how these voluntary disclosures have progressed over this time.

Ascertaining the content, motivations and progression of voluntary disclosures of GHG emission information reveals corporate commitment to the climate change agenda. It also reveals corporate attitude to society's climate change concerns. Establishing the entire population of ASX-listed companies' 2007 and 2009 voluntary GHG emission disclosure practices permits a firm benchmark from which future cross-sectional and temporal comparisons may be made. This knowledge is useful for stakeholders at all levels of society in their decision-making.

Given the global context in which companies list their securities, standard-setters and policy-makers are able to determine the adequacy of the information currently provided and mandate improvements or extensions in the form and content of reports to serve their general objectives. Deeper knowledge of the ecological credentials of companies is likely to influence how investors, suppliers, creditors, and lobby groups deal in future with those companies.

This study serves to reduce gaps in the academic and professional communities' knowledge about corporate greenhouse gas emission disclosures in voluntary settings. This knowledge permits conjectures about corporations' behaviour towards future legislative mandates. Knowing how voluntary disclosures change pre- and post-NGER legislation is beneficial to the understanding of corporate anticipatory and reactive behaviour towards reducing the information problem inherent in the company form of business structure.

### **6.3 Summary of the Results**

Some 1,776 companies are studied for 2007 and 1,853 for 2009. These companies represent the entire population of ASX-listed companies in those years. Tests are run for 2007 and 2009 separately. Four models are drawn with which to test this population. Models 1 and 2 test the population in 2007 and 2009. Linear and Tobit regression analysis is applied to Model 1. The dependent variable in this model is continuous and represents each company's indexed score of disclosures. Logistic regression is used for Model 2. The dependent variable is a dichotomous measure, reflecting whether or not companies make GHG disclosures. Models 3 and 4 are subsets of the population and represent companies making GHG emission disclosures in their annual and stand-alone sustainability reports in either or both 2007 and 2009. Dependent variables are index of quality, and the ratio of hard to total disclosures made for Model 3 and Model 4 respectively. Linear regression is the statistical technique performed on these latter models.

Hypotheses 1 and 2, representing information asymmetry theory, test whether voluntary GHG disclosures are made when companies seek additional finance in the year following the disclosures. Hypothesis 1 deals with debt finance and hypothesis 2 makes assertions about the issue of additional equity in the next year. Support is found for hypothesis 1 only.

Hypotheses 3 and 4 are based on agency theory. Hypothesis 3 tests the relationship between voluntary GHG disclosures and the amount of leverage in company capital structure. Support is observed from linear regression results for 2007 only. Hypothesis 4 is concerned with concentration of ownership and tests whether disclosures are negatively associated with the level of ownership held by those owning more than 5 per cent of ordinary shares. No support is found.

Competition influences proprietary costs and is central to hypothesis 5. This hypothesis proposes that voluntary GHG disclosures are negatively related to the level of competition in the industry in which the company operates. Support is found for this hypothesis.

Hypothesis 6 involves political cost theory, and relates to industry membership. Results show that GICS sector membership in a climate change-sensitive sector contributes to each model in both years.

ROA, Tobin's Q, age of fixed assets, foreign listing status, and size are all found to be associated with voluntary GHG disclosures. An opposite result is determined for the presence of a Big 4 auditor.

#### **6.4 Limitations of the Research**

This research seeks to explain the nature and motivations of voluntary reporting of greenhouse gas emissions and relies on information asymmetry, agency, political cost and proprietary cost theories. By limiting the scope of this research to these theories, the ultimate explanations for corporate motivations and behaviour in reporting their greenhouse gas emissions at this point in time and in these particular media may not have been fully determined.

External validity refers to the generalisability of the findings, that is, whether the results can be extrapolated to other settings and times (Neuendorf, 2002). This calls for the representativeness of the sample to be examined. In this case, the sample is the entire population of ASX-listed companies in 2007 and 2009 and thus the results are applicable to Australia at these times. However, by limiting this study to Australian-listed public companies, differences in business, regulatory and capital markets environments detracts from the generalisability of the results to corporations in other parts of the world.

This study investigates GHG disclosures in annual reports and sustainability reports only. A large and increasing variety of alternative reporting media is used by companies (Adams *et al.*, 1998). Disclosures in other media may contain different information.

The index used for this study is a modification of one used by Clarkson *et al.* (2008) that mapped back to the Global Reporting Initiative guidelines and that had been validated by collaboration with an expert in environmental reporting. Its validity, therefore, is reasonably assured. Reliability testing of the indexation of the disclosures

results in a Krippendorff's agreement coefficient  $\alpha$ , of 84 per cent. While this is an acceptable reliability distribution, there remains 16 per cent to which agreement is not reached. These differences may affect the index scores of the disclosing companies ultimately analysed. Additional coders' input may have improved reliability but time and cost constraints prevented this.

Estimation techniques used are not prone to small sample size problems as the entire population of ASX-listed companies are studied here. However, a characteristic of social and economic data is that "normal distribution is likely to be the exception rather than the rule" (Friedman, 1937, p. 675) and therefore the sample's distributional properties violate normality distribution assumptions. Winsorisation processes improved but did not overcome normality violations. Hence, using the equations produced by ordinary least square regression to make inferences outside of the population tested is problematic.

## **6.5 Implications for Future Research**

Multiple theoretical constructs are used in this research. These relate to information asymmetry, agency, political cost and proprietary cost theories. This selection considers the motivation for voluntary GHG emission disclosures using economic, wealth maximisation theories. They consider incentives to disclose based on the costs and benefits of doing so. This narrow approach leaves open the consideration of firm corporate image and good corporate citizenship as motivating factors. Thus, opportunities exist to apply socio-political theories to explore the motivations for this behaviour.

## **6.6 Conclusion**

This final chapter presented a summary of the motivations for the research, the questions it sought to answer, and its various contributions. It summarised the results of tests of the hypotheses, the limitations inherent in the study, and suggestions for future research. This thesis is now concluded.

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## APPENDICES

### Appendix A. Selected Voluntary Disclosure Studies: Reporting Media

Study	Annual Report	Stand-alone Report	Corporate Web Pages	Conference Call	Press Release	Corporate Brochure or Newsletter	Other	Sample Studied	Findings
Adams, Hill & Roberts (1998)	●							150 firms in France, Germany, The Netherlands, Sweden, Switzerland, and the U.K for 1992.	The amount and nature of information disclosed varies significantly across Europe. Corporate social reporting patterns are influenced by company size, industrial grouping and country of domicile all influence corporate social reporting patterns.
Aerts & Cormier (2009)	●				●			158 U.S. and Canadian firms in consumer goods and services, energy, chemicals and drugs, industrials, information technology, Telecom and media, mining and resources, and utilities for 2002.	Reactive environmental press releases and the quality of the economic-based segments of annual report environmental disclosures positively affect environment legitimacy. Environmental press releases are driven by negative media legitimacy.
Banghøj & Plenborg (2008)	●							36 Danish industrial firms from 1996 to 2000.	Association between current returns and future earnings are not improved by more voluntary disclosure.

Study	Annual Report	Stand-alone Report	Corporate Web Pages	Conference Call	Press Release	Corporate Brochure or Newsletter	Other	Sample Studied	Findings
Bansal & Clelland (2004)	●						● News articles	100 U.S. firms in the paper, chemicals, petroleum, primary metals, and transportation equipment for 1990 to 1994.	Environmental legitimacy is earned when firms meet stakeholders' expectations of environmental performance.
Beretta & Bozzolan (2008)	●							85 Italian-listed nonfinancial companies for 1999 to 2001.	High quality disclosure, measured multidimensionally, is positively associated with accuracy of financial analysts' earnings forecasts.
Bhojraj, Blacconiere & D'Souza (2004)	●						● 10-K filings	81 U.S. investor-owned electric utility companies for 1996 and 1997.	Conflicting disclosure incentives exist in multiple-audience environments.
Birt, Bilson, Smith & Whaley (2006)	●							286 Australian Top 500 companies for 2001 to 2003.	Ownership concentration and competition interact to influence voluntary segment disclosures.
Botosan & Plumlee (2002)	●	●					● Investor relations	668 U.S. firms in 43 industries for 1986 to 1996.	Cost of equity capital decreases with the level of annual report disclosure, but increases with the level of timely disclosures.

Study	Annual Report	Stand-alone Report	Corporate Web Pages	Conference Call	Press Release	Corporate Brochure or Newsletter	Other	Sample Studied	Findings
Bowman & Haire (1975)	●							82 U.S. food processing firms for 1973.	There is a U-shaped association between corporate responsibility activity and profits (medium CSR is associated with high profits, low and high CSR is associated with low profits). CSR is evidence of a broad management style that extends beyond the business function to a posture that is sensitive to, and deals with, a dynamic, multi-dimensional environment.
Brammer & Pavelin (2006, 2008)							● PIRC Environmental Reporting 2000 survey ● News media reports	447 large U.K. companies for 2000.	High quality disclosure is associated with larger firms and those in sectors most closely related to environmental concerns. Media exposure does not influence voluntary disclosures.
Brennan, Guillamon-Saorin & Pierce (2009)					●			21 U.K. companies for 2000.	Positive information is exaggerated and negative information is either ignored or underplayed.

Study	Annual Report	Stand-alone Report	Corporate Web Pages	Conference Call	Press Release	Corporate Brochure or Newsletter	Other	Sample Studied	Findings
Broberg, Tagesson & Collin (2009)	●							199 and 194 Swedish companies for 2002 and 2005 respectively.	Agency theory predicts voluntary disclosure. The main influences of voluntary disclosure are the locus of ownership, capital structure and industry. Corporations with ownership separated from management, with more debt and those in the manufacturing industry disclose more voluntary information. Less voluntary information is disclosed when there is a large share of management ownership.
Brown (2007)	●							All listed entities on Port Morseby Stock Exchange for 2002.	No link between conventional accounting predictors and aggregated natural environment disclosures, but some individual predictors explained some individual components of natural environment disclosures.
Cahan, Rahman & Perera (2005)	●							216 Fortune's Global 500 list for 1998 or 1999.	The existence of global operations influence the level of voluntary disclosure, but the extent of global financing has no influence.

Study	Annual Report	Stand-alone Report	Corporate Web Pages	Conference Call	Press Release	Corporate Brochure or Newsletter	Other	Sample Studied	Findings
Campbell (2003)	●							10 U.K. FTSE 100 companies for 1974 to 2000.	Legitimacy theory is a meaningful explicator for variability in environmental disclosures in U.K. companies
Campbell, Shrives & Bohnbach-Saager (2001)	●							FTSE 100 companies for 1998.	Mission statements are used to signal companies' attitudes to various constituencies, many of which are external.
Cerin (2002)			●					337 companies on the OM Stockholm Exchange in 2000.	Fewer than 10 of OM Stockholm-listed companies provide documented environmental reports on the Internet annually.
Clarke & Gibson-Sweet (1999)	●	●						95 Times Top 100 U.K. companies in 1997.	Stand-alone reports are used to communicate with a variety of stakeholders, while annual report disclosures' primary audience is existing shareholders.
Clarkson, Li, Richardson & Vasvari (2008)		●	●					191 U.S. firms from five polluting industries in 2003.	Confirms voluntary disclosure theory predictions: superior environmental performers are more informative in truly discretionary disclosure channels.
Collett & Hrasky (2005)	●							299 Australian companies for 1994.	Voluntary disclosure of corporate governance information is positively associated with the intention to raise equity capital.

Study	Annual Report	Stand-alone Report	Corporate Web Pages	Conference Call	Press Release	Corporate Brochure or Newsletter	Other	Sample Studied	Findings
Cormier & Magnan (2003)	●	●						50 French non-financial firms for 1992 to 1997.	There is a link between voluntary corporate environmental reporting and firm media visibility.
Cormier & Magnan (2007)	●	●						50 French non-financial firms for 1992 to 1997; 55 German non-financial firms for 1992 to 1998; 118 Canadian non-financial firms for 1992 to 1997.	Voluntary environmental disclosure does not significantly influence the stock market valuation of Canadian and French firms' earnings, but does have a moderating influence on German firms' earnings.
Cormier, Aerts, Ledoux & Magnan (2009)			●					155 (189) non-financial Canadian companies in 2005 (2002).	Efficient governance leads to more disclosure about its social and human capital.
Cormier, Magnan & Van Velthoven (2005)	●	●						55 large German non-financial firms for 1992 to 1998.	Environmental disclosure is a multifaceted phenomenon, underpinned by no single theoretical framework. Quality of voluntary environmental disclosure is determined by imitation and by routine.
Cowan & Gadenne (2005)	●							25 Australian companies reporting on the National Pollutant Inventory for 1998 to 2000.	The voluntary sections of the annual reports contain higher levels of positive environmental disclosures than in the statutory sections.

Study	Annual Report	Stand-alone Report	Corporate Web Pages	Conference Call	Press Release	Corporate Brochure or Newsletter	Other	Sample Studied	Findings
Daley, McKinlay & Percy (2000)	●							Australian listed 20 companies that were prosecuted by Environmental Protection Agency from 1 January 1994 to 30 June 1998.	The quantity of environmental disclosures is influenced by proprietary costs and firm size.
Deegan & Gordon (1996)	●							197 Australian-listed companies for 1991, 25 of which were studied for 1980, 1985, 1988 and 1991.	Companies report favourable environment performance but are silent on negative performance. Environmental disclosures are self-laudatory. Environmental disclosures increase over time.
Deegan & Rankin (1996)	●							20 EPA-prosecuted Australian companies for 1990 to 1993, matched with non-EPA-prosecuted Australian companies.	Negative environmental performance is not likely to be voluntarily disclosed in annual reports. Prosecution produces greater positive environmental disclosures. Australian annual reports are similar to those elsewhere, in that they are biased in their portrayal of corporate environmental performance.
Depoers (2000)	●							102 non-financial listed French companies for 1995.	Managers make strategic decisions to disclose discretionary information.

Study	Annual Report	Stand-alone Report	Corporate Web Pages	Conference Call	Press Release	Corporate Brochure or Newsletter	Other	Sample Studied	Findings
Deumes & Knechel (2008)	●							All non-financial listed Amsterdam Stock Exchange companies for 1997 to 1999.	Managers make a conscious trade-off between the costs and benefits of making voluntary disclosures of their internal controls.
Eng & Mak (2003)	●							158 firms listed on Singapore Stock Exchange for 1995.	Voluntary disclosure is affected by ownership structure and board composition.
Fekrat, Inclan & Petroni (1996)	●							168 major international companies covering 18 countries for 1991.	There is a significant variation among disclosures across industries and countries. There is no link between disclosure and environmental performance.
Firth (1980)	●							278 U.K. manufacturing firms for 1971 to 1973.	Small companies increase voluntary disclosure levels significantly when raising new stock market finance. Larger companies disclose more than small companies.
Firth (1984)	●							100 U.K. manufacturing firms for 1977.	The amount of disclosure has no impact on the level of unsystematic risk and variance of return.
Francis, Nanda & Olsson (2008)	●			●	●		● Management forecasts	677 U.S. companies for 2001.	Firms with better earnings quality make more voluntary disclosures. More voluntary disclosure is associated with a lower cost of capital.

Study	Annual Report	Stand-alone Report	Corporate Web Pages	Conference Call	Press Release	Corporate Brochure or Newsletter	Other	Sample Studied	Findings
Frost (2007)	●	●						71 Australian firms in environmentally sensitive industries for 1998 to 2001.	More companies are making environmental disclosures and the level of information provided is increasing, although the reporting approaches vary. Annual reports contain less disclosure than stand-alone reports.
Gazoli, How & Verhoeven (2002)	●							Australian-listed companies for 1998 to 2000.	Disclosure of environmental information is increasing. Companies that disclose positive environmental information are better stock-market performers.
Gibson & Guthrie (1995)	●							60 large public and private companies, and 20 NSW government departments and agencies for 1994.	Australian environmental disclosures are similar in mix and type to international organisations' disclosures.
K. Gibson & O'Donovan (2007)	●							41 Australian companies for 1983 to 2003.	Environmental disclosures are increasing over time in terms of volume of information and number of disclosing companies.
R. Gray, Javad, Power & Sinclair (2001)	●							95 U.K. firms for 1988 to 1995.	In the U.K., corporate social and environmental disclosure is related to corporate characteristics of size, profit and industry affiliation, but those relationships are not stable over time.

Study	Annual Report	Stand-alone Report	Corporate Web Pages	Conference Call	Press Release	Corporate Brochure or Newsletter	Other	Sample Studied	Findings
S.J. Gray, Meek & Roberts (1995)	●							180 large multinational U.S. and U.K. industrial companies for 1989.	Participation in international capital markets is significantly associated with additional voluntary disclosures. However, there are significant differences in disclosure practices between internationally listed and domestic listed multinational companies.
Hackston & Milne (1996)	●							47 large listed New Zealand companies.	Companies make most social disclosures on human resources, with environment and community themes also receiving significant attention. Narrative information is mostly presented, and information tends to be positive rather than negative. Size and industry are associated with the amount of disclosure.
Ho & Taylor (2007)	●	●	●					100 large U.S. and Japanese companies for 2003 to 2004.	Size determines total TBL disclosure. Japanese firms disclose more, with environmental disclosures being the key driver.
Holland & Foo (2003)	●	●						37 publicly-listed U.K. and U.S. firm in chemicals, mining, oil and gas, construction and power industries for 2000.	More U.K. companies produce stand-alone reports in comparison to U.S. companies. Motivations for environmental disclosures differ between U.S. and U.K.

Study	Annual Report	Stand-alone Report	Corporate Web Pages	Conference Call	Press Release	Corporate Brochure or Newsletter	Other	Sample Studied	Findings
Hossain, Perera & Rahman (1995)	●							55 listed New Zealand companies for 1991.	Firm size, leverage and foreign listing are statistically related to the level of financial information voluntarily disclosed. Firm size determines levels of disclosure.
Hutton, Miller & Skinner (2003)							● Management earnings forecasts	147 publicly-listed firms for 1993 to 1997.	Positive forecasts are supplemented with verifiable forward-looking statements, but negative forecasts are accompanied by “soft talk” disclosures. Bad news forecasts are always informative but good news forecasts require supplements of verifiable forward-looking statements information to be informative.
Jantadej & Kent (1999)	●							1 Australian company (BHP) for 1992 to 1996.	BHP increased its environmental disclosures to reduce its exposure to the social, legal and political environments following the Ok Tedi copper mine disaster.

Study	Annual Report	Stand-alone Report	Corporate Web Pages	Conference Call	Press Release	Corporate Brochure or Newsletter	Other	Sample Studied	Findings
Jones (2007)	●			●			● Not disclosed	119 R&D-intensive firms in chemicals and pharmaceuticals, machinery and computer hardware, electrical and electronics, and scientific instruments industries in United States for 1997.	Firms disclose a variety of information about all stages of R&D activity. Firms disclose less when the proprietary costs of disclosure are higher. Firms with a lower book-to-market ratio provide more detailed information about R&D-related activities.
Kolk & Perego (2008)	●	●	●					212 Fortune Global 250 companies for 1999, 2002 and 2005	European and Japanese companies are most likely to provide verified sustainability reports, the provision of which is more likely in companies in more stakeholder-oriented countries and with weaker governance enforcement regime.

Study	Annual Report	Stand-alone Report	Corporate Web Pages	Conference Call	Press Release	Corporate Brochure or Newsletter	Other	Sample Studied	Findings
Lee (2007)	●							829 East Asian companies for 2002 and 2003.	Corporate voluntary disclosure is negatively associated with the separation of cash flow rights from control rights. Large non-management shareholding mitigates agency problems associated with the separation of ownership and control. Firms with high agency costs and greater external financing needs have more incentives to undertake higher firm-level voluntary disclosures.
Lightstone & Driscoll (2008)	●				●			13 Canadian public companies that received cease-trading orders in 2004 or 2005	High-risk companies attempt to manage legitimacy by selectively releasing information and by using ambiguous language. Managers will use symbolic language to distort or conceal negative organisational outcomes.

Study	Annual Report	Stand-alone Report	Corporate Web Pages	Conference Call	Press Release	Corporate Brochure or Newsletter	Other	Sample Studied	Findings
Lim, Matolcsy & Chow (2007)	●							181 Australian companies in 2001.	There is a positive association between board composition and voluntary disclosure. Independent boards provide more voluntary disclosure of forward looking and strategic information but board structure does not influence voluntary disclosure of non-financial and historical financial information.
Magness (2006)	●				●			44 Canadian public gold-mining companies with mining accidents in 1995.	Environmental disclosure increases with company size, intention to access external financial markets, and an active strategy of stakeholder management through press releases.

Study	Annual Report	Stand-alone Report	Corporate Web Pages	Conference Call	Press Release	Corporate Brochure or Newsletter	Other	Sample Studied	Findings
Meek, Roberts & Gray (1995)	●							226 internationally- and domestically-listed multinational companies for 1989.	Continental European multinational companies voluntarily disclose more strategic information than U.S. or U.K. companies. The largest multinational companies set the trend in providing voluntary disclosures of nonfinancial and financial information. Industry patterns exist for voluntary nonfinancial and financial information. All multinational companies provide more information in their annual reports than is regulated.
Niskanen & Nieminen (2001)	●							27 Finnish listed companies for which environmental news items were published for 1985 to 1996.	Negative events are unlikely to be reported in annual reports.
Patten (1991)	●							128 listed Fortune 500 firms for 1985.	Profitability variables do not explain the level of voluntary social disclosures, but size and industry classification do.
Peck & Sinding (2003)			●					30 companies from Australia, Canada, South Africa and U.S. in the mining industry for 1998 to mid-2000.	Resource dependency or institutional pressures influence leading mining groups' reporting decision.

Study	Annual Report	Stand-alone Report	Corporate Web Pages	Conference Call	Press Release	Corporate Brochure or Newsletter	Other	Sample Studied	Findings
Pollach, Scharl & Weichselbraun (2009)			●					989 corporate websites of companies included in the 2004 edition of Fortune 1000.	Companies avoid negative information about waste management in environmental communication.
Raar (2006)	●							187 Australian firms for 1998 to 2002.	Based on the categories of the Global Reporting Initiative (GRI), the annual report does not provide reliable information on sustainability issues and does not necessarily link financial measurement with environmental or social performance.
Skinner (1994)					●			93 NASDAQ National Market System firms for 1981 to 1990.	Managers face an asymmetric loss function in choosing their voluntary disclosure policies due to U.S. securities laws (and so pre-empt large negative earnings surprises by voluntarily disclosing that information early) and because of the effect on relations with the investment community.

Study	Annual Report	Stand-alone Report	Corporate Web Pages	Conference Call	Press Release	Corporate Brochure or Newsletter	Other	Sample Studied	Findings
Toms (2002)	●							89 (126) U.K. firms rated as “Britain’s Most Admired Companies” for 1996 (1997).	Environmental reputation is enhanced with implementation, monitoring and disclosure of environmental policies in annual reports. Diverse institutional share ownership and low systematic risk are associated with positive environmental reputation.
Trotman & Bradley (1981)	●							207 Australian-listed companies for 1978.	Managerial decision-horizon, size and extent of company-perceived social pressure influence the amount of voluntary social disclosure.
Vormedal & Ruud (2009)	●	●						98 largest Norwegian companies for 2004.	While the number of firms issuing separate reports is low, the quality of reporting is higher in separate reports. 90 of companies do not comply with environmental reporting laws, and voluntary reporting is less than satisfactory.
Wahyuni, Rankin & Windsor (2009)	●	●	●					271 ASX300 Australian listed companies for 2007.	34.3 of firms make GHG emission disclosures, preferring the annual report above any other media.

Study	Annual Report	Stand-alone Report	Corporate Web Pages	Conference Call	Press Release	Corporate Brochure or Newsletter	Other	Sample Studied	Findings
Zéghal & Ahmed (1990)	●					●	● Advertisements	15 large Canadian firms in banking and petroleum industries for 1981 and 1982.	A company's operations determine the information content and form of social information disclosure, and different media are used to communicate to different audiences.

## Appendix B. Disclosing Companies and Disclosure Media

		2007 Annual Report	2007 Sustainability Report	2009 Annual Report	2009 Sustainability Report
AAC	Australian Agricultural Company Limited			X	
AAD	Ardent Leisure Group			X	
AAE	Agri Energy Limited	X			
AAI	Alcoa Inc	X	X	X	X
AAX	Ausenco Limited			X	
ABC	Adelaide Brighton Limited	X		X	
ABU	ABM Resources NL			X	
ABY	Aditya Birla Minerals Limited			X	
ACE	Advanced Engine Components Limited	X		X	
ACS	Accent Resources NL			X	
ACZ	Atticus Resources Limited			X	
AEF	Australian Ethical Investment Limited	X	X	X	X
AEJ	Redbank Energy Limited	X		X	
AEO	Austereo Group Limited	X			
AFG	Allco Finance Group Limited	X			
AFI	Australian Foundation Investment Company	X			
AFR	African Energy Resources			X	
AFT	Aft Corporation Limited	X			
AGG	Anglogold Ashanti Limited	X			
AGK	AGL Energy Limited	X	X	X	
AHE	Automotive Holdings Group Limited	X		X	
AIA	Auckland Airport			X	
AIO	Asciano Limited			X	
AIW	Australian-American Mining Corporation Limited	X			
AIX	Australian Infrastructure Fund	X		X	
AIZ	Air New Zealand	X			
AJL	AJ Lucas Group Limited	X		X	
AKF	Ask Funding Limited			X	
AKI	African Iron Limited			X	
ALL	Aristocrat Leisure Limited			X	
ALZ	Australand Holdings Limited	X			
AMC	Amcor Limited	X	X	X	X
AMP	AMP	X		X	
AMU	Amadeus Energy Limited			X	
AND	Andean Resources			X	
ANN	Ansell	X			
ANZ	ANZ	X	X	X	X
AOE	Arrow Energy	X		X	
AOH	Altona Mining Limited			X	
APA	APA Group	X		X	
API	Australian Pharmaceutical Industries Limited			X	
APK	Australian Power & Gas Limited			X	
AQP	Aquarius Platinum Limited			X	
ARQ	Arc Energy Limited	X			
ARU	Arafura Resources Limited			X	
ARW	Australian Renewable Fuels Limited			X	
ASB	Austal			X	
ASL	Ausdrill Limited	X			

		2007 Annual Report	2007 Sustainability Report	2009 Annual Report	2009 Sustainability Report
ASX	ASX Limited	X		X	
ATM	Antam	X			
AUQ	Alara Resources Limited			X	
AUT	Aurora Oil & Gas Limited			X	
AVA	Aviva Corporation Limited	X		X	
AVG	Australian Vintage Limited			X	
AVM	Anvil Mining Limited	X	X		
AWC	Alumina Limited			X	
AWE	AWE Limited	X	X	X	
AXA	AXA Asia Pacific Holdings Limited	X		X	
AXI	Axiom Properties Limited	X			
AXM	Apex Minerals NL			X	
AZM	Azumah Resources Limited			X	
AZS	Azure Minerals Limited			X	
BAU	Bauxite Resources Limited			X	
BBG	Billabong International Limited	X		X	
BEC	Becton Property Group Limited	X			
BEI	Babcock & Brown Environmental Investments	X			
BEL	Bentley Capital Limited			X	
BEN	Bendigo And Adelaide Bank Limited	X		X	
BGD	Boulder Steel Limited			X	
BHP	BHP Billiton Limited	X	X	X	X
BIS	Bisalloy Steel Group			X	
BKL	Blackmores Limited	X		X	
BKN	Bradken Limited			X	
BKW	Brickworks Limited	X		X	
BLD	Boral Limited			X	X
BLE	Blue Ensign Technologies Limited	X			
BLK	Blackham Resources Limited			X	
BNB	Babcock & Brown	X			
BNV	Brand New Vintage Limited			X	
BOE	Boss Energy Limited			X	
BPT	Beach Petroleum Limited			X	
BSE	Base Iron Limited			X	
BSL	Bluescope Steel Limited	X		X	
BTT	BT Investment Management Limited			X	
BVA	Bravura Solutions Limited			X	
BWD	Blackwood Corporation Limited	X			
BWP	BWP Trust			X	
BXB	Brambles Limited	X		X	X
BYR	Burey Gold Limited			X	
CAA	Capral Limited			X	
CAB	Cabcharge	X		X	
CBA	Commonwealth Bank Of Australia	X			X
CBD	CBD Energy Limited	X			
CBH	CBH Resources Limited			X	
CBQ	Coalbank Limited			X	
CBR	Constellation Brands, Inc	X		X	
CCL	Coca-Cola Amatil Limited	X		X	X
CDP	Carindale Property Trust	X		X	

		2007 Annual Report	2007 Sustainability Report	2009 Annual Report	2009 Sustainability Report
CDT	Castle Minerals Limited			X	
CEL	Challenger Energy Limited			X	
CES	Coal Fe Resources Limited			X	
CEU	ConnectEast Group	X		X	
CEY	Centennial Coal Company Limited	X		X	
CFU	Ceramic Fuel Cells Limited			X	
CFX	CFS Retail Property Trust	X		X	
CGV	Clean Global Energy Limited			X	
CHR	Chalmers Limited			X	
CII	CI Resources Limited			X	
CLH	Collection House Limited			X	
CLK	Cypress Lakes Group Limited			X	
CLQ	Clean Teq Holdings Limited			X	
CNA	Coal & Allied Industries Limited	X		X	
CNB	CIC Australia Limited	X		X	
CNN	Cardia Bioplastics Limited			X	
CNP	Centro Properties Group	X			
CNX	Carbon Energy Limited			X	
COH	Cochlear Limited	X			
COZ	Co2 Group Limited	X		X	
CPA	Commonwealth Property Office Fund	X	X	X	
CPB	Campbell Brothers Limited	X		X	
CPI	CPI Group			X	
CPU	Computershare Limited			X	
CPZ	Car Parking Technologies Limited			X	
CQO	Charter Hall Office REIQ	X		X	
CQR	Macquarie Countrywide Management Limited			X	
CRG	Crane Group	X		X	
CSL	CSL Limited			X	
CSR	CSR Limited	X		X	X
CTO	Citigold Corporation Limited			X	
CTX	Caltex Australia Limited	X		X	
CUS	Customers Limited			X	
CVC	CVC Limited	X			
CVY	Coventry Resources Limited			X	
CWE	Carnegie Wave Energy Limited	X		X	
CWN	Crown Limited			X	X
CWP	Cedar Woods Properties Limited	X			X
CXC	Couer D'alene Mines Corporation			X	
CXH	Compass Hotel Goup			X	
CXM	Centrex Metals Limited	X			
CXP	Corporate Express	X		X	X
CXU	Cauldron Energy Limited			X	
CYG	Coventry Group Limited			X	
DDD	3D Resources Limited			X	
DEX	Dexion Limited			X	
DIO	Dioro Exploration NL			X	
DJS	David Jones Limited	X		X	
DMA	Dynasty Metals Australia Limited	X			
DMP	Domino's Pizza Enterprises Limited			X	

		2007 Annual Report	2007 Sustainability Report	2009 Annual Report	2009 Sustainability Report
DMX	Dolomatrix International Limited			X	
DOW	Downer EDI			X	X
DTL	Data#3 Limited			X	
DTM	Dart Mining NL			X	
DUE	Duet Investment Holding Limited			X	
DXL	Dyno Nobel Limited	X			
DXS	Dexus Property Group	X			
DYE	Dyesol Limited	X		X	X
EAR	Echo Resources Limited			X	
EDS	Every Day Mine Services Limited			X	
EER	East Energy Resources Limited			X	
EGL	The Environmental Group Limited	X			
EGN	Coote Industrial	X			
ELD	Elders Limited	X			
EME	Energy Metals Limited			X	
ENB	Eneabba Gas Limited	X		X	
ENE	Energy Developments Limited	X		X	
ENL	Eagle Nickel Limited			X	
ENV	Envestra Limited	X		X	
EPX	Ethane Pipeline Income Fund			X	
ERA	Energy Resources of Australia Limited	X	X	X	
ERJ	Enerji Limited			X	
ESG	Eastern Star Gas Limited	X			
EVE	Energy Ventures Limited			X	
EXG	Excelsior Gold Limited			X	
EZL	Euroz Limited			X	
FBU	Fletcher Building	X		X	
FEA	Forest Enterprises Australia Limited	X		X	X
FGL	Foster's Group Limited	X	X	X	X
FKP	FKP	X		X	
FLX	Felix Resources	X		X	
FMG	Fortescue Metals Group Limited			X	X
FNT	Frontier Resources Limited			X	
FPH	Fisher & Paykel Healthcare Corporation Limited			X	
FPS	Fiducian Portfolio Services Limited			X	
FRR	Frigrite Limited	X			
FXJ	Fairfax Media Limited	X		X	
FXL	Flexigroup Limited	X			
GAU	Great Australian Resources Limited			X	
GCL	Gloucester Coal Limited			X	
GCS	Global Construction Services Limited			X	
GDN	Golden State Resources Limited			X	
GDY	Geodynamics Limited			X	
GFF	Goodman Fielder	X		X	
GGE	Grand Gulf Energy Limited			X	
GGG	Greenland Minerals And Energy Limited			X	
GLE	GLG Corporation			X	
GMD	Genesis Minerals Limited			X	
GMG	Goodman Group			X	
GNB	Greenbox Group Limited	X		X	

		2007 Annual Report	2007 Sustainability Report	2009 Annual Report	2009 Sustainability Report
GNC	Graincorp Limited			X	
GNI	Global Nickel Investments Limited			X	
GNS	Gunns Limited	X		X	
GOG	Great Artesian Oil And Gas Limited	X			
GPT	GPT Management Holdings Limited			X	
GRB	Gage Roads Brewing Co Limited			X	
GRK	Green Rock Energy Limited	X			
GRR	Grange Resources Limited			X	
GRV	Greenvale Mining NL			X	
GRY	Gryphon Minerals Limited			X	
GTE	Great Western Exploration Limited			X	
GTP	Great Southern Limited	X			
GUD	GUD Holdings	X			
GUN	Gunson Resources Limited			X	
GWA	GWA Group Limited	X		X	
GXY	Galaxy Resources Limited			X	
HAZ	Hazelwood Resources Limited			X	
HDF	Hastings Diversified Utilities Fund			X	
HGG	Henderson Group Plc	X		X	
HGO	Hillgrove Resources Limited	X			
HHM	Hampton Hill Mining NL			X	
HIL	Hills Industries Limited			X	
HRR	Heron Resources Limited			X	
HST	Hastie Group Limited			X	
HTA	Hutchison Telecommunications (Australia) Limited			X	
HUM	Humanis Group Limited			X	
HZL	Healthzone Limited			X	
HZN	Horizon Oil Limited			X	
IAG	Insurance Australia Group Limited	X	X	X	
ICL	Straits Resources Limited	X			
ICN	Icon Energy Limited			X	
IDG	Indago Resources Limited			X	
IDL	Industrea Limited			X	
IDO	Indo Mines Limited	X			
IFE	Ironclad Mining Limited			X	
IFN	Infigen Energy Re Limited	X		X	
IGO	Independence Group NL			X	
IOF	Investa Office Fund	X		X	
IPL	Incitec Pivot	X	X	X	
IPT	Impact Minerals Limited			X	
IRD	Iron Road Limited			X	
IRM	Iron Mountain Mining Limited			X	
ISL	Intelligent Solar Limited	X		X	
ITO	Intoll Group			X	
IVC	Invocare Limited	X		X	
IVR	Investigator Resources Limited			X	
JAT	Jatenergy Limited			X	
JBH	JB Hi-Fi Limited			X	
JHX	James Hardie	X		X	X
JRL	Jindalee Resources Limited			X	

		2007 Annual Report	2007 Sustainability Report	2009 Annual Report	2009 Sustainability Report
KAR	Karoon Gas Australia Limited			X	
KAS	Kasbah Resources Limited			X	
KCN	Kingsgate Consolidated Limited	X		X	
KEN	Kuth Energy Limited			X	
KEY	Key Petroleum Limited			X	
KOG	Kilgore Oil & Gas Limited			X	
KRS	Kresta Holdings Limited			X	
KSC	K&S Corporation Limited	X			
KZL	Kagara Zinc Limited	X			
LBY	Liberty Resources Limited			X	
LEI	Leighton Holdings Limited	X	X	X	X
LGL	Lihir Gold Limited	X		X	X
LLA	Living And Leisure Australia Group			X	
LLC	Lend Lease Corporation	X		X	
LNC	Linc Energy Limited	X		X	
LNG	Liquefied Natural Gas Limited	X			
LNN	Lion Merchant Limited	X			
LYC	Lynas Corporation Limited	X		X	
LYL	Lycopodium Limited	X			
MAH	Macmahon Holdings Limited	X			
MAP	MAp Group	X		X	
MAS	Mesa Minerals Limited	X		X	
MBT	Mission Newenergy Limited	X		X	
MCC	Macarthur Coal Limited	X		X	
MCG	Macquarie Communications Infrastructure Group	X			
MCP	Mcperson's Limited			X	
MCQ	Macquarie Capital Alliance Group	X			
MDA	Modena Resources Limited			X	
MDL	Mineral Deposits Limited			X	
MDX	Mindax Limited			X	
MEL	Metgasco Limited	X		X	
MEY	Marenica Energy Limited			X	
MGR	Mirvac Group Limited	X	X	X	X
MIX	Mirvac Industrial Trust	X		X	
MLB	Melbourne IT Limited	X			
MLM	Metallica Minerals			X	
MND	Monadelphous Group Limited			X	
MNM	Mantle Mining Corporation Limited			X	
MQG	Macquarie Group Limited	X		X	
MRC	Mineral Commodities Limited			X	
MRI	MRI Holdings Limited			X	
MRZ	Mirvac Real Estate Investment Trust	X		X	
MSF	The Maryborough Sugar Factory Limited			X	
MTN	Marathon Resources Limited			X	
MTS	Metcash Limited	X		X	
NAB	National Australia Bank	X	X	X	X
NCM	Newcrest Mining Limited	X		X	X
NEN	Neon Energy Limited			X	
NFE	Northern Iron Limited			X	
NFK	Norfolk Group Limited			X	

		2007 Annual Report	2007 Sustainability Report	2009 Annual Report	2009 Sustainability Report
NFL	Natural Fuel Limited	x			
NGF	Norton Gold Fields Limited			x	
NHC	New Hope Corporation Limited	x		x	
NHF	Nib Holdings Limited			x	
NHR	National Hire Group Limited			x	
NOD	Nomad Building Solutions Limited			x	
NPX	Nuplex Industries Limited	x		x	
NRU	Newera Uranium Limited			x	
NWS	News Corporation	x		x	
NXS	Nexus Energy Limited			x	
ODN	Odin Energy Limited			x	
OEL	Otto Energy Limited			x	
OEQ	Orion Equities Limited			x	
OGC	Oceanagold Corporation	x		x	x
OGL	Overseas & General Limited	x			
ORG	Origin Energy Limited	x	x	x	x
ORI	Orica Limited	x	x	x	x
OSH	Oil Search Limited			x	
OST	Onesteel Limited	x		x	
OZL	Oz Minerals Limited	x		x	x
PAN	Panoramic Resources Limited			x	
PAX	Panax Geothermal Limited			x	
PBB	Pacifica Group Limited	x			
PBD	Port Bouvard Limited			x	
PBG	Pacific Brands Limited	x		x	
PDN	Paladin Energy Limited	x		x	
PEH	Pacific Environment Limited			x	
PEM	Perilya Limited	x		x	
PEX	Peel Exploration Limited			x	
PFL	Patties Foods Limited			x	
PGA	Photon Group	x			
PHG	Pulse Health Limited			x	
PHI	Phileo Australia Limited			x	
PIR	Papillon Resources Limited			x	
PMP	PMP Limited	x		x	x
PNA	PanAust Limited		x	x	x
PNN	Pepinnini Minerals Limited			x	
PNR	Pacific Niugini Limited			x	
PPC	Peel Limited	x		x	
PPT	Perpetual Limited	x		x	
PPX	Paperlinx Limited	x	x	x	x
PRW	Proto Resources & Investments Limited			x	
PSH	Penrice Soda Holdings Limited	x		x	
PTM	Platinum Asset Management Limited	x			
PUN	Pegasus Metals Limited			x	
QAN	Qantas Airways Limited	x	x	x	x
QBE	QBE Insurance Group Limited	x		x	
QMG	Quay Magnesium Limited	x			
QTM	Quantum Energy Limited	x			
QUE	Queste Communications Limited			x	

		2007 Annual Report	2007 Sustainability Report	2009 Annual Report	2009 Sustainability Report
QXQ	Q Limited	x			
RCR	RCR Tomlinson Limited			x	
REX	Regional Express Holdings Limited			x	
RFL	Rubik Financial Limited			x	
RHC	Ramsay Health Care Limited	x			
RHD	Ross Human Directions Limited	x			
RHI	Red Hill Iron Limited			x	
RHL	Ruralco Holdings Limited			x	
RIC	Ridley Corporation Limited	x		x	
RIN	Rinker Group Limited	x			
RIO	Rio Tinto	x	x	x	x
RIV	Riversdale Mining Limited	x			
RMP	Red Emperor Resources NL			x	
RND	Rand Mining NL			x	
RNI	Resource & Investment NL			x	
ROC	Roc Oil Company Limited			x	x
ROG	Red Sky Energy Limited			x	
RRS	Range Resources Limited			x	
RSG	Resolute Mining Limited			x	
RSP	Resource Pacific Holdings Limited	x			
RUL	Runge Limited			x	
RVR	Red River Resources Limited			x	
SAF	Safe Effect Technologies Limited	x			
SAQ	Sydney Attractions Group Limited	x			
SBM	St Barbara Limited	x		x	
SCD	Scantech Limited	x		x	
SDM	Sedgman Limited	x			
SEK	Seek Limited			x	
SFC	Schaffer Corporation Limited			x	
SFH	Specialty Fashion Group Limited			x	
SFR	Sandfire Resources NL			x	
SFZ	South American Ferro Metals Limited			x	
SGL	Sydney Gas Limited	x			
SGM	Sims Metal Management Limited	x		x	
SGP	Stockland	x		x	x
SHL	Sonic Healthcare Limited			x	
SHX	Shield Mining Limited			x	
SIP	Sigma Pharmaceuticals Limited	x			
SKE	Skilled Group			x	
SLA	Solagran Limited			x	
SLM	Salmat Limited	x			
SLX	Silex Systems Limited	x		x	
SMC	Strategic Minerals Corporation NL			x	
SMX	SMS Management & Technology Limited			x	
SOL	Washington H. Soul Pattinson & Company Limited			x	
SPH	Sphere Minerals Limited			x	
SPN	SP Ausnet			x	x
SPT	Spotless Group Limited	x		x	
SRA	Strathfield Group Limited	x			
SRK	Strike Resources Limited			x	

		2007 Annual Report	2007 Sustainability Report	2009 Annual Report	2009 Sustainability Report
SRV	Servcorp Limited			X	
SST	Steamships Trading Company Limited	X			
STG	Staging Connections Group Limited			X	
STO	Santos Limited	X	X	X	X
STU	Stuart Petroleum Limited	X		X	
STX	Strike Energy Limited	X			
SUN	Suncorp-Metway Limited	X		X	
SUR	Sun Resources NL			X	
SWM	Seven West Media Limited			X	
SWN	Silver Swan Group Limited			X	
SXL	Southern Cross Media Group Limited			X	
SYP	Style Limited			X	
SYS	Syngas Limited			X	
TAH	Tabcorp Holdings Limited	X			
TAL	Tower Australia Group Limited	X		X	
TAM	Tanami Gold NL			X	
TAP	Tap Oil Limited			X	
TAW	Tawana Resources N. L.	X		X	
TBG	Tutt Bryant Group Limited			X	
TBR	Tribune Resources NL			X	
TCL	Transurban Group	X	X	X	X
TCN	Techniche Limited			X	
TCQ	Trinity Group			X	
TEL	Telecom Corporation of New Zealand Limited	X		X	
TEN	Ten Network Holdings Limited			X	
TGR	Tassal Group Limited			X	
TIM	Timbercorp Limited	X			
TKL	Traka Resources Limited			X	
TLS	Telstra Corporation Limited	X		X	
TMR	Tamaya Resources	X			
TMX	Terrain Minerals Limited			X	
TNE	Technology One Limited			X	
TOE	Toro Energy Limited			X	
TOL	Toll Holdings Limited	X		X	
TOX	Tox Free Solutions Limited			X	
TPI	Transpacific Industries Group Limited			X	
TRF	Trafford Resources Limited			X	
TSE	Transfield Services Limited	X	X	X	X
TSI	TSI International Limited			X	
TTS	Tatts Group Limited			X	
UGL	UGL Limited			X	
UOG	United Orogen Limited			X	
UXA	UXA Resources Limited	X		X	
UXC	UXC Limited	X		X	
VBA	Virgin Blue Holdings Limited	X		X	
VOR	Voyager Resources Limited	X			
VPG	Valad Property Group			X	
VRL	Village Roadshow Limited			X	
WAS	Wasabi Energy Limited			X	
WBC	Westpac Banking Corporation	X	X	X	X

		2007 Annual Report	2007 Sustainability Report	2009 Annual Report	2009 Sustainability Report
WCB	Warrnambool Cheese & Butter Factory Co Holdings	x		x	
WCL	Westside Corporation Limited			x	
WDC	Westfield Group	x		x	x
WDS	WDS Limited	x		x	
WEC	White Energy Company Limited	x		x	
WES	Wesfarmers Limited	x	x	x	x
WFL	Willmott Forests Limited			x	
WGP	Westralian Gas & Power Limited	x			
WHC	Whitehaven Coal Limited			x	
WHE	Wildhorse Energy Limited	x			
WHS	The Warehouse Group Limited	x		x	
WOR	Worleyparsons Limited	x		x	
WOW	Woolworths Limited	x		x	x
WPG	WPG Resources Limited			x	
WPL	Woodside Petroleum Limited	x		x	
WTP	Watpac Limited			x	
WWG	World Wide Entertainment Group Limited			x	
WWW	Whinnen Resources Limited			x	
WYL	Wattyl Limited	x			
XRF	XRF Scientific Limited			x	
YBR	Yellow Brick Road Holdings Limited			x	
ZFX	Zinifex Limited	x			
ZIM	Zimplats Holdings Limited	x			

## Appendix C. Coding Instructions

### Coding Instructions for Content Analysis of Greenhouse Gas Emissions

#### Disclosures

The objective of this research is to investigate voluntary disclosures made by Australian listed companies concerning their greenhouse gas emissions (GHG) for the years 2007 and 2009. Companies making GHG disclosures have already been identified by electronically-searching their corporate PDF reports using key terms. Segments of text containing information relevant to the study have been saved in Excel worksheets. There are separate worksheets for each company, saved in files according to year and the type of report. The text is to be coded according to whether it matches items of information listed in the attached index.

You have been provided with four Excel files containing a sample of the companies' disclosures and an Excel file containing four worksheets for recording the index matches for each company's disclosure. There is a file for the type of report and year of report. The sample companies' disclosures, numbered from 1 to 266, are listed at the end of these instructions. The PDFs for each company report are also supplied.

#### Coding Instructions for Content Analysis of GHG Disclosures:

- The following guidelines apply.
- Familiarise yourself with the information on the attached sheets.
- For the purposes of this content analysis "disclosure" refers to any sentence, phrase, paragraph, table or graph.
- All disclosures must be explicitly stated, they cannot be implied.
- Identify entries in the company's worksheet that match with an index item. Only one match is to be recorded per item regardless of the number of times examples of the items appear.
- Tables, graphs or narrative statements of performance data which match multiple items in section A3 should be classed accordingly to each item.
- Note the index item code beside the corresponding text in the Excel file.
- Record a number 1 in the Excel file (*GHG Indexes Reliability Sampling*) against the relevant index item.
- Save all files regularly.

Note that the companies' disclosure worksheets represent GHG information from a random sample drawn from all GHG disclosing companies for each year. Disclosures of interest are not necessarily made by each company in each type of report used in this study. Hence, the annual report or sustainability report might not contain information that matches to any index items.

## Appendix D. Sample Companies for Reliability Assessment

No.	Report	ASX Code	Company
1	2007 AR	ACE	Advanced Engine Components Limited
2	2007 AR	AEO	Austereo Group Limited
3	2007 AR	AFG	Allco Finance Group Limited
4	2007 AR	AFT	AFT Corporation Ltd
5	2007 AR	AIX	Australian Infrastructure Fund
6	2007 AR	ANN	Ansell
7	2007 AR	AOE	Arrow Energy
8	2007 AR	ARW	Australian Renewable Fuels Limited
9	2007 AR	ASL	Ausdrill Limited
10	2007 AR	AVA	Aviva Corporation LTD
11	2007 AR	AWE	AWE Ltd
12	2007 AR	AXA	Asia Pacific Holdings Limited
13	2007 AR	BEC	Becton Property Group Ltd
14	2007 AR	BHP	BHP Billiton Limited
15	2007 AR	BKW	Brickworks Limited And Controlled Entities
16	2007 AR	BSL	Bluescope Steel Limited
17	2007 AR	BUL	Blue Energy Limited
18	2007 AR	BWD	Matilda Minerals Ltd
19	2007 AR	CBA	Commonwealth Bank of Australia
20	2007 AR	CBR	Constellation Brands, Inc
21	2007 AR	CEY	Centennial Coal Company Ltd
22	2007 AR	CNB	Canberra Investment Corporation Limited
23	2007 AR	CQO	Macquarie Office Trust
24	2007 AR	CSR	CSR Ltd
25	2007 AR	CTX	Caltex Australia Limited
26	2007 AR	CVC	CVC Limited
27	2007 AR	DJS	David Jones
28	2007 AR	DMA	Dynasty Metals Australia Limited
29	2007 AR	DXL	Dyno Nobel Limited
30	2007 AR	DXS	DbReef Trust
31	2007 AR	DYE	Dyesol Limited
32	2007 AR	EGL	The Environmental Group Limited
33	2007 AR	EGN	Coote Industrial
34	2007 AR	ENB	Eneabba Gas Limited
35	2007 AR	ENE	Energy Developments Limited
36	2007 AR	ERA	ERA
37	2007 AR	FEA	FEA Group Companies
38	2007 AR	FGL	Fosters Group
39	2007 AR	FXL	FlexiGroup Limited
40	2007 AR	GNB	Jackgreen Limited
41	2007 AR	GOG	Great Artesian Oil and Gas Limited
42	2007 AR	GTP	Great Southern Limited
43	2007 AR	GWT	GWA International Limited
44	2007 AR	HGO	Hillgrove Resources Limited
45	2007 AR	IAG	Insurance Australia Group Limited
46	2007 AR	IPL	Incitec Pivot
47	2007 AR	JHX	James Hardie
48	2007 AR	KSC	K & S Corporation Limited

No.	Report	ASX Code	Company
49	2007 AR	KZL	Kagara Zinc Ltd
50	2007 AR	LGL	Lihir Gold Limited
51	2007 AR	LNC	Linc Energy Limited
52	2007 AR	LNN	Lion Merchant Limited
53	2007 AR	MAH	Macmahon
54	2007 AR	MBT	Mission Biofuels Limited
55	2007 AR	MCQ	Macquarie Capital Alliance Group
56	2007 AR	MQG	Macquarie Bank
57	2007 AR	MRZ	Mirvac Real Estate Investment Trust
58	2007 AR	MTS	Metcash Limited
59	2007 AR	NAB	National Australia Bank
60	2007 AR	NWS	News Corporation
61	2007 AR	PMP	PMP Ltd
62	2007 AR	PNA	PanAustralia
63	2007 AR	PPC	Peel Ltd
64	2007 AR	PPT	Perpetual Ltd
65	2007 AR	PSH	Penrice Soda Holdings Ltd
66	2007 AR	QBE	QBE Insurance Group Ltd
67	2007 AR	QXQ	Q Ltd
68	2007 AR	RIC	Ridley Corporation Ltd
69	2007 AR	RIO	Rio Tinto
70	2007 AR	RIV	Riversdale Mining Ltd
71	2007 AR	SBM	St Barbara Ltd
72	2007 AR	SGL	Sydney Gas
73	2007 AR	SIP	Sigma Pharmaceuticals Limited
74	2007 AR	SLX	Silex Systems Ltd
75	2007 AR	SRA	Strathfield Group Ltd
76	2007 AR	STU	Stuart Petroleum Ltd
77	2007 AR	TAH	Tabcorp
78	2007 AR	TLS	Telstra Corporation Ltd
79	2007 AR	TMR	Tamaya Resources
80	2007 AR	TOL	Toll
81	2007 AR	UXC	UXC Ltd
82	2007 AR	VBA	Virgin Blue Group
83	2007 AR	WDC	The Westfield Group
84	2007 AR	WDS	Walter Diversified Services Limited
85	2007 AR	WEC	White Energy Company Limited
86	2007 AR	WGP	Westralian Gas & Power Ltd
87	2007 AR	WHE	Wildhorse Energy Limited
88	2007 AR	WOT	Westpac Office Trust
89	2007 AR	WOW	Woolworths Ltd
90	2007 SR	AEF	Australian Ethical Investment Ltd
91	2007 SR	AMC	Amcor Limited
92	2007 SR	ANZ	ANZ Banking
93	2007 SR	ERA	ERA
94	2007 SR	FGL	Foster's Group Limited
95	2007 SR	IAG	Insurance Australia Group Limited
96	2007 SR	ORI	Orica
97	2007 SR	PNA	PanAustralia Ltd
98	2007 SR	TSE	Transfield Services Limited

No.	Report	ASX Code	Company
99	2007 SR	WBC	Westpac Banking Corp
100	2009 AR	AAC	Australian Agricultural Company Limited
101	2009 AR	AAD	Ardent Leisure Group
102	2009 AR	AAX	Ausenco Limited
103	2009 AR	ABC	Adelaide Brighton Limited
104	2009 AR	ABU	ABM Resources NL
105	2009 AR	ABY	Aditya Birla Minerals Limited
106	2009 AR	ACS	Accent Resources NL
107	2009 AR	AGK	AGL Energy Limited
108	2009 AR	AMP	AMP
109	2009 AR	API	Australian Pharmaceutical Industries Limited
110	2009 AR	ASX	Australian Securities Exchange
111	2009 AR	AUQ	Alara Resources Limited
112	2009 AR	AUT	Aurora Oil & Gas Limited
113	2009 AR	AVG	Australian Vintage Ltd
114	2009 AR	AWE	Australian Worldwide Exploration Limited
115	2009 AR	AXM	Apex Minerals NL
116	2009 AR	AXY	Atom Energy Limited
117	2009 AR	AZS	Azure Minerals Limited
118	2009 AR	BIS	Bisalloy Steel Group
119	2009 AR	BKL	Blackmores Limited
120	2009 AR	BLD	Boral Limited
121	2009 AR	BOE	Boss Energy Limited
122	2009 AR	BPT	Beach Petroleum Limited
123	2009 AR	BSE	Base Iron Ltd
124	2009 AR	BSL	BlueScope Steel Limited
125	2009 AR	BVA	Bravura Solutions Limited
126	2009 AR	BWP	Bunnings Property Management Limited
127	2009 AR	BXB	Brambles Limited
128	2009 AR	BYR	Burey Gold Limited
129	2009 AR	CCL	Coca-Cola Amatil Limited
130	2009 AR	CDP	Carindale Property Trust
131	2009 AR	CES	Coal FE Resources Ltd
132	2009 AR	CFX	CFS Retail Property Trust
133	2009 AR	CHR	Chalmers Limited
134	2009 AR	CII	CI Resources Limited
135	2009 AR	CLH	Collection House Limited
136	2009 AR	CNB	CIC Australia Limited
137	2009 AR	CPU	Computershare Limited
138	2009 AR	CRG	Crane Group Limited
139	2009 AR	CSR	CSR Limited
140	2009 AR	CVY	Coventry Resources Limited
141	2009 AR	CWE	Carnegie Wave Energy Limited
142	2009 AR	CWP	Cedar Woods Property
143	2009 AR	CXP	Corporate Express
144	2009 AR	CXU	Cauldron Energy Limited
145	2009 AR	CYG	Coventry Group Ltd
146	2009 AR	DRK	Drake Resources Limited
147	2009 AR	DSF	DSF International Holdings Limited
148	2009 AR	DTL	Data#3 Limited

No.	Report	ASX Code	Company
149	2009 AR	EAR	Echo Resources Limited
150	2009 AR	EEE	Empire Beer Group Limited
151	2009 AR	EME	Energy Metals Limited
152	2009 AR	ENE	Energy Developments Limited
153	2009 AR	ENL	Eagle Nickel Limited
154	2009 AR	ERA	Energy Resources of Australia Ltd
155	2009 AR	ERJ	Enerji Ltd
156	2009 AR	EXT	Extract Resources Ltd
157	2009 AR	FKP	FKP Property Group
158	2009 AR	FMG	Fortescue Metals Group Ltd
159	2009 AR	FPH	Fisher & Paykel Healthcare Corporation Limited
160	2009 AR	FPS	Fiducian Portfolio Services Limited
161	2009 AR	GDY	Geodynamics Limited
162	2009 AR	GGE	Grand Gulf Energy Limited
163	2009 AR	GLE	GLG Corporation
164	2009 AR	GMD	Genesis Minerals Limited
165	2009 AR	GMG	Goodman Group
166	2009 AR	GNC	GrainCorp Limited
167	2009 AR	GNI	Global Nickel Investments Limited
168	2009 AR	GNV	Green Invest
169	2009 AR	GPT	GPT Management Holdings Limited
170	2009 AR	GRY	Gryphon Minerals Limited
171	2009 AR	GXY	Galaxy resources limited
172	2009 AR	HGG	Henderson Group plc
173	2009 AR	HRR	Heron Resources Limited
174	2009 AR	HTA	Hutchison Telecommunications (Australia) Limited
175	2009 AR	HUM	Total Staffing Solutions Limited
176	2009 AR	HZN	Horizon Oil Limited
177	2009 AR	IDG	Indago Resources Limited
178	2009 AR	IPL	Incitec Pivot Limited
179	2009 AR	ITO	Macquarie Infrastructure Investment Management Limited
180	2009 AR	ITS	InterStaff Recruitment Limited
181	2009 AR	JGL	Jackgreen Limited
182	2009 AR	KAS	Kasbah Resources Limited
183	2009 AR	KEY	Key Petroleum Ltd
184	2009 AR	LBY	Liberty Resources Ltd
185	2009 AR	LNG	Liquefied Natural Gas Limited
186	2009 AR	LYC	Lynas Corporation Limited
187	2009 AR	MAP	MAp Airports Limited
188	2009 AR	MAS	HITEC ENERGY LIMITED
189	2009 AR	MBT	Mission NewEnergy
190	2009 AR	MCP	McPherson's Limited
191	2009 AR	MDA	Modena Resources Limited
192	2009 AR	MEL	Metgasco Ltd
193	2009 AR	MIX	Mirvac Industrial Trust
194	2009 AR	MND	Monadelphous Group
195	2009 AR	MOF	Macquarie Office Trust
196	2009 AR	MQG	Macquarie Group Limited
197	2009 AR	MYR	NB Flinders Pty Ltd
198	2009 AR	NAB	National Australia Bank Limited Group

No.	Report	ASX Code	Company
199	2009 AR	NEN	Salinas Energy Limited
200	2009 AR	NFE	Northern Iron Limited
201	2009 AR	NFK	Norfolk Group Limited
202	2009 AR	NHC	New Hope Corporation Limited
203	2009 AR	NHR	National Hire Group Limited
204	2009 AR	NOD	Nomad Building Solutions Limited
205	2009 AR	NSL	NSL Consolidated Limited
206	2009 AR	NSX	NSX Limited
207	2009 AR	OGC	Oceana Gold
208	2009 AR	OSH	Oil Search Limited
209	2009 AR	OZL	Oz Minerals Ltd
210	2009 AR	PBD	Port Bouvard Limited
211	2009 AR	PDN	Paladin Energy Ltd
212	2009 AR	PEH	Pacific Environment Limited
213	2009 AR	PEM	Perilya Limited
214	2009 AR	PFL	Patties Foods Ltd
215	2009 AR	PHG	Pulse Health Limited
216	2009 AR	PPX	PaperlinX Limited
217	2009 AR	QUE	Queste Communications Ltd
218	2009 AR	RCI	Rocklands Richfield Limited
219	2009 AR	RCR	RCR Tomlinson Limited
220	2009 AR	RFL	Rubik Financial Limited
221	2009 AR	RGD	RER Group Limited
222	2009 AR	RNI	Resource & Investment NL
223	2009 AR	RRS	Range resources ltd
224	2009 AR	SFR	Sandfire Resources NL
225	2009 AR	SGP	Stocklands Group
226	2009 AR	SGZ	Scotgold Resources Limited
227	2009 AR	SLX	Silex Systems Limited
228	2009 AR	SMC	Strategic Minerals Corporation NL
229	2009 AR	STG	Staging Connections Group Limited
230	2009 AR	TAM	Tanami Gold NL
231	2009 AR	TAP	Tap Oil Limited
232	2009 AR	TAW	Tawana Resources NL
233	2009 AR	TBG	Tutt Bryant Group Limited
234	2009 AR	TBR	Tribune Resources NL
235	2009 AR	TCL	Transurban Group
236	2009 AR	TEN	Ten Network Holdings Limited
237	2009 AR	TLS	Telstra Corporation Limited
238	2009 AR	TNE	Technology One Limited
239	2009 AR	TRF	Trafford Resources Limited
240	2009 AR	TSE	Transfield Services Limited
241	2009 AR	TSF	Total Staffing Solutions Limited
242	2009 AR	TTS	Tatts Group Limited
243	2009 AR	UOG	United Orogen Limited
244	2009 AR	UXA	United Uranium Limited
245	2009 AR	VRL	Village Roadshow Limited
246	2009 AR	WAN	West Australian Newspapers Holdings Limited
247	2009 AR	WBC	Westpac Banking Corporation
248	2009 AR	WDC	Westfield Group

No.	Report	ASX Code	Company
249	2009 AR	WDS	WDS Limited
250	2009 AR	WHC	Whitehaven Coal Limited
251	2009 AR	WPG	Western Plains Resources Ltd
252	2009 AR	WPL	Woodside Petroleum Ltd
253	2009 AR	WTP	Watpac Limited
254	2009 AR	WWG	World Wide Entertainment Group Limited
255	2009 SR	BLD	Boral Limited
256	2009 SR	CBA	Commonwealth Bank of Australia
257	2009 SR	CSR	CSR Limited
258	2009 SR	CWN	Crown Limited
259	2009 SR	DYE	Dyesol Limited
260	2009 SR	FMG	Fortescue Metals Group Ltd
261	2009 SR	LEI	Leighton Holdings Limited
262	2009 SR	LGL	Lihir Gold Limited
263	2009 SR	OZL	Oz Minerals Ltd
264	2009 SR	ROC	Roc Oil Company Limited
265	2009 SR	SGP	Stockland
266	2009 SR	SPN	SP Australia Networks (Distribution) Ltd