Corporate Governance and Carbon
Performance and Disclosure:
Australian Experience

By
Jibriel Omer Elsayih

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Supervised
By
Professor Qingliang Tang,
Professor Gabriel Donleavy
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Dedication

To my wonderful Mum and Dad

To my darling wife (Fatma) and fabulous sons (Mohammed, Hossain and Amjid)

To my dear brothers and sisters and their kids

Thank you very much for always supporting me and encouraging me throughout my life.
Acknowledgements

In the name of Allah the Most Gracious, the Most Merciful.

First and foremost, I am deeply grateful to almighty Allah (God), who granted me the strength, ability, patience and guidance in order to overcome all the problems and difficulties that I have encountered throughout my entire life, particularly during my research journey.

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Last but not least, I would like to offer my regards to all the people who encouraged me in any respect during the completion of this project.
Statement of Authentication

I hereby declare that the ideas, designs, analysis, results and conclusions set out in this thesis are entirely my own intellectual efforts, except where otherwise acknowledged. I further declare that this work has not been previously submitted and approved for any other award or any other higher education institution.

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Signature of Candidate                                                                         Date
The Author’s Publication

Conference Paper

Abstract

There has been a global consensus that GHG emissions including carbon dioxide (CO2) are the main cause of climate change and global warming, which can have a significant impact on business activity and behaviour (Saka and Oshika, 2014). Thus, carbon information has become more and more important for stakeholders to make an informed decision about a company’s GHG emissions performance (Luo & Tang, 2014a&b; Rankin et al. 2011; Tang & Luo, 2014; Luo et al. 2013; Luo & Tang, 2015). However, there is criticism that companies tend to disclose some unreliable climate change related information (Kolk et al. 2008). It can be argued that corporate governance plays a critical role in determining how companies are responding to climate change. This is because companies that have a high quality of corporate governance are more likely to integrate climate change into their business strategy and are more likely to maintain the long term commitment to effectively address climate change risks and opportunities across their entire operating system. But there is limited empirical evidence about this (Liao et al. 2014).

The purpose of this thesis is, therefore, to investigate two empirical issues. First, it investigates the effect of corporate governance mechanisms (board size, board independence, board diversity, board meetings, audit committee independence, environmental committee presence, CEO stock option, CEO long term bonus, ownership concentration and managerial ownership) on carbon performance. Second, this study examines the relationship between corporate governance mechanisms and the extensiveness of carbon disclosure.

The sample of this study consisted of an unbalanced panel set of 205 firm-year observations from the largest Australian companies that participated in the Carbon Disclosure Project (CDP) questionnaire survey over a period of four years (2009-2012). Twenty hypotheses are developed and tested using Ordinary Least Squares (OLS) multiple regression analysis to identify the correlation between corporate governance structures and carbon performance and disclosure together with the possible impact of the institutional environment in determining this relationship.

Regarding carbon performance, the empirical results show: first, generally speaking, the overall corporate government strength is not significantly related to carbon performance. Second, superior carbon performance is only found in firms that take
an environmental orientation and proactive carbon strategy. Third, carbon performance is higher in carbon intensity sectors than carbon non-intensity sectors. Finally, the results also indicate carbon performance is sensitive to some financial indicators such as leverage, Tobin’s Q, and capital intensity. The findings from the empirical study on carbon disclosure indicate that some dimensions of corporate governance, (board size, board independence, board diversity and managerial ownership), are significantly correlated with the degree of carbon transparency. Whereas, other corporate governance mechanisms are not significantly associated with the extensiveness of carbon disclosure. The results also showed that firm size, (as control variable), is significantly associated with the degree of carbon transparency.

The results of this study contributes to a growing literature on corporate governance and climate change association and presents new evidence of how carbon performance/disclosure is impacted by corporate governance. My findings suggest the current version of corporate governance mechanism in Australia appears to be structured to focus primarily on maximisation of financial performance. As a consequence, the board of directors of my sample firms seem to focus less on other aspects of performance such as carbon reduction. The study also contributes to the increasing literature about how corporate governance motivates the proactivity of corporate sustainability strategy in general and in carbon disclosure in particular.
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<th>Description</th>
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<tbody>
<tr>
<td>β1… β 16</td>
<td>are the coefficients of each of the independent variables</td>
</tr>
<tr>
<td>C</td>
<td>Error term.</td>
</tr>
<tr>
<td>3SLS</td>
<td>Three-Stage Least Squares Regression</td>
</tr>
<tr>
<td>2SLS</td>
<td>Two-Stage Least Squares Regression</td>
</tr>
<tr>
<td>ANGER</td>
<td>Australian National Greenhouse and Energy Reporting</td>
</tr>
<tr>
<td>ASX</td>
<td>Australian Stock Exchange</td>
</tr>
<tr>
<td>BGD</td>
<td>Board Gender Diversity</td>
</tr>
<tr>
<td>C_DIS</td>
<td>Carbon Disclosure</td>
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<tr>
<td>C_PER</td>
<td>Carbon Performance</td>
</tr>
<tr>
<td>CAPINT</td>
<td>Capital Intensity</td>
</tr>
<tr>
<td>CD₂</td>
<td>Carbon Dioxide</td>
</tr>
<tr>
<td>CDLI</td>
<td>Carbon Disclosure Leaders Index</td>
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<tr>
<td>CDP</td>
<td>Carbon Disclosure Project</td>
</tr>
<tr>
<td>CEO</td>
<td>Chief Executive Officer</td>
</tr>
<tr>
<td>CEO_LTG</td>
<td>CEO Long Term Bonus</td>
</tr>
<tr>
<td>CEO_SO</td>
<td>CEO Stock Options</td>
</tr>
<tr>
<td>CER</td>
<td>Corporate Environmental Responsibility</td>
</tr>
<tr>
<td>CPI</td>
<td>Carbon Performance Index</td>
</tr>
<tr>
<td>CSD</td>
<td>Corporate Social Disclosure</td>
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<tr>
<td>CSDI</td>
<td>Corporate Social Disclosure Index</td>
</tr>
<tr>
<td>CSDL</td>
<td>Corporate Social Disclosure Length</td>
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<tr>
<td>CSP</td>
<td>Corporate Social Performance</td>
</tr>
<tr>
<td>CSR</td>
<td>Corporate Social Responsibility</td>
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<tr>
<td>DEFRA</td>
<td>Department for Environment Food and Rural Affairs</td>
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<tr>
<td>DIB</td>
<td>Diversity In Boards</td>
</tr>
<tr>
<td>DOB</td>
<td>Diversity Of Boards</td>
</tr>
<tr>
<td>EC_D</td>
<td>Environmental Committee Presence</td>
</tr>
<tr>
<td>ECSR</td>
<td>Environmental Corporate Social Responsibility</td>
</tr>
<tr>
<td>ENEDs</td>
<td>Expertise Of Non-Executive Directors</td>
</tr>
<tr>
<td>EP</td>
<td>Environmental Performance</td>
</tr>
<tr>
<td>EPAs</td>
<td>Environmental Protection Authorities</td>
</tr>
<tr>
<td>FSIZE</td>
<td>Firm Size</td>
</tr>
<tr>
<td>FTSE</td>
<td>Financial Times and Stock Exchange</td>
</tr>
<tr>
<td>GICS</td>
<td>Global Industry Classification Standard</td>
</tr>
<tr>
<td>GMM</td>
<td>Generalised Method Of Moments</td>
</tr>
<tr>
<td>H</td>
<td>Hypothesis</td>
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<tr>
<td>IVs</td>
<td>Independent Variables</td>
</tr>
<tr>
<td>INTSECTOR</td>
<td>Intensive Sector</td>
</tr>
<tr>
<td>KLD</td>
<td>Kinder Lydenberg Domini</td>
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<tr>
<td>KLSE</td>
<td>Kuala Lumpur Stock Exchange</td>
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<tr>
<td>LEV</td>
<td>Leverage</td>
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<tr>
<td>LID</td>
<td>Lead Independent Director</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Description</td>
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<tr>
<td>LOG_CAPINT</td>
<td>Logarithm of the Capital Expenditure Over Sales</td>
</tr>
<tr>
<td>LOG_MANG_OWN</td>
<td>Logarithm of the percentage of total outstanding shares held by all directors.</td>
</tr>
<tr>
<td>LOG_OWN_CONC</td>
<td>Logarithm of the percentage of ordinary shares owned by substantial shareholder.</td>
</tr>
<tr>
<td>NAC</td>
<td>Number of audit committee</td>
</tr>
<tr>
<td>NBM</td>
<td>Number of board meetings per year</td>
</tr>
<tr>
<td>NCC</td>
<td>Number of compensation committee</td>
</tr>
<tr>
<td>NDB</td>
<td>Number of directors on board</td>
</tr>
<tr>
<td>NFDB</td>
<td>Number of female directors on the board</td>
</tr>
<tr>
<td>NNC</td>
<td>Number of nomination committee</td>
</tr>
<tr>
<td>NIDAC</td>
<td>Number of independent directors in audit committee.</td>
</tr>
<tr>
<td>NIDB</td>
<td>Number of independent directors in the board</td>
</tr>
<tr>
<td>NIDCC</td>
<td>Number of independent directors in Compensation (remuneration) Committee.</td>
</tr>
<tr>
<td>NIDNC</td>
<td>Number of independent directors in Nomination Committee.</td>
</tr>
<tr>
<td>NSE</td>
<td>Nairobi Securities Exchange</td>
</tr>
<tr>
<td>OECD</td>
<td>The Organization for Economic Cooperation and Development</td>
</tr>
<tr>
<td>OLS</td>
<td>Ordinary Least Square</td>
</tr>
<tr>
<td>OWN_CONC</td>
<td>Ownership Concentration</td>
</tr>
<tr>
<td>PCSEs</td>
<td>Panel-Corrected Standard Errors</td>
</tr>
<tr>
<td>PwC</td>
<td>PricewaterhouseCooper</td>
</tr>
<tr>
<td>R&amp;D</td>
<td>Research and Development</td>
</tr>
<tr>
<td>ROA</td>
<td>Return on Assets</td>
</tr>
<tr>
<td>ROE</td>
<td>Return on Equity</td>
</tr>
<tr>
<td>S&amp;P</td>
<td>Standard &amp; Poor</td>
</tr>
<tr>
<td>SES</td>
<td>Stock Exchange of Singapore</td>
</tr>
<tr>
<td>SSE</td>
<td>Shanghai Stock Exchange</td>
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<tr>
<td>TOBINSQ</td>
<td>Tobin’s Q</td>
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<td>TOL</td>
<td>Tolerance</td>
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<tr>
<td>UK</td>
<td>United Kingdom</td>
</tr>
<tr>
<td>US</td>
<td>United States</td>
</tr>
<tr>
<td>VED</td>
<td>Voluntary Environmental Disclosure</td>
</tr>
<tr>
<td>VIF</td>
<td>Variance Inflation Factor</td>
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CHAPTER ONE: INTRODUCTION AND OVERVIEW OF THE RESEARCH

1.1 Introduction

Among the major problems of the 21st century is the emission of GHG and the overdependence on carbon-based energy sources. Scientific researchers continue to present mounting evidence of the effects of GHG on climate change. Companies have always been central to the efforts to face these two problems owing to the large quantity of material that they process leading to the release of GHGs as a by-product and their capabilities for technological innovation (Hoffmann & Busch, 2008). This importance is reflected in the emerging literature in the fields of corporate and public policy which requires companies and organizations to respond and adapt to climate change (Griffiths et al. 2007).

The control of GHG emissions is a fundamental aspect of sustainable development. All managers and corporate personnel are obliged to develop organizational structures for the control of emissions, assessment of the risks associated with GHG and the evaluation of carbon control mechanisms developed to address the issue. According to a report issued by the Carbon Disclosure Project (CDP, 2011) and Pinkse & Kolk, (2009) corporate carbon reporting has increased around the world and particularly in Australia over the last few years. This is mainly due to the fact that climate change issues have become increasingly fundamental to a wide range of stakeholders in the corporate sector, which has shifted attention to the effects of GHG, mainly carbon, on corporate activities (Luo & Tang, 2011). This is a trend evidenced by the increase in the number of socially responsible investments by firms all over the world (Clarkson, Richardson & Vasvari, 2011).

This current research examines the carbon information that is disclosed voluntarily in the Carbon Disclosure Project (CDP) by Australian firms and the underlying carbon performance and its correlation with corporate governance structure. The CDP reports encourage the firms to develop web-based forms of corporate accountability with regard to carbon activities (Luo & Tang, 2011).
The disclosure of environmental information by Australian companies started in the early 1990s but it was not until after a change in the Australian Corporations Law was enacted some years later in July 1998 (Section 299 (1)(f)) that it was taken seriously. In early years, environmental disclosure was largely voluntary and very few disclosures were recorded in July 1998. This change in Australian Corporations Law required all corporate executives, specifically for companies whose operations were subject to any particular environmental regulation, to include details of their company’s performance in annual director’s report (Gibson, & O'Donovan, 2007). According to Frost & English, (2002), there has been a significant increase in the number of companies disclosing the information on their performance in relation to the environmental regulations since the enactment of that law in Australia. This study analyses data in CDP reports to determine whether Australian companies actually disclose carbon performance information. It also provides an insight into the role played by institutional governance systems in their carbon performance and carbon disclosure.

1.2 Objectives of this study

This study examines the relations between corporate governance mechanisms and carbon performance and the extensiveness of carbon disclosure. It aims to investigate the impact of structure and quality of corporate governance on carbon performance and disclosure using the largest Australian Companies that participated in the CDP questionnaire survey over four years (2009-2012).

The objectives of the study are:

1- To examine the influence of corporate governance mechanisms on carbon performance.

2- To investigate whether the corporate governance indicators are linked with the extensiveness of carbon disclosure.

3- To explore whether existing conceptual framework can explains the association between corporate governance, and carbon performance and carbon disclosure.
1.3 Motivation of this study

The Australian Government has been advised by scientists that the climate is changing around the world and that there will be adverse effects on Australia if the global temperatures continue to rise (The Australian Government’s Climate Change Plan, 2011). Australia - as a hot and dry continent - has more to lose from climate change than any other developed country (Garnaut, 2011). Given the significant risks to the environment and economy of Australia, it is important for researchers to contribute and find ways to improve carbon performance.

Generally, environmental and carbon performance are not compulsory by regulation; therefore it would be of interest to find out why companies voluntarily report this information, and what theories can explain social and environmental reporting practices. The most recent version of the KPMG International Survey of Corporate Responsibility Reporting from 2011 shows nearly 80% of the Global Fortune 250 now produce corporate responsibility reports including environmental and carbon performance reports. Since a significant number of companies (both globally and in Australia & New Zealand) are embracing public social and environmental performance information, this is a worthwhile question for investigation. If we understand the reasons behind the reporting, we are in a position to judge the quality of the information that is being reported. Having the ability to judge the quality of the disclosures empowers users to make more informed decisions about how to invest, what products to buy, and which companies to work for, and could also inform regulators to improve the regulations and standards in this area.

This research work was inspired by the significance of the carbon performance of Australian organisations and their role in GHG emissions. It is also expected that this study will enrich both academic and empirical literature on several accounts:

• First, the majority of previous literature focuses on partial aspects of the relationship between corporate governance mechanisms and social and environmental performance (e.g. Walls et al. 2012; De Villiers et al. 2011; Hafsi & Targut, 2013 & Deckop et al. 2006). In contrast, this study will examine the association between a number of individual and specific dimensions of corporate
governance mechanisms and carbon performance and carbon disclosures in Australia.

- Second, there is no previous study that used a comprehensive set of corporate governance indicators or thoroughly examined the relationship with carbon performance and disclosure.

- Third, compared to prior studies, this study focuses on Carbon Disclosure Project (CDP) reports, whereas the majority of studies evaluated GHG disclosures in annual, sustainability and web site reports (Peng, Sun & Luo, 2015; Chithambo & Tauringana, 2014; Rankin et al. 2011).

1.4 Research Questions

Based on the above objectives, the main research question is:

**To what extent is good corporate governance related to better carbon performance and higher level of carbon disclosures?**

The study discusses the following questions:

1- What is corporate governance?

2- How to measure carbon performance?

3- How to measure the extensiveness of carbon disclosure?

4- What indicators of corporate governance are associated with carbon performance and the extensiveness of carbon disclosure?

1.5 Expected Contribution of the study

There are limited studies that have investigated the relationship between corporate governance and environmental disclosure, especially for carbon performance/disclosure in Australia. The current study will fill the gap and, to my knowledge, this is the first study to examine the issue in Australia by using a wide array of corporate governance mechanisms. The study chooses Australian firms because Australia is one of the highest per capita carbon emitters in the world and Australia will be most significantly and negatively affected by global warming (Lue
& Tang, 2014). Additionally, Australian government has introduced a series of GHG legislations which signal a new era of transition toward a carbon constrained economy. Currently the environmental accounting literature is limited to the issues related to water and toxic chemical pollution rather than carbon pollution. For the majority of Australian firms, the exposure to carbon liability has much more financial implication than general environmental exposure. This is due to the fact that these firms do not have water or toxic chemical air pollution problems, but any carbon emission is subject to carbon tax (although this tax was repealed in 2014, there are other provisions to restrict carbon emissions). Consequently, the results of my study contributes to a growing literature on corporate governance and climate change association and presents new evidence of how carbon performance and transparency is impacted by the strength and structure of corporate governance.

1.6 Research Methodology

The sample selection process of this study starts from the largest Australian companies that participated in the CDP survey over the 2009 - 2012 periods. The final sample that met all of the selection criteria includes 205 firm-year observations. While the data relating to corporate governance were hand collected from firms’ annual reports, carbon emissions and activities data have been obtained from firms’ response to a CDP standardised questionnaire. The financial data are gathered from the FinAnalysis database. In order to test the hypotheses, descriptive statistics was used first that includes sample values such as the mean, median, standard deviation, minimum, maximum values, 25th and 75th percentile of the variables and Skewness-Kurtosis statistics, etc. And then, the Pearson correlation matrix is constructed to identify the correlation between the dependent and independent variables. In addition, Ordinary Least Squares (OLS) multiple regression analysis was the primary statistical technique adopted to test the predicted association between two dimensions of the carbon activity. First, the association between a number of corporate governance characteristics and carbon performance was tested. Second, the impact of various corporate governance mechanisms on carbon disclosure was examined. Finally, additional analysis was performed to check the robustness of the main regression analysis.
1.7 Outline of the Thesis

As seen in Figure 1.3 below, this thesis has six chapters which are structured as follows; Chapter 1 provides an overview of this thesis, which begins with the objectives of this thesis, followed by the motivations of the study. It then continues to identify research questions as well as expected contribution of the research. A brief summary of the research methodology is also presented in the end of this chapter.

Chapter 2 provides a review of relevant literature to this study. The first section of the chapter provides a comprehensive definition of corporate governance. The chapter then focuses on the background of GHG emission in Australia. The chapter also explores previous studies on carbon performance and their relationship with corporate governance mechanisms. Following this, we provide the previous literature investigating the association between corporate governance mechanisms and environmental and carbon disclosure. Finally, this chapter presents the three main theories that would be suitable within the scope of the empirical work. The theoretical perspectives reviewed are: legitimacy theory, stakeholder theory, and signalling theory.

Chapter 3 discusses the research method that was employed to test my hypotheses in the current study. The first section commences with explaining the procedures of sample selection and data sources. The criteria for selection of my sample are also explained. After the data description, the chapter also discusses the development of the main hypotheses to be tested in this study. My hypotheses are drawn heavily from literature reviews that are provided in chapter three. The chapter also describes the measurements of the dependent variable (carbon performance and carbon disclosure). Following this, the chapter describes the measurements of corporate governance mechanisms and control variables. Finally, the chapter further concludes with an explanation of the statistical techniques used in this study and the regression models employed to test my hypotheses and the outcome of this research.

Chapter 4 presents the first phase of the current study which uses quantitative methods for the investigation of the impact of corporate governance on carbon performance. It starts by explaining five statistical assumptions that determines the
validity of the regression model, namely: linearity, independence of errors, normality, homoscedasticity and multicollinearity. The chapter then includes a comprehensive descriptive analysis of the variables used in the first model. After that the correlation coefficients analysis and Variance Inflation Factor (VIF) are conducted to identify the collinearity and multicollinearity problems among variables. OLS regression analysis was employed in this study to examine this relationship. The results of the regressions of corporate governance and carbon performance are evaluated. Finally, additional analysis and the robustness checks are discussed in the end of this chapter.

Chapter 5 investigates the link between a number of individual corporate governance mechanisms and the extensiveness of carbon disclosure in the largest Australian companies. The assumptions, namely; linearity, independence of errors, normality, homoscedasticity and multicollinearity are examined to detect violations in the regression model. The chapter then presents the descriptive analysis of the variables used in this model. Additionally, the correlation coefficients analysis and Variance Inflation Factor (VIF) are reviewed. Following this, OLS regressions have been employed to test the association between corporate governance mechanisms and the extensiveness of carbon disclosure. The chapter also provides a detailed discussion of the results and testing of the hypotheses developed in Chapter 3.

Finally, the summary of the whole thesis is provided in chapter 6. In this chapter, an overview of the main results are presented and commented upon. It then discusses the main contributions, potential implications and limitations of this study. In addition, this chapter ends by providing several avenues for future research that arise from the empirical; results and limitations of the study.
Figure 1.3: Thesis Structure

Chapter One
Introduction

Chapter Two
Literature Review and Theoretical Background

Part One
Theoretical Background

Part Two
Literature Review

Chapter Three
Research Methodology

Chapter Four
Corporate Governance & Carbon performance

Chapter Five
Corporate Governance & Carbon Disclosure

Chapter Six
Conclusions
CHAPTER TWO: THEORETICAL BACKGROUND AND LITERATURE REVIEW

2.1 Introduction

The primary goals of this chapter are to provide a review of the extensive research on the structure of corporate governance and to review its relationship with environmental/social performance and disclosure, as well as to review the different theories that have been used to explain these associations. However, since the context of carbon emissions is relatively new, this chapter sheds light on previous environmental studies in order to link this study with the prior literature. Furthermore, previous studies are to be reviewed in order to build the relevant theoretical framework and research hypotheses and the methodology of this study.

The remainder of this chapter is structured as follows: Section 2.2 provides a comprehensive picture of corporate governance definitions. Section 2.3 presents a background to carbon emissions. Section 2.4 highlights the three main theories that would be suitable within this study: legitimacy theory, stakeholder theory and signalling theory. Section 2.5 presents prior studies that have investigated the relationship between corporate governance mechanisms and social/environmental performance, while Section 2.6 reviews studies that have demonstrated an association between corporate governance mechanisms and social/environmental performance. Finally, Section 2.7 concludes the whole chapter.

2.2 Corporate Governance Definitions

The increasing amount of corporate governance research over the last decades leads to greater variation of the corporate governance definitions. However, there is as yet no single, universally accepted definition of corporate governance because the circumstances vary country-by-country (Solomon, 2007). Furthermore, countries across the globe are dissimilar from each other in terms of culture, legal systems and historical developments (Ramon, 2001). This explains why there has been a multitude of corporate governance definitions around the world. Therefore, Table 2.1
below provides various definitions of corporate governance from different sources to give a better understanding of the concept of corporate governance (CG).

**Table 2.1: summary of CG Definitions adopted from previous studies**

<table>
<thead>
<tr>
<th>Year</th>
<th>Author/s</th>
<th>Definitions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1992</td>
<td>Cadbury Report</td>
<td>CG is “the system by which companies are directed and controlled”.</td>
</tr>
<tr>
<td>1993</td>
<td>Keasey &amp; Wright</td>
<td>CG is “the structures and processes associated with production, decision making, control and so on within an organisation to ensure that the agent acts for the benefit of shareholders and stakeholders”.</td>
</tr>
<tr>
<td>1997</td>
<td>Shleifer &amp; Vishny</td>
<td>CG is defined as “the ways in which suppliers of finance to corporations assure themselves of getting a return on their investment”.</td>
</tr>
<tr>
<td>1998</td>
<td>Gillan &amp; Starks</td>
<td>CG is “the system of laws, rules, and factors that control operations at a company”.</td>
</tr>
<tr>
<td>1998a</td>
<td>Zingales</td>
<td>CG is “the complex set of constraints that shape the ex post bargaining over the quasi-rents generated by the firm”.</td>
</tr>
<tr>
<td>2001</td>
<td>Tirole</td>
<td>CG is “the design of institutions that induce or force management to internalize the welfare of stakeholders.”</td>
</tr>
<tr>
<td>2003</td>
<td>Daily, Dalton &amp; Cannella</td>
<td>CG is “the determination of the broad uses to which organizational resources will be deployed and the resolution of conflicts among the myriad of participants in organizations”.</td>
</tr>
<tr>
<td>2003</td>
<td>Denis &amp; McConnell</td>
<td>CG is “the set of mechanisms – both institutional and market-based – that induce the self-interested controllers of a company (those that make decisions regarding how the company will be operated) to make decisions that maximize the value of the company to its owners (the suppliers of capital).”</td>
</tr>
<tr>
<td>2004</td>
<td>The Organization</td>
<td>CG is “a set of relationships between a company’s”</td>
</tr>
<tr>
<td>Year</td>
<td>Author(s)</td>
<td>Definition</td>
</tr>
<tr>
<td>------</td>
<td>---------------------------------</td>
<td>------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>2005a</td>
<td>Luo</td>
<td>CG is “the relationship between the corporation and the stakeholders that determines and controls the strategic direction and performance of the corporation”.</td>
</tr>
<tr>
<td>2005</td>
<td>Du Plessis, McConvill &amp; Bagaric</td>
<td>CG as “the process of controlling management and of balancing the interests of all internal stakeholders and other parties (external stakeholders, governments and local communities) who can be affected by the corporation’s conduct in order to ensure responsible behaviour by corporations and to achieve the maximum level of efficiency and profitability for a corporation”.</td>
</tr>
<tr>
<td>2005</td>
<td>Hennessey</td>
<td>CG is “the set of actions and procedures that ensure a company is soundly managed so all investors receive a return on their investment that is reasonable given the risks involved”.</td>
</tr>
<tr>
<td>2007</td>
<td>Larcker, Richardson &amp; Tuna</td>
<td>CG is “the set of mechanisms that influence the decisions made by managers when there is a separation of ownership and control”.</td>
</tr>
<tr>
<td>2008</td>
<td>Donnelly &amp; Mulcahy</td>
<td>CG is “a set of control mechanisms that is specially designed to monitor and ratify managerial decisions, and to ensure the efficient operation of a corporation on behalf of its stakeholders.”</td>
</tr>
<tr>
<td>2009</td>
<td>Rezaee</td>
<td>CG is “The process affected by a set of legislative, regulatory, legal, market mechanisms, listing standards, best practices, and efforts of all corporate participants including the company’s directors, officers, auditors, legal counsel, and financial advisor’s which creates a system of management, its board, its shareholders and other stakeholders.”</td>
</tr>
</tbody>
</table>
checks and balances with the goal of creating and enhancing enduring and sustainable shareholder value, while protecting the interests of other stakeholders”.

<table>
<thead>
<tr>
<th>Year</th>
<th>Source</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010, 2007</td>
<td>ASX Corporate Governance Council</td>
<td>CG is “the framework of rules, relationships, systems and processes within and by which authority is exercised and controlled in corporations.”</td>
</tr>
<tr>
<td>2011</td>
<td>Larcker and Tayan</td>
<td>CG is “the collection of control mechanisms that an organization adopts to prevent or dissuade potentially self-interested managers from engaging in activities detrimental to the welfare of shareholders and stakeholders.”</td>
</tr>
<tr>
<td>2013</td>
<td>Solomon</td>
<td>CG is “the system of checks and balances, both internal and external to companies, which ensures that companies discharge their accountability to all their stakeholders and act in a socially responsible way in all areas of their business activity.”</td>
</tr>
</tbody>
</table>

In sum, whatever definition above is preferred, it is clear that the narrowest definition of corporate governance was proposed by Cadbury Report, (1992) which described the basic role of corporate governance. OECD’s (2004) definition focused only on shareholders and company management from the finance perspective. Solomon, (2013) extended this concept to a broader definition that encompassed corporate accountability to all their stakeholders and the wider society. Therefore, the key purpose of corporate governance is to manage the corporation in such a way that will ensure better performance for its key stakeholders.

2.3 Theoretical Background

2.3.1 Introduction

Chambers (1996) reported that a theory will not tell us what we ought to do, but it will tell us what it is possible to do and what it is not possible to do. In that way it
removes countless considerations when confronted with the necessity of choosing or acting. In this sense, a review of the relevant literature reveals that a variety of theoretical frameworks have been used in order to describe and explain environmental disclosure practices and mechanisms of corporate governance. A number of theories, e.g. legitimacy theory, stakeholder theory and signalling theory, have been found to be particularly relevant to explain the relationship between corporate governance mechanisms and carbon performance and disclosure.

The rest of this section provides a theoretical framework to support the aforementioned argument. In doing so, the study explores multiple theories that explain different perspectives related to carbon performance and disclosure and governance practices.

2.3.2 Legitimacy theory

Legitimacy theory has become one of the most popular theories that have been widely used to explain the social and environmental disclosure literature (Patten 1992; Deegan & Gordon, 1996; O'Donovan, 2002; Deegan, Rankin & Tobin 2002). Legitimacy was defined by Lindblom (1994, p.2) as: “a condition or a status which exists when an entity's value system is congruent with the value system of the larger social system of which the entity is a part. When a disparity, actual or potential, exists between the two value systems, there is a threat to the entity's legitimacy”. Fundamentally, legitimacy theory relies upon the idea of a social contract between a company and the members of the society in which it operates (Patten, 1991; Mathews, 1993; Deegan, 2002). Normative argument that is fundamental to legitimacy theory is that organisations will only survive and prosper if they operate within the boundaries and norms of their respective societies (Gray, Owen & Adams, 1996). In order to maintain their legitimacy within society, the theory of legitimacy assumes that companies may voluntarily disclose social and environmental information regarding their performance in order to legitimise their activities so as to give the impression of being socially responsible to the society (Deegan, 2002; O’Donovan, 1999; Patten, 1991). Therefore, legitimacy theory has been adopted by numerous previous studies in the context of the social and environmental disclosure literature (e.g. Deegan & Gordon, 1996; Deegan et al. 2000; Deegan, 2002; Gray et al. 1996).
The legitimacy of an organisation can be thought of as a process or simply as a state of being (Deephouse, 1996). No problems exist when there are no differences between organisational and societal values. However, legitimacy is threatened when such differences arise. Therefore, whenever there is such a gap, organisations take sufficient steps or perform certain activities to close this ‘legitimacy gap’ that exists between their values and those of the wider society. This is done in order to re-establish a state of organisational legitimacy. Ultimately, this state of legitimacy is bestowed upon organisations by the wider society or relevant public, as it is within their power to determine the organisation’s state of legitimacy, thereby reflecting their views of the organisation. Ultimately, it is in the best interests of the organisation to ensure that the wider society has a positive perception of them, since they exist within the sphere of the wider society and are dependent upon it. As such, when there is a shift in society’s perception of them, the organisation focuses on gaining or repairing legitimacy. Therefore, it is crucial that corporate entities are aware of shifts in societal perceptions in order to ensure that no threats to their legitimacy exist (Deegan, 2007).

Lindblom (1994) argues that there are four distinct strategies that organisations employ whenever there is a perceived threat to their legitimacy. First, they try to educate and inform their stakeholders regarding relevant changes in the organisation’s performance. Second, they seek to change stakeholders’ perceptions regarding the organisation’s performance without changing the performance itself. Third, they manipulate perceptions by deflecting attention from the issues of concern to other related but appealing issues. Fourth, they seek to change external expectations regarding their performance. Disclosure plays an important role in each of these four legitimacy threat mitigation strategies. This leads us to believe that legitimacy theory does explain some components of voluntary disclosure practices.

Legitimacy is akin to the firm’s reputation in certain ways, as it exists in people’s minds (Breton & Cote, 2006). Since people’s perceptions have a significant influence, it is crucial that these perceptions be positive in order to maximise the firm’s utility. In order to gain such legitimacy, a certain degree of disclosure is desirable, even if it is not mandatory (Magness, 2006). Without such disclosure, people rely on preconceived notions in order to form their perceptions, and this may carry an element of risk. Legitimacy is not always threatened when an organisation
deviates from societal expectations; sometimes, it may be threatened even if the organisation has failed to provide evidence that it is indeed conforming to the expectations that society has of it. Lack of disclosure could be perceived as evidence of insufficient socially responsible behaviour. This means that the entity would become vulnerable to claims of negligence (Meyer & Rowan, 1991, cited in Suchman, 1995). However, disclosure in itself might also result in a variety of responses. This is because the firm might have compromised their responsibilities in order to achieve short-term financial targets. Therefore, voluntary disclosures, whenever they are made, are done using a strategic consideration of defiance, acquiescence and compromise (O’Dwayer, 2002). Furthermore, it is important to consider how ‘legitimacy’ as a driver can often result in what can only be termed as ‘minimal appeasement’ (O’Dwayer, 2002). For example, if there is a hypothetical clash between environmentalists and the financial stakeholders of a company, there is a possibility that any disclosures made to appease the demands of the former will not be a true reflection of the organisation’s performance in the area. Instead, it may remain a symbolic gesture aimed at minimally appeasing this group as opposed to defying them completely.

In support of the legitimacy theory, Patten (1992) concluded that the increasing concerns of society increased the level of social responsibility information in annual reports, which is believed to be evidence of legitimacy in support of corporate reactions to society in order to gain its approval for the company’s existence. These conclusions are grounded in the legitimacy theory arguments of Preston & Post (1975). This is consistent with Deegan & Rankin (1996), who conducted a study indicating a positive association between an increase in the level of environmental disclosures and companies that have been prosecuted by Australian state Environmental Protection Authorities (EPAs). On the other hand, Guthrie & Parker (1989) conducted an analysis of social disclosures for Australian mining/manufacturing company, Broken Hill Proprietary Company Ltd (BHP) through its annual reports over a 100-year period. They argued that the testing of legitimacy theory as an explanation for BHP’s social disclosures relied upon the matching of peak social disclosure periods with periods of significant social and environmental events affecting the company. However, the analysis failed to confirm legitimacy theory as an explanation for CSR, particularly for BHP’s social
disclosures. Furthermore, according to Campbell, Craven & Shrives (2003), legitimacy theory has not provided a suitable measure of the effect of disclosures being able to change the perceptions of the relevant public in isolation from other influences and events in the society.

Drawing on the literature regarding legitimacy theory, it can be inferred that legitimacy theory could be used in order to predict and understand the quality of voluntary disclosures in cases of carbon performance. For example, if the legitimacy of a firm is threatened by negative media coverage, it is likely that the firm will make soft claims that are hard to verify. This is a form of tactical disclosure that aims to strategically restore legitimacy without sufficiently changing the activity of the organisation whose legitimacy is being threatened.

### 2.3.3 Stakeholder theory

Initially, the purposes of stakeholder theory were to defend the social responsibilities of businesses and to declare that managers have a moral responsibility towards stakeholders other than financial stakeholders (Hendry, 2001). These stakeholders are usually critical factors in determining and ensuring the success of the organisation, and therefore deserve to be eligible for some return on their involvement (Crowther & Jatana, 2005). Under stakeholder theory, the shared values between society and business organisations are a necessary part of doing business and reject the separation of ethics and economics (Freeman, 1994). In particular, the theory also allows businesses to articulate how they want to go about conducting their transactions and whether they care about giving something back to the people who are involved in or affected by their activities. Therefore, the following section tries to achieve two major objectives:

- Clarifying the stakeholder concept;
- Categorising stakeholders such that their individual relationships with businesses can be better understood.

The term of ‘stakeholder’ first appeared in the management literature in an internal memorandum at the Stanford Research Institute in 1963 in order to generalise the concept of stockholder as the only group to whom management need be responsive
(Freeman et al. 2010). Therefore, the concept of the stakeholder was originally defined by Freeman (1984: p.25) as “any group or individual who can affect or is affected by the achievement of the firm’s objectives”. The symmetrical phrase is “any human agency that can be influenced by, or can itself influence the activities of the organization in question” (Gray et al. 1996: p.33). Evan & Freeman (1988: p.79) further clarified the definition by stating that stakeholders are “those groups who have a stake in or a claim on the firm”. Thus, the major stakeholders of the company originally included shareholders, suppliers, customers, competitors, banks, employees, creditors, public interest groups, governmental bodies, local communities, stock markets, industry bodies and society (Tilt, 2007).

The classifications of stakeholders can take various forms, such as differentiating between ‘primary’ and ‘secondary’ stakeholders (Clarkson, 1995; Savage et al. 1991). A primary stakeholder is defined as “one without whose continuing participation the corporation cannot survive as a going concern” (Metcalfe 1998 & Clarkson, 1995). Consequently, primary stakeholders involve those who are directly engaged in transactions with the company and have the ability to impact its bottom line directly, such as shareholders, creditors, managers and employees, suppliers, customers and regulatory stakeholders (Clarkson, 1995). Secondary stakeholders are defined as those who affect or influence – or are affected or influenced by – the company, but are not involved in transactions with the company and are not necessary for its survival (Mitchell, Agle & Wood, 1997). Consequently, the media, special interest groups and the general public are identified as secondary stakeholders under this definition. Moreover, Mitchell et al. (1997) categorised stakeholders based upon stakeholders possessing one or more of the attributes of power, legitimacy and urgency. In terms of stakeholders’ power, this relates to the ability of one actor within a social relationship to have another actor do something that they would not otherwise have done (Mitchell et al. 1997; Weber, 1947). From this notion, power is described as a relationship among social actors in which one social actor (A) can get another social actor (B) to do something that (B) would not otherwise have done (Weber, 1947; Pfeffer, 1981). Legitimacy is the perception or belief that stakeholders’ claims are proper, desirable or appropriate within some socially constructed system of norms, values, beliefs and definitions (Thorne, Ferrell & Ferrell, 2003; Suchman, 1995). Urgency is based on two characteristics: time
sensitivity and the importance of the claim to the stakeholder (Thorne et al. 2003). These three attributes of a specific stakeholder can change over time or with variation of the issues (Mitchell et al. 1997).

In addition, stakeholder theory can also be identified as having two different branches (Gray et al. 1996; Deegan, 2000). The first branch is ethical (or normative). Deegan (2002) argued that all stakeholders have the right to be treated fairly by a company. This idea is reflected in the accountability model that was developed by Gray et al. (1996), who argued that the company is accountable to all stakeholders to disclose social responsibility information. Under the ethical branch, the company is a way of coordinating the interests of stakeholders and management practices that have a fiduciary relationship with all stakeholders; where conflicts of interest arise, the business should be managed so as to attain the optimal balance between them (Hasnas, 1998). The other branch is known as the managerial (or positive) branch. Ullmann (1985) stated that the more powerful stakeholders (those who have substantial control over corporate resources) are more likely to receive attention from the company. Under managerial stakeholder theory, social performance and disclosure are seen as part of the dialogue with stakeholders (Deegan & Blomquist, 2006; Gray et al. 1995). Ullman (1985: p.553) confirmed that an organisation “will use either social performance or social disclosure or both techniques simultaneously to manage its relationship with its stakeholders”.

Ullmann (1985) developed a three-dimensional framework in order to explain corporate social activity based on a stakeholder theory that includes a stakeholder’s power, the company’s strategic posture toward Corporate Social Responsibility (CSR) and the company’s economic performance. A stakeholder’s power to influence corporate management is viewed as a function of the stakeholder’s degree of control over the resources required by the organisation (Ullmann, 1985). Under stakeholder power, the more significant the resources controlled by the stakeholder to the survival of the corporation, the greater the expectation that the stakeholder’s demands will be met within the organisation’s operations (Gregoric and Debeljak, 2006). Based on this perspective, Deegan & Blomquist (2006) suggested that companies would change their operating and reporting behaviour in line with stakeholder expectations and power. For instance, if a powerful group is concerned about the social or environmental performance of the company, then that company
might perceive a need to publicly disclose information about the social or environmental initiatives that it has or plans to implement in order to alleviate any concerns held by the powerful stakeholders. As part of this response, a firm may use disclosures in order to manage stakeholder demands. Dierkers & Antal (1985) indicated that social disclosures and corporate responsibility information can provide a basis for dialogue with various business constituencies. The second dimension is the company’s strategic posture toward CSR activities. More social responsibility activities can be 'active firm' and if a company does not develop specific social programs to meet stakeholder demands, can be 'passive firm'. Therefore, the more active the strategic posture, the more socially responsible activity disclosures are to be expected. The third dimension of Ullmann’s model concerns the company’s past and current economic results. The importance placed on meeting the social responsibility goals is very much dependent on the economic demands of the company, which impact directly on a company’s continued viability. Therefore, given certain levels of stakeholder power and strategic posture, an increase in economic success will yield increased socially responsible activities and disclosures.

Donaldson & Preston (1995) argued that the stakeholder theory can be used in three different forms: descriptive, instrumental and normative. The descriptive approach of stakeholder theory is used to explain specific corporate characteristics/behaviours (Clarkson, 1995), as it has been used to describe the past, present and future activities of companies and their stakeholders in order to generate predictive propositions related to stakeholder management (Donaldson & Preston, 1995). The instrumental approach seeks to explain the specific links between stakeholder approaches and the achievement of traditional corporate objectives (e.g. profitability and growth) (Kotter & Heskett, 1992). This approach has been applied in environmental studies, indicating that adherence to stakeholder principles and practices achieve conventional corporate performance objectives. The normative approach is used to analyse the basis of the underlying moral and philosophical principles of the management of corporations (Marcus, 1993).

A number of studies have used stakeholder theory to explain the rationale behind environmental disclosure, including GHG (e.g. Clarkson, 1995; Roberts, 1992; Deegan, 2002; Freedman & Jaggi, 2005; Liao, Luo & Tang, 2014). It has been suggested that environmental disclosures are made in response to the demands of
stakeholders for social and environmental information. In particular, Liao et al. (2014) argued that the intensity of conflicting stakeholder demands and preferences provides a potential explanation for GHG disclosures in terms of a firm’s responsiveness to climate change, its strategic orientation towards social and environmental responsibility and the trade-off between economic and ecological objectives.

Stakeholder theory is significantly related to the legitimacy theory discussed above. Similarly to legitimacy theory, stakeholder theory places the organisation within the society in which it operates. However, legitimacy theory is concerned with society as a whole, whereas stakeholder theory narrows its focus to specific stakeholders who have a link (however tenuous) with the activities of the organisation. Legitimacy theory states that organisations should always operate within societal norms and ensure that their actions are perceived as legitimate by society, therefore suggesting a two-way interaction. Stakeholder theory, however, emphasises a one-way delivery of information to stakeholders regarding organisational accountability. From this, we can infer that these two theories are not in competition, as one could be led to believe. In fact, they can be seen as being complementary in terms of explaining the different frameworks that have been established in order to analyse different approaches to voluntary disclosure.

2.3.4 Signalling theory

Signalling theory deals with the issue of information asymmetry in an imperfect market (Akerlof, 1970). It argues that when there is such information asymmetry, the party with more information must convey or ‘signal’ this information to the other. It can therefore be inferred that, through such signalling, firms aim to distinguish themselves from others in terms of achievements. The concept of signalling theory was introduced by Spence, who first put forth the theory of signalling in 1973, primarily based on the seminal work of Akerlof (1970). Spence’s (1973) seminal work on labour markets revealed how a job applicant might engage in behaviours to reduce information asymmetry, which hampers the selection ability of potential employers. Signalling theory is essentially concerned with reducing information asymmetry between two parties (Spence, 2002). Therefore, signalling theory is useful for describing behaviours when two parties have access to different
information, in which the sender must choose whether and how to communicate the information and the receiver must choose how to interpret the signal (Connelly, Certo, Ireland & Reutzel, 2011). Several previous studies have confirmed the predictions of signalling theory suggesting that a high-quality firm will not shy away from informing the market of its quality (e.g. Kanagaretnam, Lobo & Whalen, 2007; Mitchell, 2006). Furthermore, managers voluntarily disclose both good and bad news, as the good news signals quality and the bad news is signalled in order to avoid reputational costs and litigation (Skinner, 1994). Dye (1985) indicated that even a company with good news may choose to withhold information from investors. By contrast, a firm with bad news may choose not to disclose such news if the firm is worried about its competitors’ potential reactions to this information. This is because the managers may not have any information to disclose (Kwon, 1988) or because the absence of disclosure may affect the managers’ performance (Nagar, 1999). In addition, Dye (1985) & Verrecchia (1983) posited that companies with ‘good news’ in terms of performance have the incentive to signal their ‘type’ to the market in order to avoid the adverse selection problem by making the credible environmental disclosures that poor performers find difficult to mimic.

Based on the above arguments, firms are seen to have the incentive to disclose regardless of the ‘goodness’ or ‘badness’ of their performed activities. If the activities are of sufficiently high quality, then the firm has the incentive to signal this to the market. This signalling enables stakeholders and investors to reassess the value of the firm, and they are therefore more likely to make decisions that are more favourable for the company. On the other hand, the signalling of so-called ‘bad’ information can help the company reduce legal costs and restore legitimacy, as most legitimacy-restoring strategies (discussed above) rely on the disclosure of information. In a changing corporate environment in which environmentally responsible behaviour is being rewarded, the signalling of positive environmental performance can also be helpful for attracting investors and reducing the costs of raising capital. There are a number of means by which companies can signal their positive behaviour, and amongst these, voluntary disclosure (especially in annual reports) is considered to be very effective (Ross, 1979). Therefore, the signalling of positive performance is also likely to bring about a variety of other benefits, such as improving the corporate image, attracting potential investors, lowering capital costs,
decreasing the volatility of their stocks, creating an understanding of the company’s products or services and, more importantly, improving relationships with various stakeholders (Rodgers, 2007). Other studies in this area have suggested that excellence in signalling can act as a motivation for companies to engage in voluntary disclosure (Oliviera, Rodrigues & Craig, 2006). Finally, it is also important to consider how the quality of signals is important in ensuring utility for the company. Morris (1987) reported that, for firms with superior performance, their signalling should be such that it is very difficult for low-quality firms to imitate them.

Several studies have provided empirical support for signalling theory in an environmental setting (e.g. Li, Richardson & Thornton, 1997; Bewley & Li, 2000; Clarkson, Richardson & Vasvari, 2007; Clarkson, Overell & Chapple 2011; Luo, Tang & Lan, 2013), suggesting that companies with a superior environmental performance have the incentive to signal their ‘type’ to the market by making credible environmental disclosures that are very difficult for poor performers to mimic. In particular, Luo et al. (2013) suggested that firms with a good carbon performance prefer to signal their ‘good’ news to their investors, and they tend to use the types of credible disclosure that poor performers would find costly to imitate.

2.4 literature review on carbon performance and disclosure studies

Since the field of carbon emissions is relatively new, the literature review of current study begins with studies on environmental accounting and disclosure to link this study with prior literature. The main goal of this section is to provide a summary of the key results of each of previous study and its methodology to identify gaps in the existing literature. Therefore, prior studies are classified into the following two groups of studies that are relevant to this study: first, previous studies that have investigated the association between the characteristics of corporate governance and social/ environmental performance; and second, prior studies that have examined the relationship between corporate governance mechanisms and social/environmental disclosures.
2.4.1 Corporate governance and social/environmental performance

Only a few studies have explicitly investigated the association between corporate governance and carbon performance, and even fewer specifically in Australia. Therefore, this study starts with the previous environmental studies to link this study with prior literature.

Boulota (2013) empirically investigated whether and how female board directors may affect corporate social performance (CSP). Her study used both of these alternative treatments of CSP. First, the impact of board gender diversity (BGD) is tested on overall CSP and then on CSP ‘strengths’ and CSP ‘concerns’. A sample of 126 U.S. firms was gathered from the S&P 500 group of companies over a 5-year period (1999–2003). Her study used a generalised method of moments (GMMs) estimator to examine the link between board gender diversity and corporate social performance. The empirical analysis indicated that board gender diversity has a positive and significant impact on overall CSP. However, this impact depends on the social performance metric used. In particular, the findings showed that board gender diversity has a stronger impact on the negative social practices of CSP (‘concerns’) than on the positive ones (‘strengths’).

Hafsi & Targut, (2013) investigated the relationship between boardroom diversity and corporate social performance in a sample of S&P500 firms. The independent variables employed in their study include two indices; diversity of boards (DOB), which include board size, board independence, outside directors, and leadership duality; and diversity in boards (DIB) which include director gender, age, experience, tenure, and ethnicity. The results of OLS regression, based on a sample of 95 companies was composed of 49 companies in service (52%) and 46 companies in manufacturing (48%) industries, showed that a positive and significant association between gender and corporate social performance, negative and significant relationship between age and corporate social performance, while there is no significant relationship between other board structures (e.g. board size, board independence, outside directors, leadership duality, experience, tenure, and ethnicity) and corporate social performance.
Bai (2012) investigated how board size and occupational background of directors differentially influence social performance in both for-profit and non-profit organizations. Using data from California hospitals, they employed community benefits as a proxy for social performance, which was measured by the sum of uncompensated care cost, net education expense, and net research expense, divided by hospital gross patient revenues. The independent variables were board size, government officials on the board and physicians on the board. For-profit sample included 703 hospital-year observations from 137 hospitals, while the non-profit sample consisted of 1,236 hospital-year observations from 226 hospitals over the period of 2000 to 2005. The regression results showed that board size is positively related to social performance in for-profit hospitals and negatively associated with social performance in non-profit hospitals. In addition, the presence of government officials on the board is positively associated with social performance in non-profit hospitals and negatively related to social performance in for-profit hospitals. The results also indicated that representation of physicians on the board is positively associated with social performance in for-profit hospitals, whereas their presence is not significantly related to social performance in non-profit hospitals.

Walls, Berrone & Phan, (2012) investigated how the relationships between and among the firms’ owners, managers, and boards of directors influence environmental performance of US companies. Their sample consisted of 313 US firms drawn from different polluting industries over nine years from 1997 to 2005 inclusive. Different techniques and statistical analyses were used. The regression results showed that shareholder activism and concentration have a direct influence on environmental performance. In addition, they found that the existence of environmental board committees was positive associated with KLD strengths and environmental concerns. However, environmental performance was seen to be poor in companies having large, less diverse boards. In contrast reverse results have been noted for smaller and more diverse boards. Further, in the case of environmental strengths, board size and CEO salary show that better environmental performance is due to a small board-low salary or a large board-high salary combination, whereas for environmental concerns, a high salary is much more detrimental to environmental performance than a low salary.
De Villers, Naiker & van Staden (2011) investigated the relationship between board characteristics and environmental performance of a firm. Board characteristics encompassed the boards’ monitoring role (director independence, CEO-chair duality, directors appointed after CEO, CEO-director ownership, insider-director ownership and outsider-director ownership) and boards’ resource provision role (board size, multiple directorships, active CEOs, law experts, and board tenure). The study sample consisted of an unbalanced panel of 2,151 observations from 1,216 firms, with 981 of the total observations pertaining to the year 2003 and 1,170 for the year 2004. All the data was collected after careful consideration from the KLD database. By using logistic regression model, they concluded that the environmental performance is better in firms with higher board independence and lower concentration of directors appointed after the CEO on the board of directors. In addition, environmental performance is much better in firms that have larger boards, larger representation of active CEOs on the board and more legal experts on the board. Their findings were consistent with agency theory and resource-dependence theory.

Cong & Freedman (2011) examined the relationship between good corporate governance practices and environmental performance and its disclosure among a restricted sample of major toxin-emitting U.S. firms. The dependent variables used were pollution performance (measured using a methodology that includes both the toxicology of the emissions and the population density of the community). For their review they selected the firms that were the top 50 volume metric releasers of toxics from the period of 2003 to 2005, from 1897 firms. An OLS regression was run for all the model specifications. The results indicated that good corporate governance is not associated with good pollution performance, where these results were consistent with legitimacy theory.

In a separate study, Manner (2010) examined the relationship between CEO characteristics and corporate social performance in a sample of 650 public US firms during 2006. The independent variables used were CEO characteristics which include; educational fields of study and functional career experience, gender and CEO compensation. The dependent variable employed in his study was corporate social performance (CSP) measured by KLD Index rating. The results, based on OLS regression analysis, revealed that that strong CSP is positively associated with the
CEO having a bachelor’s degree in humanities, having a breadth of career experience and being female. However, the results show that the CEO having a bachelor’s degree in economics and their level of short term compensation are negatively related to strong/proactive social performance. Whereas, long-term compensation is not associated with strong/proactive social performance.

Deckop, Merriman & Gupta (2006) examined the relationship between CEO pay structure and corporate social performance in a sample of 313 firms. They measured corporate social performance using six dimensions from the KLD which are categorized into employee relations, product quality and safety, community relations, natural environment, human rights, and diversity. While two of the independent variables were used in this study which are short term pay focus and long term pay focus, their sample was drawn from the 2001 Standard & Poor’s 500 list. Regression analysis was employed to examine empirically the relationship between CEO pay and particular dimensions of CSP. The findings showed that a short-term CEO pay focus was negatively associated with CSP, whereas the long-term focus was positively related to the corporate social performance.

Mahoney & Thorne (2005) examined the association between long-term compensation and different aspects of corporate social responsibility for 90 publicly traded Canadian firms from 1992 to 1996. The dependent variables used were CSR (measured as Total CSR, Total CSR product and total CSR people). The independent variable used was long-term compensation (measured as the percentage of stock option grants to total executive compensation). The results of the regression analysis indicated the total CSR is marginally positively associated with higher levels of longer term compensation. In addition, the results documented that the total CSR product dimension is related to higher levels of long-term compensation, whereas the total CSR people dimension is not associated with long-term compensation.

McGuire, Dow & Argheyd, (2003) examined the relationship between CEO incentives (CEO ownership, Bonus, Salary and another long term incentives) and strong and weak corporate social performance. Social and environmental performance was measured by ratings by KLD and Company, while bonus measured as the proportion of bonus payments in the CEO’s compensation and long-term incentives measured as the percentage of long-term incentive payments (stock
options and other long-term incentives) in the CEO’s compensation. Their study was based on 374 US firms, with data being collected from three different databases and analysed using the OLS regression model. The empirical results showed that the CEO incentives (either short-term or long-term compensation) and strong social performance are not significant, whereas salary and long-term incentives are positively associated with poor social performance.

Kassinis & Vafeas (2002) empirically examined the determinants of environmental litigation in the U.S. Their study was drawn on the issues of corporate governance in general and board structure in particular to empirically investigate environmental lawsuits. The potential explanatory factors that included characteristics of board structure were board size, director affiliation, director reputation and inside ownership. The sample is composed of 209 firms that were convicted and penalized for breaking an environmental law in the U.S for the period of 1994 to 1998. Multivariate logistic regression results indicated that board size and the fraction of directors in peer firms are positively related to the environmental violations. In addition, the results showed that the fraction of common stock owned by officers and directors is positively associated with environmental violations. In contrast, the number of directorships held by outside directors is negatively related to environmental violations.

McKendall, Sánchez & Sicilian (1999) conducted a study to determine the effect of several different dimensions of board structure on the incidence of illegal environmental activity by corporations from 1985 to 1987, using the number of illegal violation of environmental regulations as essential tools for investigation. Based on a sample of 150 U.S firms, the results of the Tobit regression analyses showed that value of stock owned by corporate officers and directors was positively associated with environmental violations. On the other hand, outsider dominance, joint CEO-chairperson, presence of social responsibility officers in committee and lawyers on the board did not have any significant correlation with incidences of environmental violations.

Coffey & Wang (1998) empirically evaluated both board diversity and managerial control of the board as predictors of corporate social performance in the U.S firms. They used two measures of board diversity: the percentage of inside board members
and the percentage of women board members, and two measures of managerial control: percentage of total stock owned by inside board members and ratio of stock owned by outside to inside board members. The sample used in this study was comprised of 98 Fortune 500 U.S companies. Multiple regressions were employed to examine the competing hypotheses regarding this relationship. The empirical results revealed that the ratio of insiders to outsiders on the board and the percentage of stock owned by insiders are positively significantly associated with charitable contributions. Whereas, percentage of women and ratio of stock owned by outside to inside board members are not.
### Table 2.2: Summary of previous studies investigating the association between Corporate Governance and Social/Environmental Performance

<table>
<thead>
<tr>
<th>Author/Year</th>
<th>Variables</th>
<th>Methods</th>
<th>Main results</th>
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<tr>
<td><strong>Boulota (2013)</strong></td>
<td>Corporate Social Performance</td>
<td>Board Gender Diversity</td>
<td>A sample of 126 firms drawn from the S&amp;P500 group of companies over a 5-year period. Generalised method of moments (GMMs) estimator. The findings suggested that board gender diversity (BGD) has a positive and significant impact on overall CSP. However, this impact depends on the social performance metric under investigation.</td>
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<td><strong>Hafsi &amp; Targut (2013)</strong></td>
<td>Corporate Social Performance</td>
<td><strong>Diversity of boards:</strong> outside directors, board size, ownership, leadership duality. <strong>Diversity in boards:</strong> gender, age, ethnicity, experience, and tenure.</td>
<td>A sample of 95 companies was composed of 49 companies in service (52 %) and 46 companies in manufacturing (48 %) industries. OLS regression Model. They found that gender has a positive and significant effect on social performance and age has negative effect on corporate social performance. However, other board structures (outside directors, board size, ownership, leadership duality, ethnicity, experience, and tenure) have no significant effect on social performance.</td>
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<tr>
<td>Study</td>
<td>Corporate Social Performance</td>
<td>Institutional Ownership: A sample of 313 US firms drawn from different polluting industries over nine years from 1997 to 2005 inclusive</td>
<td>Models</td>
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<td>Bai (2012)</td>
<td>Board size, government officials on the board and physicians on the board.</td>
<td>A profit sample included 703 hospital-year observations from 137 hospitals, while the non-profit sample consisted of 1,236 hospital-year observations from 226 hospitals over the period of 2000 to 2005</td>
<td>OLS regression Models</td>
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<tr>
<td>De Villiers et al. (2011)</td>
<td>Environmental performance</td>
<td>Director independence, CEO-chair duality, directors appointed after CEO, CEO-director ownership, insider-director ownership, outside-director ownership, board size,</td>
<td>A sample consists of an unbalanced panel of 2,151 observations from 1,216 firms, with 981 of the total observations pertaining to the year 2003 and 1,170 for the year 2004 in the U.S.</td>
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Managerial Incentives: CEO duality, Mgr control, CEO bonus, CEO salary, CEO options

more diverse boards can mitigate detrimental environmental performance more effectively. Environmental board committees were positively associated with both environmental strengths and concerns. In the case of environmental strengths, board size and CEO salary show that better environmental performance is due to a small board-low salary or a large board-high salary combination, whereas for environmental concerns, a high salary is much more detrimental to environmental performance than a low salary.

They found the higher environmental performance in firms is correlated with (1) higher concentration of independent directors and (2) lower concentration of directors appointed after the CEO. As well, they show that environmental performance is higher in firms that have (1) larger boards, (2) a large representation of active CEOs on the
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<tr>
<td>Manner (2010)</td>
<td>Corporate Social Performance</td>
<td>CEO characteristics: Educational field of study, functional career experience, Gender and CEO Compensation</td>
<td>A sample of 650 public US firms</td>
<td>OLS regression Model</td>
<td>They found that there is a significant positive relationship between the CEO having a bachelor's degree in humanities, having a breadth of career experience and being female and strong or exemplary CSP, as measured by the strengths categories of KLD’s ratings. However, they found that KLD strength ratings are negatively related to the CEO having a bachelor’s degree in economics and short-term compensation.</td>
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<tr>
<td>Deckop et al. (2006)</td>
<td>Corporate Social Performance</td>
<td>CEO short -term and long-term pay focus</td>
<td>A sample of 313 firms from the 2001 Standard &amp; Poor’s (S&amp;P) 500 list.</td>
<td>OLS regression model</td>
<td>They found a significant negative relationship between a short-term pay focus and CSP, and a significant positive relationship between a long-term focus and CSP.</td>
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<tr>
<td>Authors</td>
<td>Title</td>
<td>Pay mix: stock option grants/total compensation</td>
<td>Sample Description</td>
<td>Methodology</td>
<td>Findings</td>
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<tr>
<td>Mahoney &amp; Thorne</td>
<td>Strengths and weaknesses in corporate social responsibility</td>
<td>A sample of 90 publicly traded Canadian firms from the TS market capitalization (1992-1996).</td>
<td>Regression analyses</td>
<td>The results indicated a significant relationship between the long-term compensation and the total CSR weakness as well as the product/environmental weakness dimensions of CSR. In addition, they found a marginally significant relationship between long-term compensation and total CSR performance.</td>
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<tr>
<td>McGuire et al.</td>
<td>Strengths and weaknesses in corporate social performance</td>
<td>CEO salary, bonus, and long-term compensation</td>
<td>OLS regression Model</td>
<td>They found that incentives have no significant relationship with strong social performance, and the positive association between salary and long-term incentives and weak social performance.</td>
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<tr>
<td>Kassinis &amp; Vafeas</td>
<td>Environmental litigations</td>
<td>Board size, director affiliation, director reputation, managerial control, and outside</td>
<td>Logistic regressions.</td>
<td>They found that board size and the fraction of directors in peer firms are positively related to environmental litigation, and a positive relationship between environmental litigations and</td>
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<tr>
<th>Author(s)</th>
<th>Topic</th>
<th>Variables</th>
<th>Sample Size/Term Period</th>
<th>Method</th>
<th>Findings</th>
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<tbody>
<tr>
<td>McKendall et al. (1999)</td>
<td>Environmental Violations</td>
<td>Inside directors, joint CEO-chairperson, value of stock owned by directors, social responsibility committees, lawyer.</td>
<td>A sample of 150 US firms for the periods of 1985 to 1987.</td>
<td>Tobit regression analyses</td>
<td>The results demonstrated that the value of stock owned by corporate officers and directors was positively and significantly associated with serious environmental violations. Outsider dominance, joint CEO-Chairpersons, social responsibility committees and lawyers on boards were not significantly related to environmental violations.</td>
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<tr>
<td>Coffey &amp; Wang (1998)</td>
<td>Corporate philanthropy</td>
<td>Board composition, board diversity, managerial control</td>
<td>A sample of 98 Fortune 500 companies</td>
<td>Multiple regressions</td>
<td>The results indicated the ratio of insiders to outsiders on the board and the percentage of stock owned by insiders are positively related to charitable contributions, however, no relationship between corporate philanthropy and both ratio of stock owned by outside to inside board members and women directors.</td>
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</table>
2.4.2 Corporate Governance and Social/Environmental Disclosure

Previous studies have suggested there is a link between corporate governance and corporate disclosure. These studies examine different characteristics of corporate governance and their association with different types of disclosure. Some prior literature has investigated the relationship between corporate governance and voluntary disclosure in general and environmental disclosures in particular (e.g. Eng & Mak, 2003; Haniffa & Cooke, 2005; Barako, Hancock & Izan, 2006; Lim Matolesy & Chow, 2007; Donelly & Mulcahy, 2008; O’Sullivan, Percy & Stewart, 2008; Chau & Gray, 2010; Alegrini & Greco, 2011; Post, Rahman & Rubow, 2011; Kathyayini, Tilt & Lester, 2012; Rupley, Brown & Marshall, 2012). However, few studies have explicitly examined the relationship between corporate governance and carbon disclosure, and even fewer specifically in Australia.

Kathyayini, Tilt & Lester (2012) empirically investigated the relationship between environmental reporting and corporate governance characteristics of the largest 100 Australian firms listed on the Australian Stock Exchange (ASX) in 2008. Environmental disclosure as dependent variable was measured by two different ways: total number of words dedicated to environmental issues in the annual report and total number of words dedicated to environmental issues in the annual report divided by total words in the annual report. Four corporate governance variables were included in this study; board independence, ownership concentration, board size and female directors, while the control variables used were firm size, profitability and industry. The regression results, based on OLS regression, indicated a strong positive relationship between the extent of environmental disclosures and the proportion of independent and female directors on the board. Besides, a positive correlation between environmental disclosures and institutional investors and board size was shown.

Rupley, Brown & Marshall, (2012) examined the relationship between good governance characteristics and media coverage and the quality of voluntary environmental disclosure in a sample of 127 US firms during the period of 2000 to 2005 inclusive. They employed four measures of environmental disclosure quality, namely: compliance, pollution prevention, product stewardship and ecological sustainability. Five specific governance characteristics were examined which are: board independence, board diversity, multiple directorships, CEO duality and presence of a CSR committee. Control variables used were firm size, profitability, intensive sector, regulation sensitivity. The statistical analyses revealed the percentage of directors serving on multiple boards is positively associated with all levels of voluntary
environmental disclosure quality. Moreover, board independence and board diversity are significantly positively associated with at least one level of voluntary environmental disclosure quality. However, CSR committee is not significant association.

Post, Rahman & Rubow, (2011) tested the association between boards of directors’ composition and environmental corporate social responsibility (ECSR). The dependent variable was ECSR which was calculated by different ways. First, ECSR disclosures as reported in firms’ annual reports, corporate environmental reports, corporate websites, and government websites. Second, data from the proprietary KLD STATS database, issued by KLD, Inc, while the independent variables were board characteristics which included insider/outsider director, gender, age, and education. Moreover, control variables included industry, slack resources, CEO duality and board size. They used the data from KLD database for 78 US firms in the electronic and chemical industries over the period of 2006 to 2007. Using univariate and multivariate analysis, their results provided some important insights which support agency theory that a higher proportion of outside board directors are associated with more positive ECSR disclosures and higher KLD strengths scores. Furthermore, the presence of three or more female directors on a board is associated with higher KLD strength scores. Also, boards with directors whose average age is closer to 56 years and those with a higher percentage of Western European directors are more likely to disclose ECSR governance.

Alegrini & Greco (2011) tested the interplay between corporate governance and voluntary disclosure practices for all non-financial companies listed on the Italian Stock Exchange in 2007. Their study used a disclosure scoring index based on the information disclosed in 2007 to measure the level of voluntary disclosure. Seven different corporate governance characteristics were identified in this study, namely: board independence, board size, CEO duality, lead independent director, board committees, board activity and audit committee activity, plus control variables such as firm size, leverage, profitability, listing status and ownership concentration. The results, based on an OLS regression model, demonstrated that board size and diligence and the frequency of audit committee meetings had a positive impact on amount of information disclosed voluntarily. CEO duality had a weak negative relationship with voluntary disclosure. However, presence of board committees, board composition and lead independent director had no association whatsoever with information disclosed.
Chau & Gray (2010) empirically examined the relationship between the extent of voluntary disclosure and levels of family ownership and board independence in Hong Kong. Different characteristics of corporate governance were used in this study: family ownership, independent chairman and independent non-executive directors. The voluntary disclosure index was calculated as raw scores divided by the total possible voluntary disclosure scores. A sample of 273 listed companies in Hong Kong in the year 2002 was used. A linear multiple ordinary least squares (OLS) regression model was applied to examine the relationship between the dependent variable of voluntary disclosure and CEO duality, proportion of independent non-executive directors to total number of directors and family ownership of a firm. The empirical findings indicated that family ownership was negatively associated with the disclosure level not only for overall information but also for all of the information subgroups. In addition, the results showed that the proportion of non-executive directors on the board were not only positively associated with overall information disclosure but also with strategic and non-financial information disclosures.

Michelon & Parbonetti (2010) examined the impact of different characteristics of the board on sustainability disclosure among US and European companies. The content analysis of the annual, social, environmental and sustainability reports of the companies was used to measure sustainability disclosure. Board characteristics were represented by five variables; independent directors, community influential members, CSR committee, CSR director and CEO duality. The empirical analysis, based on data of 114 European and American companies (57 companies listed in Dow Jones Sustainability Index and 57 companies belong to the Dow Jones Global Index for the year 2003, indicate that a positive association was found between community influential and sustainability disclosure. Empirical results also provide a weak evidence of the association between the existence of a CSR committee or CSR director and the level of sustainability disclosure. However, the proportion of independent and CEO duality were unrelated to sustainability disclosure.

O'Sullivan, Percy & Stewart (2008) examined the association between corporate governance framework and voluntary disclosure of forward looking information of Australian companies in 2000 and 2002. The dependent variable was the voluntary disclosure of forward-looking information in corporate financial reports. The forward-looking information disclosed by sample firms exhibits certain common characteristics. The majority of disclosing firms publish qualitative forward-looking information within reports prepared by the chief executive officer, chairman and managing director. They used an index of governance
mechanisms that reflects various governance attributes to calculate an overall corporate governance score. A number of control variables such as firm size, leverage, profitability and environment information were used. The logistic regression model was adopted to test their hypotheses. The results demonstrated that, in the year 2000, the presence and independence of the audit committee, its meeting frequency, the use of a Big 6 auditor and the auditor’s independence are positively related to voluntary disclosure of forward looking information. In addition, the findings showed that the independence and existence of compensation committee, nomination committee, and overall efficiency of governance system are all positively related to voluntary disclosure practices. However, none of these factors seem to be significantly associated with voluntary disclosure in the year 2002.

Donelly & Mulcahy (2008) empirically analysed the relationship between board structure, ownership characteristics and voluntary disclosure in Ireland. Voluntary disclosure is measured by an index of disclosure. Board structure was categorized into nonexecutive directors and CEO duality, while ownership structure was classified into institutional ownership and managerial ownership. Their sample consisted of 51 publicly listed Irish firms in the year 2002. The empirical results, based on a poisson regression model, indicated that the proportion of the board comprised of nonexecutive directors is significantly positively associated with the level of voluntary disclosure. The results also suggested that having a nonexecutive director as chairman is positively related to voluntary disclosure. In contrast, ownership structure is reported to be unrelated to the level of voluntary disclosure.

Ghazali (2007) investigated the influence of ownership structure on corporate social responsibility (CSR) disclosure in Malaysian companies. His study employed the CSR disclosure checklist to measure the extent of CSR disclosure in annual reports. Ownership characteristics examined are ownership concentration, director ownership and government ownership. A multiple regression analysis was carried out to determine the association between ownership structure and CSR disclosure. Using a sample of 87 Malaysian companies listed on the Bursa Malaysia Stock Exchange, the results showed that companies in which directors hold a larger amount of equity shares (owner managed companies) disclosed significantly less information about their social activities. Companies in which the government is a large shareholder disclosed significantly more CSR information. However, ownership concentration is not statistically significant in explaining the level of CSR disclosure in annual reports.
Lim Matolcsy & Chow (2007) examined the association between board composition and level of voluntary disclosure of 181 Australian firms for the period of 1999 to 2001. They collected 67 items from annual reports to develop the total voluntary disclosure index. The independent variable used was board independence. A two-stage least squares regression (2SLS) model was employed to estimate the effects of board composition on voluntary disclosure. These items were classified into three major types of information: strategic, non-financial and financial information. The regression results revealed that board composition is positively related to voluntary disclosure of information in annual reports. In addition, the results showed that boards composed largely of independent directors voluntarily disclose more forward looking quantitative and strategic information. However, board structure has no effect on financial and non-financial voluntary disclosure.

Huafang & Jianguo (2007) empirically investigated the impact of corporate governance, as being represented by ownership structure and board composition, on voluntary disclosures of listed companies in China. They developed an index to measure the extent of voluntary disclosure by companies in the 2002 annual reports which consisted of 30 items covering background information, business information, financial information and non-financial information. They took a sample of 559 firms listed on the Shanghai Stock Exchange (SSE) for 2002 and applied the OLS regression model to analyse the data. The regression results reported that greater blockholder ownership and foreign shares/ listings are associated with increased voluntary disclosure. In addition, managerial ownership, state ownership and legal-professional ownership are not particularly related to voluntary disclosure. The study also concluded that a greater percentage of independent researchers increases voluntary disclosure, whereas CEO duality is negatively associated with disclosure.

Barako, Hancock & Izan (2006) tested the extent to which corporate governance attributes, ownership structure and company characteristics influence voluntary disclosure by Kenyan companies. The independent variables of corporate governance were board composition, board leadership structure, board size, board audit committee, ownership concentration, foreign ownership and institutional ownership. The study used a disclosure index to measure the level of reporting by companies. Their study also used a pooled Ordinary Least Square (OLS) with Panel-Corrected Standard Errors (PCSEs) to analyse the data obtained from 54 Kenyan companies listed on the NSE was investigated from 1992 to 2001. The statistical analyses showed that the presence of an audit committee is positively related to the level of voluntary disclosure, and the proportion of non-executive directors on the board is found to
be significantly negatively related to the degree of voluntary disclosure. In contrast, board leadership structure did not appear to have a significant influence on the level of voluntary disclosure by firms. The study also found that the levels of institutional and foreign ownership are significantly positively associated with voluntary disclosure, whereas ownership concentration has negative association.

Haniffa & Cooke (2005) investigated the impact of culture and corporate governance on social disclosures in Malaysian listed companies. Corporate governance structures were categorised into board composition, multiple directorships and type of shareholders. They used ethnic background of directors and shareholders as a proxy of culture. The dependent variable of disclosure in annual reports of Malaysian companies was calculated by an index score as well as in terms of number of words. The sample of this study was comprised of 139 companies listed in the Kuala Lumpur Stock Exchange (KLSE) from 1996 to 2002. Based on multiple regression models, the analyses results indicated that a significant positive relationship between Malay directors and chairs with multiple directorships are significantly positively associated with corporate social disclosure and a significant and negative relationship between composition of non-executive directors and corporate social disclosure was found. Moreover, the results showed that foreign share ownership was found to be positively and statistically significant related to CSD.

Gul & Leung (2004) empirically tested the linkages between board leadership structure in terms of CEO duality, the proportion of expert outside directors on the board and voluntary corporate disclosures. They developed an index to measure the extent of voluntary disclosures by companies in the 1996 annual report which contained 44 discretionary items, which were classified into: background information (includes items such as corporate goals, competition, products and markets), financial performance information (includes items such as changes in sales, gross profits and R&D expenditures) and non-financial performance information (includes items such as number of employees, staff training, products segment analysis, environmental measures and Y2K issues). Regression analysis of observations from 385 Hong Kong companies indicated that CEO duality was negatively associated with the levels of voluntary corporate disclosures, supporting the view that the position of chairman and CEO should be separated. The results also revealed that firms with a higher proportion of expertise of non-executive directors are associated with lower voluntary disclosures. More interestingly, it was found that the negative association between CEO duality and corporate disclosures is weaker when the firm has a higher proportion of expert outside directors.
Eng & Mak (2003) investigated the association between ownership structure and board composition and voluntary disclosure of 158 Singapore firms listed on the Stock Exchange of Singapore (SES) in 1995. Voluntary disclosure was proxied by an aggregated disclosure score of non-mandatory strategic, financial and non-financial information, while ownership structure is characterized by managerial ownership, blockholder ownership and government ownership, and board composition is measured by the percentage of independent directors. Ordinary least squares (OLS) regression model was employed. Their results found that government ownership is positively associated with voluntary disclosure and significant negative association between voluntary disclosure and managerial ownership. Furthermore, they reported that the percentage of independent directors is negatively associated with voluntary disclosure. However, blockholder ownership is not related to voluntary disclosure.

Chau & Gray (2002) tested the relationship between ownership structure and the voluntary disclosures of listed companies in the settings of Hong Kong and Singapore. A checklist of voluntary disclosure items was constructed to capture corporate information disclosure practices in annual reports. This checklist had three classifications: general information, nonfinancial information and financial information multiple(s). The independent variable of ownership structure was measured by adding together the proportions of equity belonging to directors and to dominant shareholders to arrive at the proportion of a firm’s equity owned by insiders. A control variable of firm size, leverage, auditor’s size, multinationality and profitability were included. Based on a sample of 60 and 62 industrial companies listed in the Stock Exchange of Singapore and Hong Kong respectively and linear multiple regression analysis, the findings revealed that the extent of outside ownership is significantly positively related to voluntary disclosures, while the strong prevalence of “insider” and family-controlled companies is likely to be associated with lower levels of disclosure.

Haniffa & Cooke (2002) tested the relationship between a number of corporate governance, cultural and firm-specific characteristics and the extent of voluntary disclosure in the annual reports of Malaysian companies. Voluntary disclosure was measured by an index of disclosure. The independent variables are categorized into three groups: corporate governance (represented by board composition, cross-directorships, role duality, family members on the board, finance director on the board and chairperson with cross-directorships), cultural and firm-specific. The study was based on a stratified random sample of 167 companies gathered from the Annual Companies Handbook (1995), published by the Kuala Lumpur Stock Exchange (KLSE). Using multiple regression models, the results
revealed that family members sitting on the board and a non-executive chairperson were significantly negatively associated with the extent of voluntary disclosure, whereas other variables of corporate governance are not related. The findings also showed that no significant association between the extent of voluntary disclosure and any of the cultural variables in the full model.

Halme & Huse (1997) examined the relationship between environmental disclosure and corporate governance factors, industry factors, and country factors in Scandinavian countries. The independent variable was environmental disclosures which are examined with the help of a three-class categorization: annual report contains little or no environmental information, annual report has an environmental section and the company has an environmental policy and future action plans in the annual report. Two corporate governance variables were contained within this study: board size and ownership concentration. This study was conducted on the largest corporations from each of the Scandinavian countries: 40 firms from Finland 40 firms from Norway, 40 firms from Sweden and 20 firms from Spain (Based on each firms’ data from the year 1992 onwards). The analysis was performed using multiple logistic regression analyses. The regression results showed that there is not any significant relationship between environmental disclosure and ownership concentration and the number of board members. In addition, the results indicate that the extent of a corporation's environmental impact is significantly positively associated with environmental reporting.
Table 2.3: Summary of previous studies investigating the association between Corporate Governance and Social/Environmental Disclosure

<table>
<thead>
<tr>
<th>Author/Year</th>
<th>Variables</th>
<th>Methods</th>
<th>Sample</th>
<th>Main results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kathyayini et al. (2012)</td>
<td>Environmental reporting:</td>
<td></td>
<td></td>
<td>The results indicated a significant relationship between the extent of environmental disclosures and the proportions of independent and female directors on a board. As well as a positive association between the extent of environmental disclosures and institutional investors and board size.</td>
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<tr>
<td></td>
<td>- Environmental disclosure.</td>
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<td>- Proportion of environmental disclosure.</td>
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<td>Dependent</td>
<td>Independent</td>
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<td></td>
<td>Board independence,</td>
<td>Board independence,</td>
<td>A sample of 96 of the top 100 Australian firms listed on the Australian Stock Exchange (ASX) in 2008</td>
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<tr>
<td></td>
<td>Institutional ownership, Board size and</td>
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<td></td>
<td>Proportion of Female directors</td>
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<tr>
<td>Rupley et al. (2012)</td>
<td>Quality of voluntary environmental disclosure</td>
<td>Environmental legitimacy:</td>
<td>A sample of 127 U.S. firms over a 6-year period (2000–2005).</td>
<td>They found that the percentage of directors serving on multiple boards is positively associated with all levels of quality voluntary environmental disclosure. Furthermore, board independence and board diversity have a positive association with at least one level of</td>
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<tr>
<td></td>
<td>Environmental media coverage, negative environmental media.</td>
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<td></td>
<td>Board of directors:</td>
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<td></td>
<td>board independence, directorship, Gender</td>
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<td>Post et al. (2011)</td>
<td><strong>Environmental corporate social responsibility (ECSR): (ECSR) disclosures:</strong> Disclosed ECSR Governance, Disclosed ECSR Credibility, Disclosed Environmental Performance Indicators.</td>
<td><strong>KLD STATA database:</strong> as measured by KLD environmental Strengths, KLD environmental concerns, Total KLD diversity, CEO duality and CSR committee. <strong>Institutional investors:</strong> long-horizon investors and short-horizon investors</td>
<td><strong>Insider-outsider status, gender, age, Western European education and educational attainment</strong> A sample of 78 U.S. Firms. - Electronics firms found in the 2006 list of Fortune 1000 companies. - Chemical firms found in the 2007 list of Fortune 1000 companies.</td>
<td><strong>OLS Regressions</strong> The study found that a higher proportion of outside board directors is associated with more favourable ECSR disclosures and higher KLD strengths scores. Firms with boards composed of three or more female directors received higher KLD strengths scores. In addition, boards whose directors average closer to 56 years in age and those with a higher proportion of directors with Western European education were more likely to implement environmental governance structures or processes.</td>
</tr>
<tr>
<td>Study</td>
<td>Research Question</td>
<td>Variables</td>
<td>Sample Size</td>
<td>Methodology</td>
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<tr>
<td>Allegrini &amp; Greco (2011)</td>
<td>The level of voluntary disclosure</td>
<td>Board composition, Board size, CEO duality, Lead independent director, Board committees, Board activity and Audit committee activity</td>
<td>A sample consists of 177 companies listed on the Italian Stock Exchange in 2007</td>
<td>OLS regression model</td>
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<tr>
<td>Chau &amp; Gray (2010)</td>
<td>The extent of voluntary disclosure</td>
<td>Family ownership, and board independence</td>
<td>A sample of 273 listed firms in Hong Kong for the year 2002.</td>
<td>OLS regression Model</td>
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<tr>
<td>Authors</td>
<td>Research Question</td>
<td>Methodology</td>
<td>Findings</td>
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<tr>
<td>Michelon &amp; Parbonetti</td>
<td>The level of sustainability disclosure</td>
<td>OLS regression model</td>
<td>They found a positive association between community influential and the level of sustainability disclosure, a weak evidence of the association between the existence of a CSR committee or CSR director and the level of sustainability disclosure. However, the proportion of independent and CEO duality were unrelated to sustainability disclosure.</td>
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<tr>
<td>(2010)</td>
<td>Board composition (independent directors and community influential members), Board structure (CSR responsible and CSR committee), and Board leadership (CEO duality).</td>
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<td></td>
<td>A sample of 114 European and American companies of which 57 companies are listed in Dow Jones Sustainability Index and 57 companies belong to the Dow Jones Global Index for the year 2003.</td>
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<td>O'Sullivan et al.</td>
<td>Voluntary disclosure of forward-looking information</td>
<td>logistic regression model</td>
<td>The results indicated that audit quality which consists of the presence and independence of the audit committee, its meeting frequency, the use of a big 6 auditor and the auditor’s independence, are positively associated with the disclosure of forward-looking information. In addition, board committees which consist of the</td>
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</table>
The extent of voluntary disclosure

Non-executive directors, non-executive directors as chairman, institutional ownership and managerial ownership

A sample consists of 51 publicly listed Irish firms in the year 2002.

Poisson regression model

They found a positive and significant association between nonexecutive directors and the level of voluntary disclosure. The results also suggested that having a nonexecutive director as chairman is positively related to voluntary disclosure. However, there is no relationship between voluntary disclosure and institutional ownership and managerial ownership.

Corporate social responsibility (CSR) disclosure

Ownership concentration, director ownership, government

A sample of 87 non-financial companies included in the Bursa

Multiple regression analysis

The results indicated that director ownership and the government as a substantial shareholder are
<p>| Lim et al. (2007) | The level of voluntary disclosure including Environmental disclosure | Board composition | A sample consisting of 181 Australian firms for the period of 1999 to 2001 | A two-stage least squares regression (2SLS) model | They found a positive association between board composition and total voluntary disclosure. Furthermore, the results indicated that (1) boards composed largely of independent directors would voluntarily disclose, were more forward looking, and had quantitative and strategic information and (2) board structure has no bearing on non-financial and financial voluntary disclosure. | Ownership. Malaysia Composite Index | Significant influences on CSR disclosure in annual reports. However, ownership by the ten largest shareholders is not statistically significant in explaining the level of CSR disclosure in annual reports. |</p>
<table>
<thead>
<tr>
<th>Authors</th>
<th>Research Area</th>
<th>Ownership Structure</th>
<th>Sample Size</th>
<th>Methodology</th>
<th>Findings</th>
</tr>
</thead>
</table>
Board composition: The proportion of independent directors and CEO duality. | A sample of 559 firms listed on Shanghai Stock Exchange (SSE) for 2002. | OLS regression Model    | They found that higher blockholder ownership and significant foreign listing/shares ownership are associated with increased voluntary disclosure, while managerial ownership, state ownership and legal-person ownership are not related to disclosure. Also, an increase in independent directors improves voluntary disclosure and CEO duality reduces disclosure. |
| Barako et al. (2006) | Voluntary disclosure   | Board composition, Board leadership structure, Board audit committee, ownership concentration, foreign ownership and institutional ownership. | A sample consists of 54 companies listed on the Nairobi Stock Exchange during the period 1992-2001 | Pooled Ordinary Least Square (OLS), Panel-Corrected Standard Errors (PCSEs). | They found that the existence of audit committee is positively related to the extent of voluntary disclosure, and the percentage of non-executive directors on the board is negatively related to voluntary disclosure, whilst they found an insignificant association between board leadership structure and voluntary disclosure. The study also found that the levels of institutional and foreign ownership |
|-----------------------|-----------------------------|---------------------------------------------------------------|-------------------------------------------------------------------------------------------------|---------------------|
|                       | - Corporate social disclosure index (CSDI). | | | The study found a significant positive relationship between Malay directors and chairs with multiple directorships are significantly positively associated with corporate social disclosure and a significant and negative relationship between composition of non-executive directors and corporate social disclosure was found. Moreover, the results showed that foreign share ownership was found to be positively associated with CSD. |
|                       |                             |                                                                 | | They found that CEO duality is associated with lower levels of voluntary corporate disclosures, while firms with a higher proportion of the expertise of non-executive |

are significantly positively associated with voluntary disclosure, whereas ownership concentration has negative association.
<table>
<thead>
<tr>
<th>Study</th>
<th>Research Focus</th>
<th>Ownership Structure</th>
<th>Sample Size</th>
<th>Methodology</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eng &amp; Mak (2003)</td>
<td>Voluntary disclosure</td>
<td>Ownership structure: Managerial ownership, blockholder ownership, and government ownership. Board composition: the proportion of outside directors</td>
<td>A sample of 158 Singapore firms listed on the Stock Exchange of Singapore.</td>
<td>OLS regression Model</td>
<td>Results indicated that lower managerial ownership and significant government ownership are associated with increased voluntary disclosure, while blockholder ownership is not related to disclosure. They also found that an increase in outside directors reduces voluntary disclosure.</td>
</tr>
<tr>
<td>Chau &amp; Gray (2002)</td>
<td>The extent of voluntary disclosure</td>
<td>Ownership structure</td>
<td>A sample of 60 Industrial companies in Hong Kong and 62 Industrial companies in Singapore listed in the respective stock exchanges.</td>
<td>Multiple regression Model</td>
<td>They found a positive relationship between the extent of outside ownership and voluntary disclosure, while the strong prevalence of ‘‘insider’’ and family-controlled companies is likely to be associated with lower levels of disclosure.</td>
</tr>
<tr>
<td>Haniffa &amp; Cooke (2002)</td>
<td>The extent of voluntary disclosure</td>
<td>Corporate governance represented by board composition, cross-directorships, role duality, family members on the board, finance directors on the board and chairperson with cross-directorships.</td>
<td>A sample of 167 Malaysian Companies listed in the Kuala Lumpur Stock Exchange (KLSE) for 1995.</td>
<td>Multiple regression Model</td>
<td>They found that family members sitting on the board and the chairperson as non-executive chairperson were significantly negatively associated with the extent of voluntary disclosure, whereas other variables of corporate governance are not related. The findings also showed no significant association between the extent of voluntary disclosure and any of the cultural variables in the full model.</td>
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<tr>
<td>Halme &amp; Huse (1997)</td>
<td>Environmental reporting: - Annual reports - Environmental disclosure.</td>
<td>Ownership structure, Board size, Industry variations, and country differences.</td>
<td>The largest corporations from each of the Scandinavian countries: 40 firms from Finland 40 firms from Norway, 40 firms from Sweden and 20 firms from Spain.</td>
<td>Logistic regression analyses.</td>
<td>They found a positive association between the extent of a corporation's environmental impact and environmental reporting. Also, results indicated that there was no significant relationship with ownership concentration or the number of board members.</td>
</tr>
</tbody>
</table>
2.4.3 Carbon performance, carbon disclosure and other carbon related studies

Many studies have examined the motivations toward voluntary carbon disclosure (Cotter & Najah, 2012; Freedman & Jaggi, 2005; Kolk et al. 2008; Prado- Lorenzo et al. 2009; Stanny, 2010; Stanny & Ely, 2008). Another important stream of carbon studies involves investigations of the association between carbon performance and its valuation (e.g. Griffin et al. 2012; He et al. 2013; Krishnan, 2003; Luo & Tang, 2014b; Matsumura, Rachna & Vera-Munoz, 2014). However, few attempts have been made to examine the association between corporate governance and carbon performance and disclosure (Liao et al. 2014; Tauringana & Chithambo, 2014).

Liao, Luo & Tang (2014) empirically tested the impact of corporate boards’ characteristics on the voluntary disclosure of GHG emissions in the United Kingdom. The dependent variable was carbon disclosure, which measured as equal to 1 if the firm participated in the CDP in 2011 and 0 otherwise. The independent variables include the key CG test variables (board diversity, board independence and environmental committee). Two sets of control variables were used; first, CG variables including board size, board meetings, the number of non-executive directors, non-executive directors as chair, CEO duality, short-term bonus, long-term bonus, share option, managerial ownership and ownership concentration. Second, financial variables include firm size, leverage and profitability. A sample was composed of 329 largest companies in the UK (out of the FTSE 350) that were included in the 2011 CDP reports. Univariate tests and probit regression models were employed. The regression results showed that the proportion of female directors in the board and the existence of an environmental committee are significantly and positively associated with GHG disclosure. In addition, board independence was positively related to GHG disclosure.

Luo & Tang (2014b) examined whether voluntary carbon disclosure reflects firms’ carbon performance. Their study measured carbon disclosure based on content analysis of Carbon Disclosure Project (CDP) reports, while carbon performance index was focused on both carbon intensity and carbon mitigation. They used OLS regression model to analyse their data. Based on a sample of 474 observations for the United States, the United Kingdom and Australian firms, the results showed that there is a significant positive relationship between carbon disclosure and performance, suggesting that firms’ voluntary carbon disclosure in the CDP is indicative of their underlying actual carbon performance.
Tauringana and Chithambo (2014) examined the effect of the 2009 DEFRA guidance on the extent of GHG disclosure and whether GHG disclosure is determined by corporate governance mechanisms. A sample of 215 companies from a population of London Stock Exchange FTSE 350 companies was investigated from 2008 to 2011. They employed a fixed effects modelling technique to examine the determinants of GHG disclosure. The empirical results revealed that board size is positively related to GHG disclosure, whereas, director ownership, and ownership concentration have a significant and negative effect on GHG disclosure. However, the percentage of non-executive directors has no significant association with GHG disclosure.

Saka & Oshika (2014) examine the impact of corporate carbon emissions and disclosure on corporate value of Japanese companies that reported carbon emissions in 2006, 2007 and 2008. They used the company responses to the CDP questionnaire as a proxy for the disclosure of carbon management, while carbon emissions were measured by the volume of carbon emissions per unit of sales in that period. Based on a sample of 1,094 observations of firms that responded to the CDP questionnaire and OLS regression analysis, they found that the volume of carbon emissions is negatively associated with the market value of equity, while the disclosure of carbon management has a positive relation with the market value of equity, and the positive relation between carbon management disclosure and the market value of equity is stronger for the companies with a high volume of carbon emissions.

Peters & Romi (2013) investigated whether environmental corporate governance characteristics are associated with GHG disclosure in the United States. A sample of 1,238 firm year observations from firms that participated in the CDP from 2002 until 2006 was examined. Their study used a probit regression and Heckman two-stage regression models to test the relationships between GHG disclosure and the existence of an environmental committee and a sustainability officer. The findings documented that GHG disclosure and disclosure transparency were significantly positively related to the presence of environmental committees on the board and the existence of corporate sustainability officers. Further analyses of this study showed that the size of the environmental committee, number of environmental committee meetings, expertise of environmental committee members, expertise of the sustainability officer and overlap between the environmental committee and audit committee were also positively associated with the likelihood of GHG disclosure.
He, Tang & Wang (2013) used a sample of US S&P 500 corporations that presented their CDP reports on the CDP website in 2010, to investigate the interactions among carbon disclosure, carbon performance and the cost of capital. They used the carbon disclosure score index from the CDP, which is more comprehensive than others and covers many aspects of relevant information such as: carbon governance mechanisms, carbon risks and opportunities, carbon strategy and targets, carbon actions and processes, carbon emissions and reporting, carbon emission trading and offsetting, carbon communications and engagement, while carbon performance was measured as the inverse of total carbon emission per million dollars of sales turnover (net). They used a three-stage least squares regression (3SLS) model to analyse their data. The results showed that carbon disclosure was negatively associated with the cost of capital and that this negative relationship was largely found in firms with poor carbon performance. In addition, they documented a negative relationship between prior disclosure and contemporaneous emission reduction, suggesting that poor carbon performers tend to present (rather than withhold) carbon information in advance in attempts to mitigate any future negative impacts on the market.

Ennis, Kottwitz, Lin & Markusson (2012) explored the relationships between carbon disclosure and performance in FTSE 350 companies. They used the Carbon Disclosure Leaders Index (CDLI) to calculate disclosure scores. Two carbon performance measures were used in this study. First was the absolute level of emission, which is the total of scope 1 and scope 2 emissions reported in CDP. Second was the emission intensity measure (or index measure) that is calculated as the reported emission (direct and indirect) per unit of company revenue. Carbon emissions data was obtained from the CDP, selecting FTSE 350 companies that have reported consistently over the period from 2006 to 2009 using the GHG protocol. The results showed that there is no significant relationship between voluntary carbon disclosure and emissions performance in FTSE 350 companies. The findings on the relationship between emissions performance and financial performance show that emissions levels are not presently drivers of stock prices. The financial market is not yet responsive to the carbon performance of companies, or perhaps the information available is not sufficient to provide clear signals to differentiate between companies’ performance.

Busch & Hoffmann (2011) investigate the relationship between carbon emissions and corporate financial performance measured by ROA, ROE and Tobin’s Q respectively. Focusing on climate change, they developed a set of questions that cover a firm’s carbon emissions and carbon management strategies. They use a firm’s carbon intensity, measured as
the ratio of the total GHG emissions (Scope 1 and Scope 2) to a firm’s sales, as the outcome based environmental performance measurement. Regarding the process-based environmental performance measurement, they use the aggregated score of 13 questions from the questionnaire. The results show that when using carbon management as a process-based measurement, carbon management is negatively related to Tobin’s Q and ROE as measures of corporate financial performance. However, when using carbon emissions as an outcome-based measurement, environmental performance is positively associated with Tobin’s Q.

Prado-Lorenzo & Garcia-Sanchez (2010) used multiple regressions to empirically examine the role of boards of directors in disseminating relevant GHG information in a sample of companies listed on the FTSE Global 500 companies that participated in the CDP questionnaire. They developed their disclosure index from the Carbon Disclosure Leadership Index (CDLI). Based on a sample of 283 companies that participated in the CDP 2008 survey, the results found that the existence of a dual CEO / board chair person is significantly positively related to the level of GHG information disclosed. However, the percentage of female board members and board independence are not statistically significant in the analysis, while board size and board meetings are negatively associated with the level of GHG information disclosed.
Table 2.4: Summary of previous studies on carbon performance, carbon disclosure and other carbon related studies

<table>
<thead>
<tr>
<th>Author/Year</th>
<th>Variables</th>
<th>Methods</th>
<th>Main results</th>
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</thead>
<tbody>
<tr>
<td>Liao et al. (2014)</td>
<td>Carbon disclosure</td>
<td>Board diversity, Board Independence and Environmental Committee</td>
<td>A sample of 329 large companies in the UK that were included in the 2011 CDP FTSE 350 reports Probit regression Models The results found that the proportion of female directors in the board and the existence of an environmental committee have a positive association with GHG disclosure. In addition, board independence was positively related to GHG disclosure.</td>
</tr>
<tr>
<td>Luo &amp; Tang (2014b)</td>
<td>Carbon disclosure</td>
<td>Carbon performance</td>
<td>A sample of 474 large companies that were listed as Australian Securities Exchange 200 (ASX 200), Standard &amp; Poor’s 500 (S&amp;P 500), and Financial Times UK Top 350 (FTSE 350) companies. OLS regression Model. The results indicated that there is a positive association between carbon disclosure and carbon performance, indicating that firms with good performance are likely to disclose more to distinguish themselves for investors and other stakeholders.</td>
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<tr>
<td>Authors</td>
<td>Research Focus</td>
<td>Methodology</td>
<td>Findings</td>
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<tr>
<td>Tauringeana &amp; Chithambo (2014)</td>
<td>The extent of GHG disclosure</td>
<td>DEFRA guidance, Corporate governance (which includes board size, proportion of non-executive directors, director share ownership and Ownership concentration.)</td>
<td>A sample of 215 companies from a population of London Stock Exchange FTSE 350 companies over four years (2008-2011). Fixed Effects Models. They revealed that board size is positively related to GHG disclosure, whereas director ownership and ownership concentration are negatively associated with GHG disclosure. In contrast, the percentage of non-executive directors is unrelated to GHG disclosure.</td>
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<tr>
<td>Peters &amp; Romi (2013)</td>
<td>GHG disclosure.</td>
<td>Existence of an environmental committee on the board and a sustainability officer as well as environmental</td>
<td>A sample of 1,238 firm year observations that participated in the CDP from 2002 until 2006. Probit regression and Hackman two-stage regression models. They found that GHG disclosure and disclosure transparency were significantly positively related to the presence of environmental committees and corporate sustainability officers on the board.</td>
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<tr>
<td>committee size, diligence, expertise, knowledge spillover and sustainability officer expertise</td>
<td>Further analyses of this study showed that the size of environmental committee, number of environmental committee meetings, expertise of environmental committee members, expertise of the sustainability officer and overlap between the environmental committee and audit committee were also positively associated with the likelihood of GHG disclosure</td>
<td>They found that carbon disclosure was negatively associated with the cost of capital and that this negative relationship was largely found in firms with poor carbon performance. In addition, they found that there is an inverse relationship between carbon disclosure and carbon performance.</td>
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<tr>
<td>Ennis, Kottwitz, Lin &amp; Markusson (2012)</td>
<td>Carbon disclosure</td>
<td>Carbon Emissions Performance</td>
<td>A sample of FTSE 350 companies that have reported consistently over the period from 2006 to 2009 using the GHG protocol.</td>
</tr>
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</table>

| Busch & Hoffmann (2011) | carbon emissions: - Carbon intensity - Carbon management | Corporate financial performance | A sample of 174 largest U.S. companies in 2007 | OLS regression Model. | The results show that when using carbon management as a process-based measurement, carbon management is negatively related to Tobin’s Q and ROE as measures of corporate financial performance. However, when using carbon emissions as an outcome-based measurement, environmental performance is positively associated with Tobin’s Q. |
| Prado-Lorenzo & Garcia-Sanchez (2010) | The level of GHG information disclosure | Board independence, CEO duality, women, Indebtedness ratio, Board size and Meeting number. | A sample of 283 companies that participated in the CDP 2008 questionnaire | Multiple OLS regression. | The results indicated that there is a positive relationship between CEO duality and the level of GHG information disclosed. However, the percentage of female board members and board independence are insignificant association, while board size and board meetings have significant negative effect. |
2.5 The Gaps Identified from prior literature

Based on the review of the previous studies, the following gaps are identified.

First, while there is an increasing number of studies that have investigated the association between corporate governance mechanisms and environmental disclosure (e.g. Rupley et al. 2012; Kathyayini et al. 2012; Post et al. 2011 & Ghazali, 2007), there are limited research examining the relationship between corporate governance characteristics and GHG disclosure (e.g. Liao et al. 2014; Tauringana & Chithambo, 2014; Peters & Romi, 2013).

Second, many previous studies examining the impact of corporate governance indicators on social/environmental performance (e.g. Boulota, 2013; Hafsi & Targut, 2013; Bai, 2012; Walls et al. 2012 & De Villiers et al. 2011) do not consider carbon performance. The current study, to the best of my knowledge, is one of the first scholarly studies that addresses the variety of array of corporate governance mechanisms and their influence on carbon performance. Carbon disclosure and performance is one of the dimensions of environmental performance, but this is a unique dimension and deserves a separate study.

Third, most of the studies on corporate governance and environmental issues are conducted in a US context, and very few research projects use Australian setting. Yet, Australia is one of the countries with the highest GHG emission per capita and adopting unique GHG management institution, thus the study can provide extra insight in the relationship between corporate governance and corporate carbon activity beyond existing literature.

Fourth, some results of previous studies were inconclusive. For instance, Walls et al. (2012) found that an environmental board committee is positively associated with both environmental strengths and environmental concerns. However, Rodrigue et al. (2013) & McKendall et al. (1999) did not find significant association between the presence of environmental committee and environmental performance. Another example shows the mixed results between board characteristics and GHG disclosure. Liao et al. (2014) found that board independence is positively associated with Co2 disclosure. But, Tauringana &
Chithambo (2014) found that the percentage of non-executive directors is unrelated to GHG disclosure.

Finally, there is lack of agreement on how to measure social/environmental performance in the extant literature. Prior studies have often used environmental data, such as waste management; toxic emissions to air, land, and water pollution to measure environmental performance (e.g. Johnston, et al., 2008; Sutantoputra et al., 2012). Since the current study focuses on specific carbon performance, these general proxies for environmental performance are not appropriate for our purpose. Thus, following prior research (e.g. Luo and Tang, 2014; Clarkson et al., 2008; Patten, 2002; Sutantoputra et al., 2012), this study adopts carbon intensity as proxy of carbon performance, which is measured as the total scope 1 and scope 2 emissions divided by the total sales at the end of fiscal year. This means a lower level of carbon emissions scaled by sales suggests a higher carbon performance. There are a number of advantages with the measure. First, public concern about climate change which has been caused by the release of CO₂ emissions into the atmosphere. Therefore, the level of carbon emissions would seem to be an appropriate indicator of carbon performance. Second, this is an objective and direct measure of carbon performance. Finally the measure reflects the outcome of carbon management, because the purpose of carbon management is to control excessive carbon emissions. As this measure uses sales to control the impact of fluctuation of business activity on emissions, the proxy can highlight the effect of carbon management on Co2 emissions.

Therefore, the current research attempts to fill the gaps by adding to the existing body of evidence regarding the association between corporate governance and carbon performance and disclosure of Australian companies. This study considers a broader set of dimensions of corporate governance so as to provide more insightful empirical evidence which has not been documented in prior literature.

In sum, Chapter Two provides a comprehensive review of previous studies. First, this chapter began with a discussion of the definitions of corporate governance from different sources in the existing literature. Next, the chapter provided a

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1 Various databases have been used for measurement of firms’ social or environmental performance, such as the Council on Economic Priorities (CEP), the Toxics Release Inventory (TRI), the KLD Research & Analytics (KLD), the National Pollution Release Inventory (NPRI), and the National Pollutant Inventory (NPI).
general overview on the regulatory background about carbon emissions in Australia. This chapter also discussed the different theoretical frameworks that have been utilised in this thesis. These theories include legitimacy theory, stakeholder theory and signalling theory. Then the chapter examined the empirical evidence produced by prior studies on the association between corporate governance mechanisms and social/environmental performance, and on the relationship between corporate governance characteristics and social/environmental disclosure. Finally, this chapter ends by identifying the existing gaps in previous studies, which provides opportunities for future research.
CHAPTER THREE: RESEARCH DESIGN AND HYPOTHESIS DEVELOPMENT

3.1 Introduction

Research methodology or research approach depends on research questions to be addressed or hypothesis to be tested (Polit & Beck 2004). Furthermore, the way in which the study is designed influences the choice of procedures and techniques. However, any research methodology should be established on a systematic and rigorous collection and data analysis (Robson, 2002, 45). The previous chapter illustrated the relevant literature review and highlighted the theoretical framework for the current study to construct the suitable research methodology. The aims of this chapter are to develop a theoretical link between the quality of corporate governance and carbon performance and disclosure in the Australian companies; and to provide a description of the research methods applied and analysis method used in collecting data to test the presence of an association between corporate governance and carbon performance and disclosure. This chapter proceeds as follows: Section 3.2 outlines the sample selection procedure and data sources used. Section 3.3.1 outlines the hypotheses related to corporate governance and carbon performance. 3.3.2 outlines the hypotheses related to corporate governance and carbon disclosures. 3.4 illustrates how the dependent variable was measured. 3.5 provides information on how the independent variables were calculated. 3.6 describes the measurement of the control variables. 3.7 provides the statistical technique used in this study 3.8 discusses the empirical model used to test the hypotheses.

3.2 Sample Selection and Data

This section provides the procedures of sample selection, the types of data used, and the data sources used in carrying out this study. Specifically, this section is classified into three subsections. Subsection 3.2.1 will discuss the procedures of sample selection; subsection 3.2.2 will explain the data sources used in this study, whilst subsection 3.2.3 will provide the criteria for selecting the final sample.
3.2.1 Sample Selection

The initial sample for the current study consists of the largest Australian companies which participated in the CDP for the period 2009 to 2012. The sample includes both financial and non-financial firms based on their sector affiliation as defined by the Global Industry Classification Standard (GICS) (e.g. Consumer Discretionary, Energy, Consumer Staples, Financial, Health Care, Information Technology, Industrials, Materials, Telecommunications and Utilities). Important reasons for choosing these companies and this period are: First, the CDP sent the questionnaire to these companies for the period of 2009 through 2012. The second reason for selecting this period was because the CDP questionnaire before 2006 was incomplete and fewer companies responded. Third, the periods between 2006 until 2009 for these companies were without a template of the CDP Scoring Methodology. In addition, an important motivation for choosing the banking, insurance, and other industries is that they contribute to climate change mainly by purchasing electricity and provide finance for green projects.

However, some of the observations need to be dropped from this sample due to some companies that did not meet certain criteria in the present study. For example, companies that did not respond to CDP, firms that do not have details publicly available and declined to participate in CDP and companies that provided information but did not answer the CDP questionnaire. In addition, companies with unpublished annual reports are excluded, companies with missing corporate governance data and companies missing data from DataStream are deleted, and some companies in 2009 were also omitted due to unavailability of the template of CDP 2009 Scoring Methodology. Hence, the current study covered a period of four years. So the final sample that meets all of these selection criteria is 205 firm year observations. Table 3.1 provides a summary of the sample selection procedures.
Table 3.1 Sample Selection Procedures for the study period

<table>
<thead>
<tr>
<th>Description</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>Pooled</th>
</tr>
</thead>
<tbody>
<tr>
<td>Original sample obtained from CDP database in Australia (less)</td>
<td>192</td>
<td>195</td>
<td>189</td>
<td>236</td>
<td>812</td>
</tr>
<tr>
<td>No Response (did not reply to CDP regarding request) (less)</td>
<td>(73)</td>
<td>(73)</td>
<td>(55)</td>
<td>(106)</td>
<td>(307)</td>
</tr>
<tr>
<td>Declined to participate (Decline to participate in the project) (less)</td>
<td>(17)</td>
<td>(29)</td>
<td>(34)</td>
<td>(29)</td>
<td>(109)</td>
</tr>
<tr>
<td>Information provided – View Investor Response (did not answer all question) (less)</td>
<td>(3)</td>
<td>(1)</td>
<td>(3)</td>
<td>(1)</td>
<td>(8)</td>
</tr>
<tr>
<td>Information provided (provided information relevant to the questionnaire, did not answer the questionnaire) (less)</td>
<td>(0)</td>
<td>(0)</td>
<td>(2)</td>
<td>(0)</td>
<td>(2)</td>
</tr>
<tr>
<td>Details not publicly available (less)</td>
<td>(22)</td>
<td>(15)</td>
<td>(18)</td>
<td>(17)</td>
<td>(72)</td>
</tr>
<tr>
<td>See Another (the response is covered by another company usually parent company) (less)</td>
<td>(0)</td>
<td>(3)</td>
<td>(5)</td>
<td>(7)</td>
<td>(15)</td>
</tr>
<tr>
<td><strong>Total Sample of View Investor Response</strong> (less)</td>
<td>77</td>
<td>74</td>
<td>72</td>
<td>76</td>
<td>299</td>
</tr>
<tr>
<td>Annual reports not available or shorter than 12 months fiscal year (less)</td>
<td>(10)</td>
<td>(1)</td>
<td>(2)</td>
<td>(0)</td>
<td>(13)</td>
</tr>
<tr>
<td>Missing Corporate Governance Data (less)</td>
<td>(2)</td>
<td>(1)</td>
<td>(1)</td>
<td>(1)</td>
<td>(5)</td>
</tr>
<tr>
<td>Firms without Scoring in 2009 due to unavailability of the template of CDP 2009 Scoring Methodology (less)</td>
<td>(43)</td>
<td>(0)</td>
<td>(0)</td>
<td>(0)</td>
<td>(43)</td>
</tr>
<tr>
<td>Missing data from DataStream(e.g. financial data, scope1 &amp; 2) (less)</td>
<td>(2)</td>
<td>(12)</td>
<td>(3)</td>
<td>(16)</td>
<td>(33)</td>
</tr>
<tr>
<td><strong>Final Test Sample</strong></td>
<td>20</td>
<td>60</td>
<td>66</td>
<td>59</td>
<td>205</td>
</tr>
</tbody>
</table>

3.2.2 Data Sources

To investigate the relationships among good corporate governance structure and carbon performance and disclosure, this study focuses its analysis on all Australian companies in the CDP database for the period from 2009 until 2012. For these companies, data related to corporate governance were manually collected from annual reports of the sampled companies. Data related to carbon performance and carbon disclosure scores were mainly gathered from a firm's response for CDP standardised questionnaire. In addition, data for the control variables group (e.g. natural logarithm of total assets, Tobin’s Q, the return on
assets, and capital intensity) are obtained from the *FinAnalysis* database. Therefore, the current study relies on the CDP questionnaire responses and annual reports of these companies. This results in 205 firm year observations. In terms of industry representation 11.70% are in the “energy” industry, 18.54% are in the “materials” industry, 17.65% are considered “industrials” firms, another 6.34% are in “consumer discretionary” and 6.83% are in “Consumer Staples”. The rest of the sample consists of firms in the “Health Care, Financials, Telecommunication Services and Utilities” are a (2.44%, 30.24%, 1.95% and 4.39%, respectively). As presented in table 3.2 below, this leaves a final sample size of 205 companies.

**Table 3.2 Sample Distribution of Companies by Sector**

<table>
<thead>
<tr>
<th>Sector</th>
<th>Number of Companies</th>
<th>percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2009</td>
<td>2010</td>
</tr>
<tr>
<td>Energy</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>Materials</td>
<td>2</td>
<td>11</td>
</tr>
<tr>
<td>Industrials</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>Consumer Discretionary</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Consumer Staples</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Health Care</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Financials</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>Telecommunication</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Services</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Utilities</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>20</td>
<td>60</td>
</tr>
</tbody>
</table>
3.2.3 The criteria for choosing the final sample

To be involved in the final sample, firms have to fulfil the following criteria: for carbon information, as mentioned above: (1) companies that have not responded to the CDP’s questionnaire. (2) companies that do not have details publicly available and they declined to participate in CDP (3) companies that provided information but did not answer the CDP questionnaire. For corporate governance and financial data (1) a company’s full four-year annual reports from 2009 to 2012 inclusive must be available either in Connect 4 databases or SIRCA database or company website, respectively (2) Financial data must also be available in the FinAnalysis database. Therefore, all firms that completed the CDP 2009 -2012 questionnaire and allowed their responses to be published on the CDP website are chosen since this study is constructed on the assumption that all carbon emissions information must be publicly available.
Using the above criteria, and as Table 3.2 shows, the full data required is obtained for a total of 205 out of the 299 firms constituting the remaining companies which have completed and published their response to CDP’s questionnaire. For 18 of the remaining 94 firms, one or more years of corporate governance data and/or a company’s annual reports are not available in Connect 4 databases or SIRCA database or company website, respectively, or shorter than 12 months fiscal year. For the remaining 76 firms, neither carbon information data nor financial data are available in DataStream.

3.3 Hypothesis Development

In sum, prior studies indicate that improved carbon performance involves extra cost in the short run. Conversely, it may reduce expected litigation cost and cost of capital, uphold a positive corporate social responsibility image which will eventually attract and retain customers and quality employees (Cong & Freedman, 2011). If a governance structure only targets financial performance and health of an organisation, then top management of those organisations have to make a trade-off between the short term cost of carbon performance and the potential long-term financial benefits. It is expected that a significant relationship exists between the structure and quality of corporate governance and carbon performance and disclosure in the Australian companies listed on the Australian Stock Exchange (ASX). Therefore, the following section provides a detailed discussion and theoretical justification underlying the choice of each variable of corporate governance as well as the development of hypotheses for each of these variables to be investigated in the study.

3.3.1 Corporate Governance and Carbon Performance

3.3.1.1 Board of Directors’ Characteristics

Fama & Jensen (1983) reported that characterise the responsibilities of the board of directors as being both the ratification of management decisions process and the monitoring of management’s performance. In addition, the board of directors plays an important role in corporate governance and impacts on all significant corporate decisions, including a company’s social performance (Jo & Harjoto
2011; Schwartz et al. 2005). Based on the evidence from these studies along with the theoretical framework of the current study, this section provides the hypotheses related to board characteristics. Six characteristics of board of directors will be investigated, namely: Board Size, Board Independence, Board Diversity, Board Meeting, Audit Committee Independence, and Environmental Committee Presence.

### 3.3.1.1 Board Size

Board size is considered to be one of the most important elements of corporate governance mechanism that can contribute to affect the board effectiveness. Alexander et al. (1993) indicate that larger boards (relative to others) serve a “buffering” function by connecting the firm to its environment and provide protections from environmental disturbances. Furthermore, larger board size also provides broader representation from stakeholders and wider expertise across various tasks, which in turn lead to greater monitoring capacities (Siciliano 1996).

In addition, larger and more diverse boards of directors help companies to reduce environmental uncertainties (Goodstein et al. 1994) and enhance company performance (Pearce and Zahra, 1992). Moreover, larger boards can more effectively reduce detrimental GHG opaqueness (Liao et al. 2014; Brown et al. 2006). Moreover, it is arguable that a large board is likely to include experienced and knowledgeable directors who possess expertise when it comes to managing environmental issues. On the other hand, large boards may face some problems in reaching a consensus on important decisions, and may hinder the effectiveness of the board in ensuring that the firm is responsive to environmental change (Goodstein et al. 1994). This is because of the lack of coordination related to a large board, which slows down the decision making process and decreases board efficiency (Jensen, 1993; Lipton & Lorsch, 1992).

Empirical literature that has provided evidence on the association between board size and carbon performance are generally rare. However, some evidence has found a positive and significant relationship between the size of board and environmental concerns (Walls et al. 2012). Another study by Brown et al. (2006) also indicates that the board size is positively associated with corporate philanthropy actions. Similarly, Kassinis & Vafeas, (2002) point out that board
size is positively related to environmental litigation. Further, de Villiers et al. (2011) find evidence that environmental performance is higher in firms that have larger boards. Whereas, Bai, (2012) found that board size is negatively associated with social performance in for-profit organizations, but positively related to social performance in non-profit organizations. On the other hand, Hafsi & Turgut (2013) found that board size has no significant effect on firms’ social performance in companies listed in the S&P500 Index. Therefore, due to mixed results in prior literature, the following hypothesis is proposed:

Hypothesis 1.1: There is no significant association between the number of directors on the board and carbon performance.

3.3.1.1.2 Board Independence

A common feature of international corporate governance guidelines is that company boards should have a majority of independent directors. The OECD (2004) reports that the independence of directors brings an objective view, can contribute significantly to decision-making, and play an important role where the interests of management, the company and shareholders may diverge. In Australia, the ASX (2003) Recommendation 2.1 specifies that majority members of the board should be independent, and lists seven criteria for assessing independence. Furthermore, the NYSE, (2009), cited in Larcker & Tayan, (2011) defined independence as having “no material relationship with the listed company (either directly or as a partner, shareholder, or officer of an organization that has a relationship with the company).” Zahra & colleagues (1993) have indicated that the presence of outside directors as members on the board increases the racial, ethnic, and gender diversity of the company's board. Independent directors on the firm’s board are more concerned about certain components of CSP (Ibrahim & Angelidis, 1995) and show greater social responsiveness (Zahra & Stanton 1988). Accordingly, the presence of independent directors on the board can provide more objective feedback regarding the operations of a company and its performance (Liao et al. 2014). Moreover, independent directors may face higher incentives to pursue environmental innovations as they are more likely be conscious about how corporate social performance improves a firm’s standing with constituencies such as investors, government, and lenders (Johnson & Greening, 1999). Consequently,
it can be argued that the presence of independent directors can contribute to the effective management of stakeholders through enhanced stakeholder management, which in turn, leads to elevated carbon performance.

The empirical academic studies have provided contradictory results. While some studies found that the presence of outside directors is significantly positively associated with CSR performance within a firm’s industry. Zhang et al, (2013), Dunn & Sainty (2009) found that board independence is positively related to corporate social performance. A similar study was provided by Johnson & Greening (1999), who indicated that the independence of a board is positively associated with its people (women and minorities, community, employee relations) and product quality (product and environmental) dimension of CSR. Another study by Wedd (2004) has also found evidence that having outside directors is positively associated with socially responsible behaviour of firms. Similarly, Ibrahim et al, (2003) pointed out that outside directors is positively related to the discretionary components of corporate responsibility. Further, de Villiers et al. (2011) have provided evidence that environmental performance is higher in firms that have higher board independence. Some empirical studies, on the other hand, report that engaging outside directors is negatively related to environmental litigations (Kassinis and Vafeas, 2002). Whilst other studies found no relationship between outside directors and the legal and ethical dimensions of CSR (Ibrahim et al, 2003; Ibrahim & Angelidis, 1995). Moreover, McKendall, S’anchez, & Sicilian (1999) were unable to find a significant relationship between board independence and environmental violations. In sum, the role of board independence in carbon performance is still not clear. Hence, given the above evidence, the following un-directional hypothesis is tested:

**Hypothesis 1.2:** There is significant association between board independence and carbon performance.

**3.3.1.1.3 Board Diversity**

Board diversity refers to the various characteristics that may be present among directors in the boardroom that can influence the decision–making process (Van der Walt & Ingleby, 2003). Board diversity may derive from multiple sources,
including age, gender, ethnicity, culture, religion, constituency representation, independence, knowledge, educational and professional background, technical skills and expertise, commercial and industry experience, career and life experience (Milliken & Martins, 1996). From a signalling perspective, the presence of females on a company’s board may act as a signal to observers indicating that the firm pays attention to women and minorities, and thus, is socially responsible (Bear et al, 2010). Nielsen & Huse (2010) suggests that the presence of women directors on the board may be particularly sensitive to “certain organizational practices, such as corporate social responsibility and environmental politics (p. 138)”. Moreover, representation of female directors on boards may have social consequences (Hafsi & Turgut, 2013). Therefore, having more female directors on the board may sensitize boards to environmental initiatives, and provide perspectives that can be helpful in addressing environmental issues.

Little empirical evidence to date exists on the association between board gender diversity and carbon performance. However, in the context of corporate social performance in general, a positive relationship exists between the proportion of women directors on the board and corporate social responsibility (CSR) performance as documented by Zhang et al. 2013; Boulouta 2013; Webb, 2004; Hafsi & Turgut, 2013. Wang & Coffey (1992) & Williams (2003) have found a positive and significant link between the proportion of female board members and corporate philanthropy. With respect to environmental performance, Post et al. (2011) have found weak evidence of a positive relationship between the presence of females on a firm’s board of directors and its environmental performance. On the other hand, insignificant relationship between the percentage of women board members and corporate philanthropy has been found (Coffey & Wang, 1998). In sum, overwhelming evidence suggests board diversity has a positive impact on environmental accountability which can enhance the company’s carbon performance. Therefore, the following hypothesis is formulated:

**Hypothesis 1.3:** There is a positive association between corporate board diversity and carbon performance


3.3.1.1.4 Board Meetings

According to Jensen (1993), an important proxy for measuring the effectiveness and corporate boards’ monitoring power is the frequency of board meetings. In addition, Vafeas (1999a) has contended that the frequency of board meetings is an important dimension of board operations that can have important implications for performance. In a similar argument, Conger et al (1998) suggest that the frequency of board meeting is an important resource for improving board performance. Boards that meet more often in response to company events are more likely to perform their duties in accordance with shareholders' interests (Vafeas 1999a) and are more likely to effectively monitor management, reduce manipulation of corporate earnings (Xie et al. 2003) and can result in a higher quality of financial reporting (Laksmana, 2008). Therefore, the frequency of board meetings may increase the company boards’ monitoring, improving the effectiveness of board, enhance performance, and which in turn, reduces information asymmetry.

There is limited recent empirical evidence regarding the relationship between the frequency of board meetings and environmental performance, particularly for carbon performance. However, in the area of social performance, although Prado et al. (2009b) did not find a statistically significant impact between board meetings and CSR, evidence of a significant negative association between the number of meetings and the dissemination of information on GHGs is found by Prado-Lorenzo & García-Sánchez, (2010). Consequently, it can be argued that a board of directors that meet more often are more likely to improve carbon performance via increased capacity to effectively advise and monitor management. Thus, the following hypothesis is proposed:

**Hypothesis 1.4:** There is a positive association between the number of board meetings and carbon performance.

3.3.1.1.5 Audit Committee Independence

The existence of an audit committee on the board of directors plays an important role because it is concerned with monitoring the accounting processes, and
providing the credibility of the accounting information to the firm’s stakeholders (Pincus et al. 1989; Beasley, 1996), to prevent fraudulent accounting statements (Klein 2002a), and reducing information asymmetry problems (Li 2012), which mitigates agency costs (Ho & Wong, 2001), thereby enhancing overall company performance (Weir et al. 2002). The audit committee on the company's board takes an active role in overseeing the firm’s financial reporting and accounting process (Whittington & Pany, 2000). More importantly, in order for the audit committee to more effectively fulfil its oversight role and protect the interest of shareholders, it must be independent of the management of the company (Bédard et al. 2004; Fama & Jensen, 1983). Therefore, the Australian Corporate Governance Principles and Recommendations (ACGPR) (Australian Securities Exchange Corporate Governance Council 2007) recommend that an audit committee should be comprised of at least three independent board members. The common assumption is that a higher level of audit committee independence is associated with improved monitoring of the financial reporting process (e.g. Bronson et al. 2009; Bédard et al. 2004; Klein, 2002a). Therefore, audit committees will be asked to integrate climate change and sustainability into enterprise wide risk assessment, focus on quality of disclosure, and evaluate the reporting systems (Peters & Romi, 2013)

There is limited empirical evidence on the link between the audit committee independence and environmental performance, including carbon performance. However, in the context of company performance in general, some empirical studies found that the independence of the audit committee is positively associated with the quality of financial reporting (Mangena & Tauringana, 2007, Klein 2002a) and negatively related to misleading and fraudulent reporting (Abbott et al. 2000). Based on this argument, the independence of the committee can contribute to improve overall corporate performance, thereby enhancing the carbon performance of the company. Thus, the following hypothesis is developed:

**Hypothesis 1.5:** There is a positive association between the independence of an audit committee and carbon performance.
3.3.1.1.6 Environmental Committee Presence

Prior studies (e.g. Liao, et al 2014) suggest that an environmental committee plays a significant role to bring greater objectivity and a higher level perspective to bear on environmental matters than could a full board. The aim of an environmental committee is to motivate a firm into implementing sustainability policies and activities (Liao et al. 2014). Establishing an environmental committee on the board can be viewed as a means of dealing with stakeholders and responding to their expectations (Michelon & Parbonetti, 2012). The existence of an environmental committee on the firm’s board can help to systematically plan and implement carbon-reduction actions (Liao et al. 2014). The environmental committee can provide strategic advice to management in the handling of an environmental incident and may also underscore the board's focused commitment to achieve a realistic balance between environmental concerns and the operations of the firm.

There is little empirical study that explicitly has examined directly the link between the presence of an environmental committee on the board and carbon performance. Nevertheless, some empirical studies were unable to find significant association between the existence of an environmental committee on the board and environmental performance which is measured in terms of regulatory compliance, pollution prevention, and environmental capital expenditures (Rodrigue et al. 2013). A similar study by Berrone & Gomez-Mejia (2009a) did not find that environmental performance had a higher impact on chief executive officer (CEO) pay in firms with environmental committees. Another study by McKendall et al. (1999) has also failed to find significant association between social responsibility committee and environmental violations. In contrast, Lam & Li (2008) point out that a firm with an environmental committee on its board is related to a significant increase in environmental performance for high polluting firms. Furthermore, Walls et al. (2012) indicates that an environmental board committee is positively associated with both environmental strengths and

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2 Note: Such committees can be labelled under various names, such as Compliance and Ethics Committee, Environmental Committee, Public Policy Committee, Sustainability Committee, Corporate Social Responsibility Committee, Environment, Health, and Safety Committee, and Social Welfare Committee, but they all have jurisdiction over environmental issues.
environmental concerns. Consequently, the present study argues that the existence of an environmental committee will have substantial influence on the firm, and it enables a firm to credibly collect, record and account for GHG emissions (Liao et al. 2014) and therefore is likely to see the importance of GHG reporting (Michelon & Parbonetti, 2012). Hence, the existence of environmental committees can be seen as a proxy for strategic environmental orientation that should have a positive impact on firm performance.

**Hypothesis 1.6:** There is a positive association between the presence of environmental committee and carbon performance.

### 3.3.1.2 CEO Compensation Structure

Broadly speaking, CEOs are responsible for developing talent management; as well as their responsibilities in front of the board to lead the company to success which requires them to make decisions that can maximize the firm’s value (Larcker & Tayan, 2011). In the context of corporate governance-social performance relations, McGuire et al. (2003) state that “socially pro-active” CEOs, who are most likely to take strong social actions, avoid firms with a “bottom line” orientation. The CEO compensation packages are generally divided into three main components, namely: fixed compensation (salary), Short-term incentives including annual incentives, bonuses, commissions, gain sharing, and Long-term incentives including restricted stock, stock options and other long-term compensation. Based on the empirical evidence from these studies along with the theoretical framework of the present study, this section provides the hypotheses related to CEO compensation structures. Two components of a CEO compensation structure will be examined in this study, namely, CEO stock options and long term bonus.

#### 3.3.1.2.1 CEO Stock Options

Stock options are typical forms of long term compensation used to foster a longer decision horizon among managers. Moreover, stock options provide compensation only when executives have increased the stock price to the point at which the options trade (Larcker & Tayan, 2011). Further, stock options can also contribute
to align the managers' interests and shareholders (Jensen & Meckling, 1976; Jensen & Murphy, 1990), because it is the part that is most sensitive to performance. Sander (2001) argues that stock options encourage riskier strategies by concentrating attention on potential gains, rather than loss. Accordingly, the executives that receive stock options are more likely to take actions consistent with maximizing the interests of the firm in the longer term (Mahoney & Thorne, 2006).

There has been mixed empirical evidence on the relationship between the CEO stock options and environmental performance. On the one hand, evidence of the existence of a significant positive association between the CEO stock options in long term and corporate social performance is documented by Mahoney and Thorne, (2005, 2006); Deckop et al. (2006); Callan & Thomas, (2012), respectively. Furthermore, Berrone & Gomez-Mejia, (2009a) found that long-term pay such as stock options is positive and highly significant for pollution prevention performance. On the other hand, Coombs & Gilley (2005) have found no relationship between stock options and any CSR dimensions, and McGuire et al. (2003) failed to find relationship between long-term incentives including stock options and good social performance. Further, McGuire et al. (2003) provided empirical evidence that the stock options are positively associated with poor social performance. Walls et al. (2012) found evidence that environmental performance was best when the CEO stock option was low, particularly if the institutional ownership was high. Therefore, the following null hypothesis is formulated:

**Hypothesis 1.7:** There is no significant association between CEO stock options and carbon performance.

3.3.1.2.2 CEO Long Term Bonus

The CEO long term bonuses are an alternative compensation that provide long term incentives to executives intended to align the managers' interests and shareholders (Fama & Jensen, 1983; Jensen & Meckling, 1976; Jensen & Murphy, 1990: Berrone & Gomez-Mejia, 2009a), because their final value is contingent on future performance (Murphy, 1999), and it is possible this may enhance future environmental performance (Berrone & Gomez-Mejia, 2009a).
Callan & Thomas (2012) provide evidence that the long term compensation which includes restricted stock and long-term incentive plans is positively associated with social performance. Moreover, Berrone & Gomez-Mejia, (2009a) found that long-term pay has positive impact on pollution prevention performance. A similar study by Deckop et al. (2006) finds a positive and statistically significant association between long-term CEO pay and corporate social performance. However, from their study, Rekker et al. (2014) found that there is a negative relation between long term compensation, such as long term bonus, and socially responsible firms. Thus, based on the inclusive empirical evidence documented in the previous literature, the following null hypothesis is proposed:

**Hypothesis 1.8:** There is no significant association between the CEO long term bonus and carbon performance.

### 3.3.1.3 Ownership Structure

Ownership structure is one of the most important instruments in the corporate governance system (Perrini et al., 2008) that can resolve the conflict of interest between managers and the shareholders of the company (Jensen & Meckling, 1976; Shleifer & Vishny, 1986; Shan & McIver, 2011) and enhance company performance (Filatotchev & Nakajima, 2010). Based on the empirical evidence from these studies along with the theoretical framework of the present study, this section provides the hypotheses related to ownership structures. Two aspects of a firm’s ownership structure will be examined in this study, namely; ownership concentration and managerial ownership.

#### 3.3.1.3.1 Ownership concentration

According to Shleifer & Vishny (1997), concentration of ownership leads to better monitoring of managers, who may attempt to pursue their own goals. Similarly, Admati et al. (1994) suggest that minor shareholders may attempt to free-ride on the social contributions and undermine firm performance. Moreover, Ullmann (1985) and Adams & Hardwick (1998) indicated the more dispersed the ownership structure, the more sensitive to social problems the companies. Earnhart & Lizal. (2006) found that greater concentration of ownership as
measured by the single largest shareholder in a company leads to better environmental performance with respect to absolute emissions. On the other hand, Brown et al. (2006) did not find a relationship between concentration of ownership and corporate philanthropy. Similarly, Adams & Hardwick (1998) found evidence that ownership concentration as measured by the proportion of the total number of shares held by the top three shareholders is insignificantly associated with the level of corporate discretionary donations. Finally, Reverte (2009) noted that companies with widely held shareholdings are more likely to use carbon performance reporting than companies with a concentrated ownership structure. Again, both the theoretical argument and empirical evidence is ambiguous, so we provide a null hypothesis:

**Hypothesis 1.9:** There is no significant association between ownership concentration and carbon performance.

### 3.3.1.3.2 Managerial Ownership

Managerial ownership has an important alignment effect on the interests of managers vs. shareholders (Jensen & Meckling, 1976; Fahlenbrach & Stulz, 2009), because managerial ownership provides an incentive for managers to act in accordance with the interests of shareholders. As per Jensen & Meckling, (1976), a manager who holds a percentage of shares in the company bears the consequences of managerial actions, therefore it assists to align the interests of company managers with those of the owners. In this regards, company managers that hold a higher portion of ownership can better manage the company from the perspective of equity owners (Paek et al. 2013).

There are quite limited studies that have investigated the relationship between managerial ownership and environmental performance. Prior studies found that managerial ownership had a positive and significant association with CSP factors such as donation probability and charity (Jia & Zhang, 2013) and a positive link between top management equity and social performance in terms of environment and product quality (Johnson & Greening 1999). Coffey & Wang, (1998) demonstrated that there is a positive relationship between managerial control as measured by the percentage of total stock owned by inside board members and
corporate philanthropy. In contrast, Oh et al. (2011) documented that managerial ownership is significantly negatively associated with CSR rating of the firms. Similarly, Simerly & Bass (1998) provide evidence of significant negative relationship between a firm’s corporate social performance and the proportion of stock equity owned by top management, whereas Paek et al. (2013) indicate that managerial ownership has an insignificant relationship with CSR performance in terms of community, environment, and product dimensions. Hence, given the foregoing evidence, a null hypothesis appears to be appropriate.

**Hypothesis 1.10:** There is no significant association between managerial ownership and carbon performance.

### 3.3.2 Corporate Governance and Carbon Disclosure

#### 3.3.2.1 Board of Directors’ Characteristics

The board of directors is one of the most important internal control mechanisms. The disclosure literature investigates the effect of a number of board characteristics on the extent of disclosure. Based on the evidence from these studies along with the theoretical framework of the current study this section provides the hypotheses related to board characteristics. Eight characteristics of board directors will be investigated, namely: Board Size, Board Independence, Board Diversity, Board Meeting, Audit Committee Independence, Compensation Committee Independence, Nomination Committee Independence and Environmental Committee Presence.

##### 3.3.2.1.1 Board Size

As explained in the previous section the size of a board of directors is one of the most important components of board structure that can affect board effectiveness. Stakeholder theory argues that larger boards increase the diversity of board composition. A greater number of directors lead to greater monitoring and advising capacity (Coles et al. 2008) and may bring directors with more experience, knowledge and expertise (Larmou & Vafeas 2010). On the other hand, a smaller board is found to have lower communication difficulties, less
problems with free-riders and better coordinating among members (Ahmed et al. 2006). Thus firms with smaller boards are more effective (Yermack, 1996, Jensen 1993) in monitoring the CEOs.

Empirical literature has provided limited evidence on the association between board size and environmental disclosure especially for carbon disclosure. The size of board has been found to be positively associated with the voluntary disclosure of GHG emissions (Liao et al. 2014) and with environmental disclosure (Cormier et al. 2011, Akhtaruddin et al. 2009). Size of board is found to be negatively associated with information asymmetry as demonstrated by Cormier et al. (2010). However, some studies have provided evidence that there is inverse association between board size and the level of voluntary disclosure on intellectual capital (Cerbioni & Parbonetti 2007), and no relation between board size and voluntary disclosures (Halme & Huse, 1997; Cheng & Courtenay, 2006). In my context, it can be argued that an increase in the number of directors on the board could provide a high degree of diversity and bring the board with more expertise and different ideas to consider. Such a board should be more representative for various stakeholders with a focus not only on financial performance but also on non-financial aspects of operation. Thus, a large board is more likely to provide their GHG information to a variety of stakeholders via comprehensive carbon disclosure. Consistent with this argument, the following hypothesis is proposed:

**Hypothesis 2.1:** There is a positive association between board size and the extensiveness of carbon disclosure.

### 3.3.2.1.2 Board Independence

Board independence is measured by the proportion of independent directors on the board. It can be argued that an independent board can be more effective to monitor management (Liao, Luo & Tang, 2014, Fama, 1980), and pursue interests of large groups of stakeholders (Weir et al. 2002). Fama & Jensen (1983) indicate that board independence is regarded as a reliable mechanism in the process of reducing agency conflicts between managers and owners, and thus enhances the board monitoring effectiveness (Franks et al. 2001). In addition, boards with a larger proportion of independent directors has better alignment with stakeholders'
interests, and are more likely to moderate the conflicts of interest of different stakeholders. Independent directors are generally not involved in day-to-day operations so that it can more effectively monitor the behaviour of the executives. Moreover, independent directors seem less attached to economic performance (Ibrahim & Angelidis, 1995) and more concerned with corporate social responsibility (Ibrahim, Howard, & Angelidis, 2003; Webb, 2004).

Empirically, prior literatures has tested the association between board independence and voluntary disclosures in general and found mixed outcomes. While, Arcay & Vazquez (2005); Cheng & Courtenay, (2006); Huafang & Jianguo, (2007); Lim et al. (2007); Patelli & Prencipe, (2007) & Donnelly & Mulcahy, (2008) have found a significant positive association, Eng & Mak, (2003) and Barako et al. (2006) have documented a negative association. Whereas, Ho & Wong, (2001) did not find a significant association between outside directors on the board and voluntary disclosure in a Hong Kong setting. Regarding environmental disclosure some studies were unable to confirm a significant association between outside directors and environmental disclosure (Brammer & Pavelin, 2006). Despite this, Haniffa & Cooke (2005) found that the composition of non-executive directors is significantly and positively associated with corporate social disclosure, and also positively related to the quantity and quality of corporate environmental disclosures (Post et al. 2011; Rupley et al. 2012). Further, Liao et al. (2014) found that the coefficient of board independence is positively associated with the GHG disclosure. Overall, the above argument and empirical evidence appears to justify my next hypothesis:

**Hypothesis 2.2:** There is a positive association between the number of independent directors in the boards and the extensiveness of carbon disclosure.

### 3.3.2.1.3 Board Diversity

As discussed earlier, board diversity relates to various characteristics that may be represented among directors in the boardroom in relation to board process and decision-making (Milliken & Martins, 1996; Walt & Ingley, 2003). It was argued
that board diversity can enhance the board’s expertise (Hillman et al. 2002) and decision-making process (Daily & Dalton, 2003).

Broadly speaking, there are limited samples in empirical literature that have examined the association between board diversity and carbon disclosure. Prior studies indicated no significant relationship between the proportion of female board members and voluntary information disclosure in company annual reports (Nalikka, 2009). Similarly, Prado-Lorenzo & Garcia-Sanchez (2010) show that gender diversity is not significantly associated with GHG emission disclosure. On the other hand, most of the previous research shows a positive association. For example, Liao et al. (2014) have acknowledged a significant positive relationship between gender diversity (measured as the percentage of female directors on the board) and the voluntary disclosure of GHG emissions in the form of a Carbon Disclosure Project report. The results suggest women are more likely to care about quality of life and the natural environment is extremely important to maintain the quality of life. Thus, it can be argued that the increase in the number of female directors should increase the probability of carbon disclosure and transparency. Other empirical evidence is consistent with this argument. For instance, Bear et al. (2010) demonstrated that the number of women board members is positively associated with the strength of corporate social responsibility disclosures and Rupley et al. (2012) found that the proportion of females on the board is positively associated with the quality of voluntary environmental disclosures. Fodio & Oba (2012) documented that the percentage of female directors on the board has positive impact on its environmental responsibility information disclosure. Hence, the following next hypothesis is proposed:

**Hypothesis 2.3:** There is a positive association between the number of female “directors” on the board and the extensiveness of carbon disclosure.

### 3.3.2.1.4 Board Meetings

The frequency of board meetings is considered an important proxy for measuring the intensity of a board’s activities, and the effectiveness of corporate monitoring and disciplining (Jensen, 1993; Vafeas 1999a; Conger et al, 1998). Frequent
board meetings would facilitate greater information sharing among company directors and would allow better workload distribution as well as board committee assignments, leading to more effective board decisions and increased transparency (Laksmana, 2008). In addition, the board with regular meetings is able to allocate more time to issues such as social and environmental responsibility. On the other hand, the board that has fewer meetings can reduce the ability to build their collective strength (Demb & Neubauer, 1992).

Recently, there are few reported studies that link the frequency of board meetings and carbon emissions disclosure. Nonetheless, in the context of voluntary disclosure in general, for example, Allegrini & Greco, (2013) indicated that the number of board meetings is positively correlated to the level of voluntary disclosure. A similar study by Laksmana (2008) provided evidence that the frequency of board meeting is positively associated with greater voluntary disclosure of executive compensation information. Kent & Stewart (2008) found that the quantity of disclosure is positively related to the frequency of board meetings. Further, Aburaya, (2012) has found that the board meetings frequency is significantly and positively associated with the quantity and quality of environmental disclosure. However, Liao et al. (2014) were unable to find significant relationship between the number of board meetings and the voluntary disclosure of GHG emissions. Nelson et al. (2010) also did not find any significant relationship between board meeting frequency and the nature and extent of statutory executive stock option disclosures by Australian listed companies. Notwithstanding, it is expected that a board with high frequency of meetings is more active, thus are more likely to provide financial and non-financial information, including carbon emissions, for decision making. Thus, the following hypothesis is stated:

**Hypothesis 2.4:** There is a positive association between the number of board meetings and the extensiveness of carbon disclosure.

### 3.3.2.1.5 Audit committee independence

The independence of the audit committee is required to ensure the committee’s effectiveness as a monitoring device. According to the Principles of Good
Corporate Governance and Best Practice Recommendations (ASX GCG, 2003), the board should establish an audit committee and the majority of its members should be independent directors. Cerbioni & Parbonetti (2007) provide evidence that an audit committee that consists of a majority of independent directors can enhance the quality of information disclosure to allow for a more accurate assessment of top management decisions and performance. Further, Forker (1992) argues that firms with a higher proportion of independent directors in the audit committee may reduce the opportunistic behaviour of the manager and improve the quality of disclosures.

There is little academic literature regarding the association between the independence of the audit committee and carbon emissions disclosure. Nonetheless, previous studies have proven that the existence of an audit committee in the board is positively associated with the voluntary disclosure in general (Ho & Wong, 2001; Arcay & Vazquez, 2005; Barako et al. (2006). Similarly, O’Sullivan et al. (2008) provided evidence that the existence and independence of an audit committee are positively related to the disclosure of forward-looking information. In addition, Said et al. (2009) have also found that the proportion of independent non-executive directors who sit on audit committees are positively and significantly correlated with the level of corporate social responsibility disclosure. Recently, Aburaya (2012) confirmed a positive and significant association between audit committee independence and the disclosure of environmental information in the UK. Whereas, Allegrini & Greco, (2013) have found that the existence of audit committee and its independence are insignificant associated with voluntary disclosure. Yet, examining intellectual capital disclosures, Li et al. (2012) failed to find a significant association between the independence of an audit committee and intellectual capital disclosure by UK listed firms. Despite the mixed results, it is generally accepted that the independent directors on the audit committee are likely to enhance the quality of corporate governance, thus, should have a positive influence on a firm’s ecologic transparency. Then, my next hypothesis is assumed as follows:

**Hypothesis 2.5:** There is a positive association between the independence of an audit committee and the extensiveness of carbon disclosure.
3.3.2.1.6 Compensation (Remuneration) Committee Independence

The Principles of Good Corporate Governance and Best Practice Recommendations (2003, 2007) recommended that the board should establish a compensation committee with the majority of which being independent directors and with at least three members. This committee is supposed to be associated with improved corporate governance (Forker 1992). The compensation committee can also contribute to sound governance, playing a positive role in the top management control (Allegrini & Greco, 2013), and aligning the management’s and the interests of shareholders (Conyon & Peck 1998; Laksmana 2008). Therefore, the presence of independent directors on the compensation committee could make the control over the top management team more effective.

There are limited studies that have examined the relationship between compensation committee independence and environmental disclosure, particularly that of carbon emissions disclosure. However, in the area of voluntary disclosure in general, an empirical study such as Laksmana (2008) provides evidence of a significant and positive association between the independence of a compensation committee and the voluntary disclosure of executive compensation practices. A similar study by O’Sullivan et al. (2008) documented that there is a positive association between the presence and independence of a compensation committee and voluntary disclosure of forward-looking information. On the other hand, Cerbioni & Parbonetti (2007) pointed out that the existence and independence of a remuneration committee are negatively associated with the level of voluntary disclosure on intellectual capital in European biotechnology firms. Whilst, Allegrini & Greco (2013) found that the existence of a compensation committee in the board, and its independence, are insignificantly associated with voluntary disclosure. Similarly, Aburaya, (2012) found that the independence of remuneration committee is insignificant associated with the quantity and quality of environmental disclosure. In this light, it can be expected that the independent directors on the remuneration committee may enhance the carbon emissions
disclosure. Therefore, consistent with the above justification, the following hypothesis is formulated:

**Hypothesis 2.6:** There is a positive association between the independence of compensation committee and the extensiveness of carbon disclosure

### 3.3.2.1.7 Nomination Committee Independence

The ASX Good Governance Principles and Recommendations (2003; 2007) recommends that nomination committees should be composed by a majority of independent directors. The nomination committee gives more possibilities for the minority shareholders to advocate a nominee in the presence of large controlling shareholders (Jensen 1993; Shivdasani & Yermack1999). In addition, Andrews (1987) advocated that using the nominating committees in the board is considered as a means that can enhance the independence of the board. Further, when the nomination committee is formed, the directors who staffed in this committee are most likely to guard the interests of shareholders (Vafeas, 1999b).

Empirical research has not been undertaken to examine the relationship between nomination committee independence and environmental disclosure, particularly in regard to carbon emissions. Yet, in the area of voluntary disclosure, previous academic studies such as O’Sullivan et al. (2008) found that the nomination committee presence is positively related to the voluntary disclosure of forward-looking information. On the other hand, Aburaya, (2012) found that the nomination committee independence is significantly and negatively associated with the quantity and quality of environmental disclosure. Whereas, Cerbioni & Parbonetti (2007) found that the presence of nomination committee and its independence are negatively related to with the level of voluntary disclosure on intellectual capital. Allegrini & Greco, (2013) provided evidence of insignificant relationship between the existence and independence of nomination committee in the board and voluntary disclosure. On the basis of the foregoing, the nomination committee independence results in increased monitoring and accountability to stakeholders, thus lead to enhanced reporting transparency (O’Sullivan et al. 2008). Consequently, it can be expected that the nomination committee
independence might enhance the carbon emissions disclosure. Therefore, the following hypothesis is proposed:

**Hypothesis 2.7:** There is a positive association between the independence of nomination committee and the extensiveness of carbon disclosure.

### 3.3.2.1.8 Environmental Committee Presence

As stated previously, the presence of an environmental committee or of a person responsible for environmental issues at the board level indicates the company has an active strategic posture regarding stakeholders (Ullman 1985; Michelon & Parbonetti, 2012) and the firm's willingness to balance the often conflicting interests of stakeholders regarding financial and environmental performance (Monks & Minow, 1995). The existence of an environment committee suggests that the firm is concerned about environmental protection and attempt to enhance their environmental reputation, through long-term strategies, as an objective (Neu et al, 1998). The environmental committee may also enhance the awareness of employees of environmental aspects of their jobs and their responsibility to reduce negative impacts (Liao et al. 2014). Thus, firms with an environmental committee on the board are expected to publicly disclose their emissions, and to provide more credibility in a voluntary disclosure regime to indicate their commitment to climate change (Ashforth & Gibbs, 1990).

Currently, there is very limited evidence regarding the relationship between the presence of an environmental committee and environmental disclosure, especially for carbon-activity disclosure. Although some research found positive association between an environmental committee or CSR committee presence and environmental disclosure (Peters & Romi, 2011; 2013; Aburaya, 2012), other empirical literature suggests no association (Rankin et al. 2011; Rupley et al. 2012 and Cowen et al. 1987). Notwithstanding, we argue that the existence of environmental committee on the board is considered as an effective monitoring device to address the broader stakeholders' interests. Therefore, it can be expected that the environmental committee will be more likely to respond to stakeholder demands for disclosures related to carbon emission information (Liao et al 2014). Subsequently, we pose the following hypothesis:
**Hypothesis 2.8:** There is a positive association between the presence of an environmental committee and the extensiveness of carbon disclosure.

### 3.3.2.2 Ownership Structure

As mentioned formerly, ownership structure is considered to be as an important element of corporate governance (Shleifer & Vishny, 1997; Morck, 2000; Shan & McIver, 2011). Ownership structure mechanisms help investors by aligning the interest of shareholders and managers (Watts and Zimmerman, 1986; Eng and Mak, 2003; Haniffa & Cooke, 2002; Chau & Gray, 2002). Based on the empirical evidence from these studies along with the theoretical framework of the present study, this section provides the hypotheses related to ownership structures. Two aspects of a firm’s ownership structure will be examined in this study, namely; ownership concentration and managerial ownership.

#### 3.3.2.2.1 Ownership concentration

Stakeholder perspective suggests that when shares in a company are widely held by multiple stakeholders the accountability issue becomes more important (Ghazali, 2007). Substantial shareholders are expected to have both the greatest incentives and power to monitor management, as their own personal wealth is tied to the company’s performance (Jensen & Meckling, 1976; Shan & McIver, 2011). Moreover, Shleifer and Vishny (1997) argue that large shareholders can help reduce agency conflicts because of their dominant power and incentive to prevent expropriation by insiders. Therefore, large shareholders play a crucial role in monitoring executives and can be expected to put more pressure on management to disclose more corporate information. Birt et al. (2006) argue that when ownership is concentrated in the hands of large shareholders, they have the ability to mitigate agency problems by influencing information disclosure. Similarly, Ho and Tower (2010) suggest that firm’s with concentrated ownership structure tend to provide more information. In this regard, McKinnon & Daliminthe (1993, p. 37) argue that voluntary disclosure may be useful in mitigating the severity of conflicts between managers and shareholders that arise when a company’s shares are widely held.
Currently, a number of studies have provided mixed results. For instance, Haniffa & Cooke (2002) have provided evidence of a significant positive association, but Hossain et al (1994); Barako et al, (2006); Garcia-Meca & Sánchez-Ballesta (2010); Cormier et al. (2005), Brammer & Pavelin, (2006), & Prado-Lorenzo et al. 2009) have found negative association, and Eng & Mak, (2003) failed to find a significant association between ownership concentration and voluntary disclosure.

In the context of carbon disclosure, with the growing pressure from the government and the public it can be argued that carbon emissions are likely to negatively affect firm value. Thus, the knowledge of carbon emissions and corporate carbon mitigation programs is becoming more and more important for the decision-making of investors. So the intuition is large shareholders should have more concern about carbon emissions, because if emissions reduce firm value they will suffer more than small shareholders. Thus, it is expected large shareholders tend to have more incentives to demand a transparent carbon disclosure. This is probably the main reason why large institutional investors continuously sponsored CDP (Carbon Disclosure Project) which requests the large companies in the world to disclose comprehensive GHG information (Luo et al 2012). Thus we believe the ownership concentration should have a positive impact on disclosure.

**Hypothesis 2.9:** There is a positive association between ownership concentration and the extensiveness of carbon disclosure.

### 3.3.2.2.2 Managerial Ownership

According to Jensen & Meckling (1976), a manager who owns a high percentage of a company’s shares bears the consequences of managerial actions thus it serves to align the interests of the manager with those of the owners. If the corporate managers own substantial equity in the company, they are more likely to make decisions maximizing the shareholders’ wealth (McConnell and Servaes 1990; Denis et al. 1997; Oh et al. 2011). Therefore, the greater ownership in a company's management tends to increases productivity and performance of the company.
Prior literature has found mixed results with regard to the association between managerial ownership and voluntary disclosure in general. For example, Nagar et al, (2003) have found that the value of shares held by the CEO is positively associated with disclosure in the context of the US, and Leung and Horwitz, (2004) noted that managerial ownership is positively related to voluntary disclosure in Hong Kong. Other empirical literature provided evidence that managerial ownership is negatively associated with voluntary disclosure (Eng & Mak (2003); Baek et al. (2009); Chau & Gray, (2010); Ghazali 2007; Oh et al. 2011; Khan et al, 2013) or shows no relationship at all (Huafang & Jianguo (2007) and Zourarakis (2009)). We predict a positive association between managerial ownership and voluntary disclosures because high percentage of managerial ownership aligns the interest of managers and the owners and encourages them to disclose more information including financial and non-financial information to shareholders. Thus, my last hypothesis is:

**Hypothesis 2.10:** There is a positive association between managerial ownership and the extensiveness of carbon disclosure.

### 3.4 Conceptual Framework

Based on the review of relevant literature, we posit a conceptual model linking corporate governance, carbon performance and the extensiveness of carbon disclosure (Figure 3.2, and 3.3).
3.5 Measurement of Dependent Variables

The dependent variables of the present study are carbon performance and carbon disclosure.

3.5.1 Measure of Carbon performance

The Carbon Performance Index (CPI) is a proxy focusing on the result of carbon reduction activities. The proxy of carbon performance uses four items (Luo and Tang, 2011), where each item is assigned a weight based on the importance of perceived. First, three scores are awarded if the firm reduced intensity emissions relative to the previous year and the intensity emission is the total of Scope 1 and 2 emissions divided by the total sales at the end of a fiscal year. Second, two scores are awarded if a firm’s carbon intensity is lower than its industry average; two scores are awarded as per the CDP scoring methodology. Third, two scores
are awarded if a firm has realised reduction through its initiative activities. Forth, one score is awarded if a firm met at least one of its carbon targets including intensity and absolute targets. So the range of carbon performance is from zero to eight. The first two items are chosen to use intensity measure instead of an absolute measure in order to facilitate comparisons between companies and reduction potentials become more transparent (Hoffmann & Busch, 2008). Also, this measure can avoid the influence of fluctuation of macro-economics on emissions. This measure is different from that of environmental performance in prior study. For instance, Al-Tuwajri et al. (2004), use the percentage of toxic waste recycled to measure environmental performance. This study used the total Scope1 and Scope2 divided by the total sales at the end of a fiscal year as measure of carbon performance.

3.5.2 Measure of Carbon Disclosure: Carbon Disclosure Score

We used an index to measure the extent of carbon disclosure based on relevant prior studies using the CDP method (e.g. Tang & Luo, 2011; Cotter & Najah, 2012; Luo & Tang, 2014b). The CDP 2011 scoring methodology has been developed by CDP with guidance from PricewaterhouseCooper (PwC) in its capacity as Global Advisor and report-writer. The responses to each of the questions in the questionnaire are scored and aggregated and then a final score is assigned to a firm based on the content of the information provided in the answer in a carbon report of the firm. For example, the participant receives a point of "1" if the company gives a "yes" answer or "0" if a company gives a "no" answer (Luo & Tang, 2014b). The final score is the number of points that have been awarded divided by the total available scores and then normalised to 100 point scale (CDP Rating Methodology, 2010; Tang & Luo, 2011; Najah, 2012; Luo & Tang, 2014b).

3 Scope 1 is direct emissions, which occur onsite or from sources that a company owns and controls. It includes the combustion of fuels (e.g. boilers, furnaces, turbines); its own vehicle fleet, etc., while Scope 2 is indirect emissions that result from the generation of the electricity, heat or steam a company purchases (see in Luo and Tang, 2011). Tang & Luo, (2011) suggested that the CDP has changed the design of company CDP report from previous years, but the contents of CDP report are basically the similar.

4 Note the total available scores ignore irrelevant questions, thus firms were not penalised for not answering irrelevant questions.
3.6 Definition and Measurement of Independent Variables

The independent variables of this study are the corporate governance characteristics of all Australian companies that completed the CDP 2009 -2012 questionnaire and allowed their responses to be published on the CDP website. As such the independent variables tested in the present study can be categorized into three groups. The first group is Board of Directors Characteristics: board size, board independence, board diversity, CEO duality, board meetings, audit committee independence; compensation committee independence; nomination committee independence, and environmental committee presence. The second group is the aspects of compensation structure: stock option and long term bonus. The third group of corporate governance mechanisms is ownership structure: ownership concentration and managerial ownership.

3.6.1 Board of Directors Characteristics

The board of directors are the brain of the companies who manage, control and supervise the companies. According to Fama (1980) and Fama & Jensen. (1983), who described the board of directors as a major internal mechanism in the corporate governance structure. They argue that establishing a board that provides effective monitoring of management actions on behalf of shareholders. In addition, According to Jensen & Meckling (1976), the board of directors acts on shareholders’ behalf to monitor managers as a market solution to the contracting problems inherent in organizations. Therefore, board of directors’ characteristics are expected to have a bearing on carbon performance. In the following section I will provide detailed information about the measurement of each characteristic of the board of director: board size, board independence, board diversity, CEO duality, board meetings, audit committee independence; compensation committee independence; nomination committee independence, and environmental committee presence.

3.6.1.1 Board size (NDB)

A previous study has considered the size of the board to be one of the most important parts of the ability of boards to effectively monitor management
(Persons, 2006). Therefore, the size of the board refers to the number of directors on the board (e.g. Zahra & Pearce II, 1989; Beasley, 1996; Yermack, 1996; Vafeas, 2000; Agrawal & Knoeber, 2001; Kassinis & Vafeas, 2002; Abbot et al. 2004; Coles et al. 2008; de Villiers et al. 2011). The current study measures the size of the board (NDB) as the number of directors serving in the board. This information on board size was manually collected by using the corporate governance statements in the “Directors’ report” section of the annual report for each firm.

### 3.6.1.2 Board Independence (NIDB)

With respect to the independence of the board which is another key characteristic of boards of directors, board independence is regarded as a reliable mechanism in the process of reducing agency conflicts between managers and owners (Fama & Jensen 1983) and it enhances the board monitoring effectiveness (Franks et al. 2001). Furthermore, the NYSE (2009) cited in Larcker & Tayan, (2011) defined independence as having “no material relationship with the listed company (either directly or as a partner, shareholder, or officer of an organization that has a relationship with the company).” Following Core et al., 1999; de Villiers et al. 2011 & Kathyayini & Lester, 2012, this study calculates board independence (NIDB) as the number of independent directors on the board. The information on board independence was mainly gathered from corporate governance statement in the “Directors’ report” section of the annual report for each firm.

### 3.6.1.3 Board Diversity (NFDB)

Board diversity is defined as being inclusive of various attributes that may be represented among directors in the boardroom in relation to board process and decision-making, including age, gender, ethnicity, culture, religion, constituency representation, independence, knowledge, educational and professional background, technical skills and expertise, commercial and industry experience, career and life experience (Milliken & Martins, 1996; Van der Walt & Ingley, 2003). This study will focus on gender diversity for two reasons: first, recent legislation and diversity efforts worldwide have drawn more attention to the importance of female representation on boards of directors (Miller & Triana,
second, there are growing numbers of females in top management positions today, with the pipeline for women CEOs and directors expected to increase (Giscombe & Mattis, 2002; Helfat, Harris & Wolfson, 2006). Therefore, following the prior work of Coffey & Wang, 1998; Wedd 2004; Dunn & Sainty, 2009 & Walls et al, 2012, this study measured board diversity (NFDB) as the number of female directors in the board. The data of gender diversity was gathered by looking at the biographical details in “Directors’ report” section at corporate governance statement of the annual report for each firm.

3.6.1.4 Board Meetings (NBM)

The number of board of director meetings held annually is considered another measure of board effectiveness. According to Conger et al. (1998) who suggested that frequent board meetings is an important resource in improving the board effectiveness, frequent board meetings would allow for better communication and information sharing between management and directors (Shivdasani & Zenner, 2004). Therefore, consistent with the previous studies, (e.g. Vafeas, 1999; Nelson et al. 2010; Brick & Chidambaran 2010), this research calculates board meetings (NBM) by the number of board meetings per year. The information on board meetings was selected and obtained using the corporate governance statement in the “Directors’ report” section of the annual report for each firm.

3.6.1.5 Audit committee independence (NIDAC)

The independence of an audit committee is considered the key characteristic of the committee’s effectiveness to oversee the firm’s financial reporting process. The report of principles of good corporate governance and best practice recommendations (2003) and the recommendations of the blue ribbon committee (1999) recommended that the majority of audit committee member be independent. Therefore, following the previous research (e.g. B’edard, Chtourou, & Courteau, 2004; Anderson et al. 2004), this study measured the independence of an audit committee by the number of independent directors in that audit committee (NIDAC). The source of this variable was hand-collected using the corporate governance statement found in the “Directors’ Report” section of the annual report for each firm.
3.6.1.6 Compensation “Remuneration” Committee Independence (NIDCC)

The independence of compensation committee members is seen as the most important characteristic in the board’s composition. The ASX good corporate governance and best practice and recommendations (ASX CGC, 2003) recommended that the majority of compensation committee members be independent. Therefore, following the ASX good governance principles and recommendations of 2003, compensation committee independence (NIDCC), is measured by the number of independent directors in the Compensation (Remuneration) Committee. The keywords of this variable are “Compensation (Remuneration) Committee” which was handpicked and manually collected by using corporate governance statements in the “Directors’ report” section of the annual report for each firm.

3.5.1.7 Nomination Committee Independence (NIDNC)

According to Jensen 1993; Shivdasani and Yermack 1999, the nomination committee plays a significant role in the existence of large controlling shareholders, as it gives more possibilities to the minority shareholders to advocate a nominee. In addition, the ASX good governance principles and recommendations of 2003; 2007 recommends that nomination committee is composed of a majority of independent directors. Hence, following the ASX CGC (2003), Nomination Committee independence (NIDNC) is calculated by the number of independent directors in the nomination committee. The data of this variable was selected and gathered from corporate governance statements in the “Directors’ report” section of the annual report for each firm.

3.6.1.8 Environmental Committee Presence (EC_D)

The presence of an environmental committee or of a person responsible for environmental issues at the board level indicates the company has an active strategic posture regarding stakeholders (Ullman, 1985; Michelon & Parbonetti,
2012) and the firm's willingness to balance the often conflicting interests of stakeholders (Monks & Minow, 1995). This study follows the previous work to measure the presence of an environmental committee (McKendall et al, 1999; Michelon & Parbonetti, 2012; Peters & Romi, 2011) which measured as a dummy variable equal to 1 if the company has a board-level environmental committee and 0 otherwise (EC_D). The information of environmental committee presence was hand gathered from the corporate governance statement in the “Directors’ report” section of the annual report for each firm.

3.6.2 CEO Compensation Structure

Generally speaking, CEOs are responsible for developing talent; as well as their responsibilities in front of the board to lead the company to success which requires them to make decisions that can maximize the firm’s value (Larcker & Tayan, 2011). The CEO compensation packages generally divided into three main components, namely, fixed compensation (salary), Short-term incentives including annual incentives, bonuses, commissions, gainsharing, and Long-term incentives including restricted stock, stock options and other long-term compensation. The following section will include detailed information about the measurement of two elements of compensation, namely: long term bonus and stock options. In addition, the information of these components were manually collected from remuneration reports” plus the “Key management and director remuneration” section in the corporate governance statement of firms” section of annual report for each firm.

3.6.2.1 Stock Option (CEO_SO)

Stock options are the most typical form of long term incentive compensation which is likely to foster a longer decision horizon among managers. Moreover, stock options provide compensation only when executives have increased the stock price to the point at which the options trade (Larcker & Tayan, 2011). Therefore, stock options (CEO_SO) are measured by a dummy variable that equals 1 if CEO compensation includes a stock option and 0 otherwise (McGuire et al, 2003; Fich & Shivdasani, 2004; Arcay & Vazquez, 2005).
3.6.2.2 Long Term Bonus (CEO_LTB)

In addition to CEO stock options, long term bonus is considered as another measure of long term incentives that can contribute to the alignment of managers’ and shareholders’ interests. In the current study, long term bonus is measured by a dummy variable that equals 1 if CEO compensation includes a long term bonus and 0 otherwise. (Stanwick & Stanwick, 2001; Mahoney & Thorne, 2005; Deckop, Merriman, & Gupta, 2006)

3.6.3 Ownership Structure

Ownership structure is considered to be an important element of corporate governance (Shleifer & Vishny, 1997; Morck, 2000; Shan & McIver, 2011). Ownership structure mechanisms help investors by aligning the interest of shareholders and managers (Watts & Zimmerman, 1986; Eng & Mak, 2003; Haniffa & Cooke, 2002; Chau & Gray, 2002). According to Demsetz & Villalonga, (2001), who indicate that all ownership structure measurements employed by Demsetz & Lehn (1985) are based on the percentage of shares owned by a firm’s most significant shareholders, the most attention being “given by them” to the proportion owned by the five largest shareholders. The studies that were written after the Demsetz and Lehn paper (e.g. Morck et al. 1988; McConnell & Servaes, 1990; Loderer & Martin, 1997; Cho, 1998; Holderness et al. 1999; Himmelberg, Hubbard & Palia, 1999) focus on the percentage of shares owned by board members, CEO, and top management. In this study, ownership structure is characterized by ownership concentration and management ownership. In addition, the data of these variables hand-gathered from the “Additional Information” section in the corporate governance statements of the annual report for each firm.
3.6.3.1 Ownership concentration (OWN_CONC)

Ownership concentration refers to the percentage of ordinary shares owned by substantial shareholders. Jensen & Meckling (1976) argue that substantial shareholders are expected to have both the greatest incentives and power to monitor management, as their own personal wealth is tied to the company’s performance. A commonly employed measure of ownership concentration is the proportion of ordinary shares owned by the largest shareholder (see McKinnon & Dalimunthe, 1993; Hossain et al, 1994; Halme & Huse, 1997; Haniffa & Cooke, 2002; Eng & Mak, 2003; Huafang & Jianguo, 2007). Accordingly, ownership concentration is measured in the present study using the logarithm of the percentage of ordinary shares owned by substantial shareholders.

3.6.3.2 Managerial Ownership (MANG_OWN)

Managerial ownership refers to the percentage of total outstanding shares held by all directors, including the CEO, executive directors and non-executive directors. According to Jensen & Meckling (1976), who indicated that a manager who owns a proportion of a firm’s shares bears the consequences of managerial actions thus it serves to align the interests of management with those of other shareholders. Managerial ownership has been used in the literature using the proportion of ordinary shares held by the CEO and executive directors (see Holderness et al. 1999; Johnson & Greening, 1999; Eng & Mak, 2003; Huafang & Jianguo, 2007; Oh et al. 2011; Khan et al. 2013). Accordingly, managerial ownership is calculated in this study by using a logarithm of the percentage of total outstanding shares held by all directors, including the CEO, executive directors and non-executive directors.
### Table 3.3: Description of Individual Governance Variables

<table>
<thead>
<tr>
<th>Area</th>
<th>Abbreviation/ Code</th>
<th>Variable Name</th>
<th>Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Board of Directors</strong></td>
<td>NDB</td>
<td>Board Size</td>
<td>Number of directors serving on the board.</td>
</tr>
<tr>
<td></td>
<td>NIDB</td>
<td>Board Independence</td>
<td>Number of independent directors on the board.</td>
</tr>
<tr>
<td></td>
<td>NFDB</td>
<td>Board Diversity</td>
<td>Number of female directors on the board.</td>
</tr>
<tr>
<td></td>
<td>NBM</td>
<td>Board Meetings</td>
<td>Number of board meetings per year.</td>
</tr>
<tr>
<td></td>
<td>NIDAC</td>
<td>Audit Committee Independence</td>
<td>Number of independent directors in audit committee.</td>
</tr>
<tr>
<td></td>
<td>NIDCC</td>
<td>Compensation Committee</td>
<td>Number of independent directors in Compensation (remuneration) Committee.</td>
</tr>
<tr>
<td></td>
<td>NIDNC</td>
<td>Nomination Committee</td>
<td>Number of independent directors in Nomination committee.</td>
</tr>
<tr>
<td></td>
<td>EC_D</td>
<td>Environmental Committee</td>
<td>A dummy variable equal to 1 if the company has a board-level environmental committee and 0 otherwise.</td>
</tr>
<tr>
<td><strong>CEO Compensation Structure</strong></td>
<td>CEO_SO</td>
<td>Stock Option</td>
<td>A dummy variable that equals 1 if CEO compensation includes a stock option and 0 otherwise.</td>
</tr>
<tr>
<td></td>
<td>CEO_LTB</td>
<td>Long Term Bonus</td>
<td>A dummy variable that equals 1 if CEO compensation includes a long term bonus and 0 otherwise.</td>
</tr>
<tr>
<td><strong>Ownership Structure</strong></td>
<td>OWN_CONC</td>
<td>Ownership Concentration</td>
<td>Logarithm of the percentage of ordinary shares owned by substantial shareholder</td>
</tr>
<tr>
<td></td>
<td>MANG_OWN</td>
<td>Managerial Ownership</td>
<td>Logarithm of the percentage of total outstanding shares held by all directors.</td>
</tr>
</tbody>
</table>
3.7 Measurement of Control Variables

This study included a number of control variables based on prior literature that may influence the firms’ response to the CDP. The information for the control variables group is obtained from the FinAnalysis database. These control variables include: Firm Size, Profitability, Leverage, Tobin’s Q, Capital Intensity and IntensiveSector. As presented below, the current study provides these variables individually, along with the method of measurement for each variable.

3.7.1 Firm size (FSIZE)

Firm size is an important control variable in most previous finance and accounting literatures, because large firms would disclose more information than smaller firms, in order to reduce the information asymmetry problem. In addition, it has been well known that larger firms tend to incur higher political costs and a high degree of public scrutiny and media attention than smaller firms (Stanny & Ely 2008; Shan & Taylor, 2014). In the context of environmental performance and disclosure, particularly, in respect of environmental performance, several studies have found a significant association between firm size and environmental performance (e.g. McGuire et al. 1988; McKendall et al. 1999; McGuire et al. 2003; Berrone & Gomez-Mejia, 2009; De Villiers et al. 2011; Walls et al. 2012). According to McKendall et al. (1999), large firms are associated with stronger environmental performance. This views is consistent with de Villiers et al. (2011) who found that firm size is positively related to the existence of strong environmental performance. Other studies, however, found a negative and significant relationship between firm size and pollution prevention performance (Berrone & Gomez-Mejia, 2009). In addition, this relationship is revealed not only in the context of environmental performance but also for environmental disclosure. Numerous previous studies have found that firm size is significantly associated with the level of environmental disclosure (e.g. Deegan & Gordon, 1996; Halme & Huse, 1997; Patten, 2002; Freedman & Jaggi, 2005; Al-Tuwaijri et al. 2004; Brammer & Pavelin, 2006, 2008; Clarkson et al., 2007; Cormier et al. 2005; Peters and Romi, 2011; Rupley et al. 2012; Stanny & Ely, 2008; Luo et al. 2013; Shan & Taylor, 2014; Peng et al. 2015). According to Stanny & Ely (2008),
who found that the CDP disclosure rates to be positively related to firm size. Further, Prado-Lorenzo et al. (2009a) found that the size of the firm is positively associated with the disclosure of GHG emissions information. Firm size has been addressed in different measures in the literature: for example, total sales, total assets, number of employees and market capitalization. According to Hassan, Giorgioni & Romilly, (2006), who indicated that there is no suitable criterion to select the best proxy of firm size. Reviewing the literature, however, the most popular measure of firm size is total assets. Therefore, in this study, the size of the firm (FSIZE) is included as a control variable to examine the association between corporate governance structure and carbon performance and carbon disclosure. Following the prior literature review, the firm size is measured as the natural logarithms of total assets (e.g. Bloom & Milkovich, 1998; Finkelstein & Boyd, 1998; McKendall et al. 1999; Patten 2002; Al-Tuwaijri et al. 2004; Cormier et al. 2005; Brammer & Pvelin, 2006, 2008; Clarkson et al. 2007; Berrone & Gomez-Mejia, 2009; Luo & Tang 2011; De Villiers et al. 2011; Rupley et al. 2012; Walls et al. 2012; Luo et al. 2013; Shan & Taylor, 2014).

### 3.7.2 Profitability (ROA)

The second control variable of the present study is Profitability which may influence the firms’ response to the CDP. Profitable firms could more easily afford the expenditures needed to conduct and report carbon actions (Luo et al. 2013). Moreover, less profitable companies may be more reluctant to release climate change information that may indicate a decline in future earnings. Firms that are more profitable may be inclined to respond to the CDP to assure investors that their high quality earnings can withstand a more constrained regulatory environment (Stanny & Ely, 2008).

A number of empirical studies show somewhat mixed evidence of the association between profitability and environmental performance and disclosure. In the respect of environmental performance, while some studies found that profitability is positively associated with environmental performance (Jaggi & Freedman, 1992; Russo & Fouts, 1997; Kock & Santaló, 2005; De Villiers et al. 2011), other studies found no relationship (McKendall et al. 1999; Delmas & Nairn-Birch, 2011). In regards to environmental disclosure level, many empirical studies
demonstrated a positive relationship between profitability and environmental disclosures (Neu et al. 1998; Cormier & Magnan, 1999; Li & McConomy, 1999; Bewley & Li. 2000; Al-Tuwaijri et al. 2004; Haniffa & Cooke, 2005; Luo et al. 2012; Luo et al. 2013) other studies, however, indicated a negative association (Chen & Jaggi, 2000; Ho & Taylor, 2007; Rupley et al. 2012) whereas some prior work found no association between profitability and environmental disclosures (Eng & Mak, 2003; Patten, 1991; Stanny & Ely, 2008; Peters & Romi, 2011; Wegener et al. 2013). Drawing on the prior research (Patten, 1991; Li and McConomy, 1999; Lim et al. 2007; Stanny & Ely, 2008; Cormier et al. 2010; Luo & Tang 2011; Cormier et al. 2011; De Villiers et al. 2011; Peters & Romi, 2011; Rupley et al. 2012 Luo et al. 2012; Luo et al. 2013), the current study measured profitability (ROA) as the firm’s return on assets.

3.7.3 Leverage (LEV)

Leverage has been widely used as a control variable in the context of environmental performance and disclosure (e.g.; Haniffa & Cooke, 2005; Clarkson et al. 2007; Huafang & Jianguo, 2007; Stanny & Ely, 2008; Peters & Romi, 2011; De Villiers et al. 2011; Walls et al. 2012; Luo et al. 2013; Wegener et al. 2013). There is an expectation that more highly leveraged firms will have stricter debt covenants to restrain shareholders’ actions, and creditors will likely demand more information to monitor management behaviour (Leftwich et al, 1981). Thus, highly leveraged firms may be motivated to make voluntary disclosures in order to reduce contracting costs. Moreover, higher-leverage firms have heavier debt burdens, and thus fewer assets available for a proactive carbon-reporting system (Luo et al. 2013).

Several studies in the environmental disclosure and performance literature have shown mixed results in the relationship between leverage and environmental performance and disclosure. Some studies found that leverage is positively associated with environmental performance (De Villiers et al. 2011; Walls et al. 2012) and is negatively related to environmental performance (Clarkson et al. 2011c). This relationship was conducted not only in the context of environmental performance but also for environmental disclosure level, some Empirical studies found that leverage is significant and positive with environmental disclosure
(Bradbury, 1992; Clarkson et al. 2007; O’Sullivan et al. 2008), other studies, however, provide evidence that the relationship between leverage and environmental disclosure was negative (Meek et al. 1995; Luo et al. 2013; Wegener et al. 2013) whereas other research have not found any relationship (e.g. Craswell & Taylor, 1992; Raffournier, 1995; Freedman & Jaggi, 2005; Rankin et al. 2011; Luo et al. 2012). Following previous literature (e.g. Raffournier, 1995; Brammer & Pavelin, 2006; Clarkson et al. 2007; 2011c; Huafang and Jianguo, 2007; Stanny and Ely, 2008; O’Sullivan et al. 2008; Peters & Romi, 2011; De Villiers et al. 2011; Rankin et al. 2011; Walls et al. 2012; Luo et al. 2013; Wegener et al. 2013), this study computed leverage ($LVE$) as total debt divided by total assets.

3.7.4 Tobin's Q (TOBINSQ)

The Tobin’s Q is considered to be one of the most common explanatory variables that have been used in previous empirically studies to represent a firm’s relative amount of intangible assets and growth opportunities (Barth & Kasznik, 1999; Clarkson et al. 2007; Stanny & Ely, 2008). Healy & Palepu (2001) indicate that managers seek to reduce information asymmetry through voluntary disclosures in order to decrease the firm’s cost of capital. Therefore, a higher Tobin’s Q means the firm has higher intangible assets and/or the firm has higher growth prospects, which are harder to value because of the higher information asymmetry (Stanny & Ely, 2008). Tobin’s Q is widely used in previous empirical works of the environmental-financial performance association and environmental disclosure literature (e.g.; Dowell et al. 2000; Konar & Cohen, 2001; King & Lenox, 2001; Elsayed & Paton, 2005; Clarkson et al. 2007; Stanny & Ely, 2008; Busch & Hoffmann, 2011; Zhongfu et al. 2011). Some studies find that firm performance as measured by Tobin’s Q is positively associated with adherence to stringent environmental standards (Dowell et al. 2000). Busch & Hoffmann (2011) also provided strong evidence that corporate carbon performance has a positive association with Tobin’s Q. Other studies indicate that increasing carbon emissions negatively impact on market based measures of financial performance (using Tobin’s Q) in the US companies (Delmas & Nairn-Birch 2011). In respect to environmental disclosure context, some researchers found that Tobin’s Q, as
the indicator of economic performance, is positively associated with environment information disclosure (Zhongfu et al. 2011). Whereas, other studies found no significant association between Tobin’s Q and disclosures to CDP (Stanny et al, 2008; Wegener et al, 2013). Nonetheless, the present study follows the previous researches to measure Tobin’s Q (\texttt{TOBINSQ}), which is measured as market value measured of equity, plus book value of preferred stock, book value of long term debt and current liabilities, divided by book value of total assets (Chung & Pruitt, 1994; King & Lenox, 2001; Clarkson et al. 2007; Stanny and Ely, 2008; Zhongfu et al. 2011; Busch & Hoffmann, 2011; Wegener et al. 2013).

3.7.5 Capital Intensity (\texttt{CAPINT})

A number of prior studies test capital intensity as a variable that may affect the environmental performance and disclosure (e.g. Russo & Fouts, 1997; Elsayed & Paton, 2005; King & Lenox, 2002; Clarkson et al. 2007; Stanny & Ely, 2008; Walls et al, 2012). According to Aerts et al. (2009) indicate that the magnitude of a firm's capital investment makes it less flexible with regard to government actions on environmental issues. In addition, firms with higher capital expenditures are more likely to have higher carbon emission, but may want to disclose that they are investing in new equipment that reduces overall emissions (Stanny & Ely, 2008). Empirical evidence on the association between capital intensity and environmental performance disclosure are quite limited. Russo & Fouts (1997) found evidence of a positive association between capital intensity and environmental performance. In addition, Walls et al. (2012) found that capital intensity is positively associated with environmental strengths and negatively with environmental concern. In the context of environmental disclosure, Clarkson et al. (2007); Gao & Connors, (2011) documented that capital intensity is significantly and positively associated with environmental disclosure, while Stanny & Ely (2008) were unable to confirm any significant relationship between capital intensity and disclosure. In the current study, capital expenditures over sales are used as a measure of capital intensity (\texttt{CAPINT}) (Russo & Fouts, 1997; Elsayed & Paton, 2005; King & Lenox, 2002; Clarkson et al. 2007; Gao & Connors, 2011; Walls et al. 2012).
3.7.6 Intensive Sectors (INTSECTOR)

Intensive sectors are also a control variable that may influence the firms’ response to the CDP. In line with prior literature, intensive sectors are classified as Global Industry Classification Standard (GICS): 10 (Energy), 15 (Materials), 20 (Industrials), 25 (Consumer Discretionary), 30 (Consumer Staples), 35 (Health Care), 40 (Financials), 45 (Information Technology), 50 (Telecommunication Services), 55 (Utilities). This study measures Intensive Sectors (INTSECTOR) as a dummy variable that is coded one if a firm operates in the Materials, Energy or Utilities sector, and otherwise, zero (Luo & Tang 2011, Luo et al. 2012).

Table 3.4: Measurement of Control Variables

<table>
<thead>
<tr>
<th>Acronym/ Code</th>
<th>Variable Name</th>
<th>Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>FSIZE</td>
<td>Firm size</td>
<td>The natural logarithms of total assets.</td>
</tr>
<tr>
<td>ROA</td>
<td>Profitability</td>
<td>The firm’s return on assets.</td>
</tr>
<tr>
<td>LEV</td>
<td>Leverage</td>
<td>Total debt divided by total assets.</td>
</tr>
<tr>
<td>TOBINSQ</td>
<td>Tobin’s Q</td>
<td>Logarithm of market value measure of equity, plus book value of preferred stock, book value of long term debt and current liabilities, divided by book value of total assets.</td>
</tr>
<tr>
<td>CAPINT</td>
<td>Capital Intensity</td>
<td>Logarithm of the capital expenditure over sales.</td>
</tr>
<tr>
<td>INTESECTOR</td>
<td>IntensiveSector</td>
<td>A dummy variable that is coded 1 if a firm operates in Materials, Energy or Utilities sector, and 0 otherwise.</td>
</tr>
</tbody>
</table>

3.8 Data Analysis Procedures

This section illustrates an overview of the statistical techniques used in the current study. In order to test the hypotheses, descriptive statistics are used first that include sample values such as the Mean, Median, Standard Deviation, Minimum,
Maximum, 25th and 75th percentile of the variables and skewness-kurtosis to analyse the data for four years. And then, the Pearson correlation coefficients are carried out to identify the correlation between the dependent and independent variables in the current study. In addition, Ordinary Least Squares (OLS) multiple regression analysis is the primary statistical technique used to test the predicted association between two dimensions. First I investigate the association between corporate governance and carbon performance. Second is examination of the association between corporate governance and carbon disclosure. While the first has carbon performance as the dependent variable, the second has carbon disclosure as the dependent variable. Previous studies (e.g. Gujarati, 2003 and Hair et al. 2010) point out that the regression analysis is not applicable for inference beyond the sample if the assumptions are not met in the following: linearity, independence of errors, homoscedasticity, normality and multicollinearity. These assumptions were tested for multicollinearity based on the correlation coefficients as well as the variance inflation factor (VIF). In addition, an analysis of residuals, plots of the residuals (P.P plot), histogram of residuals as well as the Q–Q plot, have been performed to test for homoscedasticity, linearity and normality assumptions. Normality tests based on skewness and kurtosis have been also carried out. Finally, robust analysis is undertaken to check the robustness of the main regression analysis. This study has employed the software package STATA to conduct the statistical analysis.

3.9 Empirical Model

In order to investigate the link between corporate governance structure and carbon performance and the extensiveness of carbon disclosure together with the possible impact of the institutional environment in determining this relationship, the Ordinary Least Squares (OLS) multiple regression analysis is the primary model used in this study to examine this relationship, while other models are used to test the robustness of the overall model. The first has carbon performance as the dependent variable. The two models are the following:

Model (1): in order to test the relationship between corporate governance and carbon disclosure, the study uses the following regression model:
Model (1):

\[ \text{LOG}_C\_\text{PER} = \beta_0 + \beta_1 \text{NDB} + \beta_2 \text{NIDB} + \beta_3 \text{NFDB} + \beta_4 \text{NBM} + \beta_5 \text{NIDAC} + \beta_6 \text{EC}_D + \beta_7 \text{CEO}_\text{SO} + \beta_8 \text{CEO}_\text{LTB} + \epsilon \]  

\[ \text{LOG}_C\_\text{PER} = \beta_0 + \beta_1 \text{NDB} + \beta_2 \text{NIDB} + \beta_3 \text{NFDB} + \beta_4 \text{NBM} + \beta_5 \text{NIDAC} + \beta_6 \text{EC}_D + \beta_7 \text{CEO}_\text{SO} + \beta_8 \text{CEO}_\text{LTB} + \beta_9 \text{LOG}_\text{OWN}\_\text{CONC} + \beta_{10} \text{LOG}_\text{MANG}\_\text{OWN} + \epsilon \]  

Model (2):

To test the relationship between corporate governance and carbon disclosure, the study uses the following regression model:

Model (2):

\[ \text{C\_DIS} = \beta_0 + \beta_1 \text{NDB} + \beta_2 \text{NIDB} + \beta_3 \text{NFDB} + \beta_4 \text{NBM} + \beta_5 \text{NIDAC} + \beta_6 \text{NIDCC} + \beta_7 \text{NIDNC} + \beta_8 \text{EC}_D + \epsilon \]  

\[ \text{C\_DIS} = \beta_0 + \beta_1 \text{NDB} + \beta_2 \text{NIDB} + \beta_3 \text{NFDB} + \beta_4 \text{NBM} + \beta_5 \text{NIDAC} + \beta_6 \text{NIDCC} + \beta_7 \text{NIDNC} + \beta_8 \text{EC}_D + \beta_9 \text{LOG}_\text{OWN}\_\text{CONC} + \beta_{10} \text{LOG}_\text{MANG}\_\text{OWN} + \epsilon \]
\[ C_{\text{DIS}} = \beta_0 + \beta_1 \text{NDB} + \beta_2 \text{NIDB} + \beta_3 \text{NFDB} + \beta_4 \text{NBM} + \beta_5 \text{NIDAC} + \beta_6 \text{NIDCC} + \beta_7 \text{NIDNC} + \beta_8 \text{EC}_D + \beta_9 \text{LOG}_\text{OWN}_\text{CONC} + \beta_10 \text{LOG}_\text{MANG}_\text{OWN} + \beta_11 \text{FSIZE} + \beta_12 \text{ROA} + \beta_13 \text{LEV} + \beta_14 \text{LOG}_\text{TOBINSQ} + \beta_15 \text{LOG}_\text{CAPINT} + \epsilon \] \hspace{1cm} (3)

\[ C_{\text{DIS}} = \beta_0 + \beta_1 \text{NDB} + \beta_2 \text{NIDB} + \beta_3 \text{NFDB} + \beta_4 \text{NBM} + \beta_5 \text{NIDAC} + \beta_6 \text{NIDCC} + \beta_7 \text{NIDNC} + \beta_8 \text{EC}_D + \beta_9 \text{LOG}_\text{OWN}_\text{CONC} + \beta_10 \text{LOG}_\text{MANG}_\text{OWN} + \beta_11 \text{FSIZE} + \beta_12 \text{ROA} + \beta_13 \text{LEV} + \beta_14 \text{LOG}_\text{TOBINSQ} + \beta_15 \text{LOG}_\text{CAPINT} + \beta_16 \text{INTSECTOR} + \epsilon \] \hspace{1cm} (4)

**Description of the variables**

**Dependent Variables:**

- **LOG\_C\_PER** = Logarithm of the total Scope1 and Scope2 divided by the total sales at the end of fiscal year

- **C\_DIS** = is the total level of carbon disclosure scored using an index developed by Carbon Disclosure Project (CDP).

**Independent Variables:**

- **NDB** = Number of directors serving on the board.

- **NIDB** = Number of independent directors on the board.

- **NFDB** = Number of female directors on the board.

- **NBM** = Number of board meetings per year.

- **NIDAC** = Number of independent directors on audit committee.

- **NIDCC** = Number of independent directors on Compensation (remuneration) Committee.

- **NIDNC** = Number of independent directors on Nomination committee.
EC_D = A dummy variable equal to 1 if the company has a board-level environmental committee and 0 otherwise.

CEO_SO = A dummy variable equal 1 if CEO compensation includes a stock option and 0 otherwise.

CEO_LTB = A dummy variable equal 1 if CEO compensation includes a long term bonus and 0 otherwise.

LOG_OWN_CONC = Logarithm of the percentage of ordinary shares owned by substantial shareholder.

LOG_MANG_OWN = Logarithm of the percentage of total outstanding shares held by all directors.

Control Variables:

FSIZE = the natural logarithms of total assets.

ROA = the firm’s return on assets.

LEV = Total debt divided by total assets.

LOG_TOBINSQ = Logarithm of the market value measured of equity, plus book value of preferred stock, book value of long term debt and current liabilities, divided by book value of total assets.

LOG_CAPINT = Logarithm of the capital expenditure over sales.

INTESECTOR = A dummy variable that is coded 1 if a firm operates in Materials, Energy or Utilities sector, and 0 otherwise.

β0 = is the intercept coefficients

β1…16 = are the coefficients of each of the independent variables

€ = Error term.
3.10 Concluding Comments

This chapter has presented a description of the research methods applied and analysis method used in collecting data to test the presence of an association between corporate governance and carbon performance and the extensiveness of carbon disclosure. The chapter begins by providing an overview of the sampling procedures and the principal sources of data. In order to fulfil the purposes of this thesis, data related to corporate governance were manually collected from companies’ annual reports and data related to carbon performance and carbon disclosure scores were mainly gathered from firm's responses for the CDP standardised questionnaire. The final sample for the study consisted of the 205 largest Australian companies that participated in the CDP questionnaire over the period of 2009 until 2012. Moreover, the chapter presents in detail the criteria for choosing the final samples for this study. In addition, this chapter has developed two groups of hypotheses that are based on the literature review in Chapter Two. First, ten hypotheses are formulated to examine the relationship between corporate governance characteristics (board size, board independence, board diversity, board meeting, audit committee independence, the presence of environmental committee, CEO stock option, CEO long term bonus, ownership concentration and managerial ownership) and carbon performance. Second, ten hypotheses are developed to test the impact of corporate governance characteristics (board size, board independence, board diversity, board meeting, audit committee independence, compensation committee independence, nomination committee independence, the presence of environmental committee, ownership concentration and managerial ownership) on the extensiveness of carbon disclosure. The chapter also discussed in detail how to measure carbon performance and carbon disclosure. The measurement of independent and control variables are also discussed in this chapter. Finally, this chapter ends with an explanation of the regression models used to investigate the impact of corporate governance mechanisms on both carbon performance and the extensiveness of carbon disclosure.
CHAPTER FOUR: EXAMINING THE ASSOCIATION BETWEEN CORPORATE GOVERNANCE AND CARBON PERFORMANCE

4.1 Introduction

This chapter serves to provide an overview of the data analysis and the statistical techniques undertaken in the current study. This chapter presents the analysis related to Hypotheses 1.1 to 1.10. These hypotheses are addressing the first research question which is concerned with the relationship between the indicators of corporate governance and carbon performance. The present chapter is outlined as follows: section 4.2 describes the diagnostic tests conducted on the data employed in this chapter; section 4.3 discusses the descriptive statistics for all variables (dependent, independent, and control variables); section 4.4 addresses the potential multicollinearity problem between independent variables; section 4.5 depicts the correlation coefficients between dependent variables, independent variables and control variables; section 4.6 presents the multiple regression results of testing the hypotheses set out in Chapter Three; section 4.7 illustrates and discusses additional analysis and the robustness checks; section 4.8 shows conclusions for the chapter.

4.2 Testing the validity of the regression model

As explained earlier the main model of the current study is Ordinary Least Squares (OLS) multiple regression analysis to test ten hypotheses that have been discussed in section 3.3.1 in Chapter Three. As a result, in order to determine the validity of the underlying regression model, previous studies (e.g. Gujarati, 2003, Pallant, 2007 and Hair et al. 2010) point out that the regression analysis is not applicable for inference beyond the sample if the following assumptions are not met:
4.2.1 Linearity

This assumption indicates that the dependent variable is linearly related to the model coefficients (Myers, 1990). To check the assumption of linearity, the current study has been used for the plot of residuals in a graph (not reported), which is the most common method of assuring the linearity existence among the variables. If the linearity exists, a residual plot will see the data points symmetrically distributed around the identity line. However, if the data points are not identically distributed around the identity line, the data represent nonlinear relationships and adjustments will need to be made to avoid erroneous predictions (Hopkins & Ferguson, 2014). Therefore, it can be concluded that the majority of variables met the condition of linearity assumption.

4.2.2 Independent error terms

Another assumption of multiple regression analysis is that the errors associated with one observation are not correlated with the errors of any other observation. To check the assumption of independent error terms, this study has employed the Durbin-Watson test to determine the independence of error terms (Durbin & Watson, 1951). According to Field (2005), the Durbin-Watson statistic ranges in value from 0 to 4, with a value of 2 meaning that there is no autocorrelation in the sample. In this study the Durbin-Watson test statistic was 1.31 for the final model (not reported) being close to 2, which is the ideal value for independence of error terms; this means that the distribution of the errors was independent.

4.2.3 Homoscedasticity

The homoscedasticity assumption is considered to be one of the important assumptions of multiple regression analysis. This assumption requires the error variance of the dependent variable have the same values of independent variable or constant variance (Hair et al. 2010). The homoscedasticity can be evaluated by two methods; graphical and statistical methods. This study has employed the graphical method by plotting the residuals in a graph, which is relatively easily
accomplished with popular software packages such as SPSS, SAS and STATA. Therefore, the graphs of residual scatter plots (which are not reported) indicate that the assumption of homoscedasticity was satisfied.

4.2.4 Normality Assumption

This assumption asserts that the sampling distribution of the mean is normal. Normality of residuals in the current study can be applied by two statistical approaches: graphical approaches and numerical approaches. The normal probability plot of the residuals (P.P plot) and histogram of residuals have been performed in this study to assess the normality assumptions, which indicates that the residuals are normally distributed (not reported). The first graphical method is the histogram of residuals, which considers the simplest option that can be made upon visual inspection, an output available through most of the statistical software programs. This output can assist researchers to identify non-normality by noting areas that fall outside of the normal distribution. Another graphical technique for evaluating normality of the data is the normal probability plot (P.P plot). Hair et al. (2010) suggested that the normal probability plot can be a reliable approach of graphical analysis as actual data values are compared with the cumulative distribution of normal distribution. In addition, there are various numerical approaches to test the normality assumption. However, the current study has used skewness and kurtosis as a common statistical test for normality. Table 4.1 shows skewness and kurtosis values of all variables are within the normal range, which means that the presented data are largely normally distributed. Thus, the statistical techniques used in this study met the general rule of thumb, and assures the assumption of normality is not violated.

4.2.5 Multicollinearity

Another fundamental assumption in regression analysis refers to the existence of a linear relationship among one or more of the explanatory variables of the regression model. This assumption was tested by conducting the Variance Inflation Factor (VIF) with tolerance values and correlation coefficient among the variables. If a Pearson’s rank correlation coefficient is less than 0.9, the limit or cut off correlation percentage, prior studies suggest multicollinearity is likely not
to exist (see Field, 2009; Hair et al. 2010, and Tabachnick & Fidell, 2013). However, there has been no definitive criterion for the level of correlation that constitutes a serious multicollinearity problem (Tsui, Ashford, StClair, & Xin, 1995; Chen & Francesco, 2003). While some researchers indicated that correlations of 0.8 or higher are problematic (e.g. Gujarati, 2003 and Cooper and Schindler, 2003); others suggest that the general rule of thumb is that it should not exceed 0.75 (e.g. Tsui, Ashford, StClair, & Xin, 1995 and Green, 1978). The Pearson correlations in Table 4.3 offered that the highest correlation coefficient between board size and board independence is 0.838, implying that multicollinearity is not likely to be a potential problem because the Pearson correlation indicators for all independent and control variables are less than 0.9.

Another place to check for multicollinearity is in the tolerance (TOL) and variance inflation factor (VIF) of all the independent and control variables calculated. Tolerance is an indicator of how much of the variable in the independent variable is not explained by the other independent variables in the model. If the tolerance values are greater than 0.1 (TOL> 0.10), it suggests that multicollinearity does not exist among all independent variables (Pallant, 2007). Another means to evaluate the multicollinearity problem is to look at the Variance Inflation Factor (VIF), which is the inverse of the Tolerance measure (1 divided by Tolerance), it regresses each independent variable of the remaining independent variables to capture any linear dependencies. As a rule of thumb, if the VIF values are less than 10 (VIF< 10), it also indicates that there is no issue of multicollinaerity (e.g. Myers, 1990; Gujarati, 2003). It can be observed in Table 4.2 that the highest VIF value is 5.48 and the mean VIF is 1.93, the lowest tolerance coefficient is 0.182. Therefore, the results of the values of tolerance (TOL) and variance inflation factor (VIF) confirm that there is no issue of multicollinerainty in the current study.

Generally, if any of these assumptions are violated by the nature of data; then the forecasts, confidence intervals and the outcomes of the regression model are likely to be inaccurate or seriously biased. In this case, non-parametric tests become more appropriate (Balian, 1982). This study has used the statistical software STATA to carry out the above statistical analysis.
4.3 Descriptive Statistics

Table 4.1 depicts the descriptive statistics for all variables (dependent, independent, and control variables) performed in the empirical model.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
<th>Std. Dev</th>
<th>Median</th>
<th>Min</th>
<th>Max</th>
<th>Skewness</th>
<th>Kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOG_C_PER</td>
<td>-2.815</td>
<td>1.897</td>
<td>-2.589</td>
<td>-7.849</td>
<td>0.820</td>
<td>-0.261</td>
<td>2.148</td>
</tr>
<tr>
<td>NDB</td>
<td>8.234</td>
<td>1.900</td>
<td>8</td>
<td>5</td>
<td>13</td>
<td>0.409</td>
<td>3.070</td>
</tr>
<tr>
<td>NIDB</td>
<td>6.385</td>
<td>1.969</td>
<td>7</td>
<td>2</td>
<td>12</td>
<td>0.123</td>
<td>2.920</td>
</tr>
<tr>
<td>NFDB</td>
<td>1.254</td>
<td>0.807</td>
<td>1</td>
<td>0</td>
<td>4</td>
<td>0.296</td>
<td>2.950</td>
</tr>
<tr>
<td>NBM</td>
<td>11.741</td>
<td>3.650</td>
<td>11</td>
<td>4</td>
<td>24</td>
<td>0.750</td>
<td>3.647</td>
</tr>
<tr>
<td>NIDAC</td>
<td>3.693</td>
<td>1.124</td>
<td>4</td>
<td>2</td>
<td>9</td>
<td>1.560</td>
<td>8.521</td>
</tr>
<tr>
<td>EC_D</td>
<td>0.429</td>
<td>0.496</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0.286</td>
<td>1.081</td>
</tr>
<tr>
<td>CEO_SO</td>
<td>0.683</td>
<td>0.466</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>-0.786</td>
<td>1.618</td>
</tr>
<tr>
<td>CEO_LTB</td>
<td>0.868</td>
<td>0.399</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>-2.178</td>
<td>5.744</td>
</tr>
<tr>
<td>LOG_OWN_CONC</td>
<td>0.293</td>
<td>2.187</td>
<td>0</td>
<td>-3.034</td>
<td>4.579</td>
<td>0.488</td>
<td>1.901</td>
</tr>
<tr>
<td>LOG_MANAG_OWN</td>
<td>-6.044</td>
<td>2.430</td>
<td>-6.668</td>
<td>-11.077</td>
<td>0</td>
<td>1.099</td>
<td>3.472</td>
</tr>
<tr>
<td>FSIZE</td>
<td>16.284</td>
<td>2.171</td>
<td>15.807</td>
<td>12.360</td>
<td>23.337</td>
<td>1.018</td>
<td>3.658</td>
</tr>
<tr>
<td>ROA</td>
<td>0.037</td>
<td>0.153</td>
<td>0.031</td>
<td>-0.467</td>
<td>1.795</td>
<td>7.553</td>
<td>89.022</td>
</tr>
<tr>
<td>LEV</td>
<td>0.236</td>
<td>0.133</td>
<td>0.226</td>
<td>0.002</td>
<td>0.695</td>
<td>0.801</td>
<td>3.979</td>
</tr>
<tr>
<td>LOG_TOBINSQ</td>
<td>1.169</td>
<td>0.801</td>
<td>0.969</td>
<td>-0.268</td>
<td>3.493</td>
<td>0.700</td>
<td>2.867</td>
</tr>
<tr>
<td>LOG_CAPINT</td>
<td>-2.480</td>
<td>1.720</td>
<td>-2.587</td>
<td>-7.118</td>
<td>1.635</td>
<td>-0.056</td>
<td>2.350</td>
</tr>
<tr>
<td>INTSECTOR</td>
<td>0.357</td>
<td>0.480</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0.601</td>
<td>1.361</td>
</tr>
</tbody>
</table>

Notes: All variables are described in the model development section and Tables 3.3 & 3.4 for variable definitions. N is the number of observations.

According to the above table, the mean (median) of carbon performance for the overall sample period is -2.815(-2.589), the standard deviation of carbon performance is approximately 1.897, with a minimum of -7.849 and a maximum of 0.820. Because of the high skewness and kurtosis statistics for the original value of the variable carbon performance, this variable has been transformed using a natural logarithm transformation in the empirical model. After the transformation, the skewness statistics of the variable were reduced from 3.189 to -0.261 and kurtosis from 14.174 to 2.148, respectively (Table 4.1). The mean (median) board size in this study sample is 8.234(8) directors, of which 6.385 are independent directors, indicating that board size in Australia seems to be smaller than board size in US companies (e.g., the median value of board size in US companies is approximately 11 in Bhagat & Black, 2002), and the majority of the directors are independent, which is in line with the ASX Good Governance...
Principles and Recommendations (2003, 2007). In addition, there is a substantial variability in board size, ranging from a minimum of 5 directors to a maximum of 13 directors. The data show that the average of the number of female directors on the board is 1.253, with standard deviation of .807. In addition, on average 11.741 board meetings were held each year, with a wide range from a minimum of 5 to a maximum of 24. With respect to board committees, the average (median) number of directors in an audit committee is 3.693(4) with standard deviation of 1.124, and a maximum and a minimum size of 9 and 2, respectively. On average, 42.6 % of the sample firms have an environmental committee. Regarding compensation structure, Table 4.1 also presents that 68.3% of firms offered stock options and 86.8% offered long term bonuses as part of CEO compensation. With regards to ownership structure, it can be observed that, the mean level of ownership concentration which is measured as the percentage of ordinary shares owned by substantial shareholder is 29.3%. While managerial ownership was measured by the percentage of total outstanding shares held by all directors, it has a mean of -6.044 (median -6.669), with standard deviation of 2.429. It can be also seen in the above table that the ownership concentration and managerial ownership had high values for skewness and kurtosis. Thus, a natural logarithm has been used to transform these variables to reduce the skewness and kurtosis statistics to a lower and acceptable level. A log of ownership concentration reduced skewness from 2.070 to 0.488 and kurtosis from 7.087 to 1.901. A log of managerial ownership reduced skewness from 3.959 to 1.099 and kurtosis from 18.533 to 3.472. Finally, regarding the control variables, Table 4.1 shows that the mean (median) value of firm size measured as the natural logarithms of total assets is approximately 16.284(15.807), indicating that the sample of this study comprises relatively larger companies in Australia, with a standard deviation of 2.171, a minimum size and a maximum of 12.359 and 23.337, respectively. The data also show that the mean (median) value of ROA is 36.6 %(3.1%) and leverage (LEV) is 23.5 %(22.6%), respectively. The mean (median) of Tobin’s Q and Capital Intensity are 1.168(.969) and -2.479(-2.586), respectively, with a standard deviation of .801 and 1.720. The Tobin’s Q and Capital Intensity variables initially had very high values for skewness and kurtosis. Thus, following previous study (e.g. Al-Akra & Ali, 2012; Delmas & Nairn-Birch, 2011; Iwata & Okada 2011), these variables have been transformed by using a natural logarithm transformation. A log
transformation of Tobin’s Q and Capital Intensity provided the most suitable distribution. A log of Tobin’s Q mitigated skewness from 2.439 to 0.700 and kurtosis from 9.566 to 2.867. A log of capital intensity mitigated skewness from 6.253 to -0.056 and kurtosis from 55.723 to 2.349. The average percentage of firms in emission intensive sectors is 35.6%, ranging from 0-1.

4.4 Results of Multicollinearity check

As can be shown in Table 4.2 below, the highest VIF value is 5.48 and the mean VIF is 1.93. Moreover, the lowest tolerance coefficient is 0.182. Consequently, the above results of VIF with tolerance values indicate that there is no multicollinearity issue between the independent and control variables. Therefore, these variables can be used in the empirical model.

Table 4.2: Variance Inflation Factor (VIF) of corporate governance structures and control variables

<table>
<thead>
<tr>
<th>Variables</th>
<th>VIP</th>
<th>Tolerance (1/VIF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIDB</td>
<td>5.48</td>
<td>0.182</td>
</tr>
<tr>
<td>NDB</td>
<td>4.57</td>
<td>0.218</td>
</tr>
<tr>
<td>CEO_LTB</td>
<td>1.83</td>
<td>0.546</td>
</tr>
<tr>
<td>LOG_TOBINSQ</td>
<td>1.85</td>
<td>0.539</td>
</tr>
<tr>
<td>NFDB</td>
<td>1.81</td>
<td>0.553</td>
</tr>
<tr>
<td>FSIZE</td>
<td>1.67</td>
<td>0.599</td>
</tr>
<tr>
<td>NIDNC</td>
<td>1.68</td>
<td>0.594</td>
</tr>
<tr>
<td>CEO_SO</td>
<td>1.57</td>
<td>0.635</td>
</tr>
<tr>
<td>LOG_MANAG_OWN</td>
<td>1.51</td>
<td>0.662</td>
</tr>
<tr>
<td>INTSECTOR</td>
<td>1.36</td>
<td>0.734</td>
</tr>
<tr>
<td>EC_D</td>
<td>1.35</td>
<td>0.742</td>
</tr>
<tr>
<td>LOG_CAPINT</td>
<td>1.31</td>
<td>0.764</td>
</tr>
<tr>
<td>NBM</td>
<td>1.32</td>
<td>0.756</td>
</tr>
<tr>
<td>LEV</td>
<td>1.28</td>
<td>0.783</td>
</tr>
<tr>
<td>LOG_OWN_CONC</td>
<td>1.20</td>
<td>0.835</td>
</tr>
<tr>
<td>ROA</td>
<td>1.17</td>
<td>0.858</td>
</tr>
</tbody>
</table>

Mean VIF 1.93

Note: Definition of variables are described in the model development section
4.5 Correlation Coefficients Analysis

Table 4.3 provides the Pearson correlation coefficients for all variables (dependent, independent, and control variables) performed in the empirical model. The results show that the carbon performance (LOG_C_PER) is significantly negatively correlated with the board size (NDB), board independence (NIDB), board diversity (NFDB) which is measured by the number of female directors on the board and audit committee independence (NIDAC) at the 1% level (p < 0.01, two-tailed). Significant and positive correlation exists with the presence of the environmental committee (EC_D) (p < 0.01, two-tailed), which is consistent with the hypothesis (1.6). In contrast, the positive but not significant correlation amongst carbon performance (LOG_C_PER), and the annual number of board meetings (NBM), ownership concentration (LOG_OWN_CONC) and managerial ownership (LOG_MANAG_OWN), while the presence of a share option (CEO_SO) and long term bonuses (CEO_LTB) are insignificantly negative correlated with carbon performance (LOG_C_PER). The analysis indicates that carbon performance (LOG_C_PER) is significantly negatively correlated with both the natural logarithms of total assets (FSIZE) and Tobin’s Q (TOBINSQ) at the 1% level (p < 0.01, two-tailed), whereas positive correlations are identified between the carbon performance (LOG_C_PER) and Capital Intensity (CAPINT) and Intensive Sector (INTSECTOR) at the same level. In contrast, no significant relationship is detected between carbon performance (LOG_C_PER) and profitability (ROA)

A number of significant correlations also existed between the numerous independent variables. More specifically, the number of directors serving in the board (NDB) is positively correlated with board independence (NIDB), number of female directors in the board (NFDB), audit committee independence (NIDAC) and CEO long term bonuses (CEO_LTB) at the 1% level (p < 0.01, two-tailed), and significant negative correlations with board meetings (NBM) and with managerial ownership (LOG_MANAG_OWN). Nevertheless, the insignificant relationship of the presence of an environmental committee (EC_D), the presence of a share option (CEO_SO) and ownership concentration (LOG_OWN_CONC) are confirmed for board size (NBM). The correlations analysis indicates that
board independence (NIDB) is positively correlated with the number of female directors in the board (NFDB), audit committee independence (NIDAC), the presence of an environmental committee (EC_D) and long term bonuses (CEO_LTB) at the 1% level (p < 0.01, two-tailed), and significant and negative correlated with board meetings (NBM) and with managerial ownership (LOG_MANAG_OWN) at the same level. However, no significant relationship is detected between board independence (NIDB) and each of the presence of a share option (CEO_SO) and ownership concentration (LOG_OWN_CONC). In addition, the number of female directors on the board (NFDB) has significant positive correlation with only audit committee independence (NIDAC). Furthermore, audit committee independence (NIDAC) is only negatively correlated with managerial ownership (LOG_MANAG_OWN). The presence of an environmental committee (EC_D) has significant and positive correlation with CEO long term bonuses (CEO_LTB) at the 5% level, but is negatively correlated with managerial ownership (LOG_MANAG_OWN) at the same level. In addition, the presence of a share option (CEO_SO) is positively related to CEO long term bonuses (CEO_LTB) at the 1% level, and negatively related to managerial ownership (LOG_MANAG_OWN) at the same level. The Pearson Correlation analyses also shows that the CEO long term bonuses (CEO_LTB) have significant and positive correlation with managerial ownership (LOG_MANAG_OWN) at the 1% level, and negative correlation with ownership concentration (LOG_OWN_CONC). Additionally, managerial ownership is significantly positively correlated with ownership concentration (LOG_OWN_CONC) at the 5% level. Finally, for the correlations between independent variables and control variables, board size (NDB), board independence (NIDB) and board diversity as measured by the number of female directors on the board (NFDB), these are positively correlated with both the natural logarithms of total assets (FSIZE) and Tobin’s Q (TOBINSQ) at the 1% level (p < 0.01, two-tailed), and significantly negatively correlated with Capital Intensity (CAPINT) at the same level. Whereas weak correlation exists between board independence (NIDB) and Intensive Sector (INTSECTOR) at the 10% level (p < 0.10, two-tailed), significant negative correlations are identified between the number of female directors on the board (NFDB) and Intensive Sector (INTSECTOR) at the 1% level (p < 0.01, two-tailed). The analysis also indicates
that the number of board meetings (NBM) is positively correlated with firm size (FSIZE), and negatively correlated with profitability (ROA). Another significant result shows that audit committee independence is positively correlated with both firm size (FSIZE) and Tobin’s Q (TOBINSQ), and negative correlated with Capital Intensity (LOG_CAPINT) and with Intensive Sector (INTSECTOR) at the 1% level. In addition, the presence of environmental committee (EC_D) is significantly negatively correlated with Tobin’s Q (TOBINSQ), and positively with Intensive Sector (INTSECTOR) at the 10% level (p < 0.10, two-tailed). With regard to CEO compensation structure, both stock options (CEO_SO) and long term bonuses (CEO_LTB) are significantly and negatively correlated with both leverage (LEV) and Capital Intensity (CAPINT), and positively correlated with Intensive Sector (INTSECTOR) at the same level, while stock options (CEO_SO) and Tobin’s Q (TOBINSQ) were positive at the 5% level. Finally, in respect to ownership structure, ownership concentration (LOG_OWN_CONC) is positively correlated with only profitability (ROA) at the 5% level and managerial ownership (LOG_MANAG_OWN) is significantly negatively correlated with both firm size (FSIZE) and Tobin’s Q (TOBINSQ) at the 1% level.
Table 4.3: Pearson’s Correlation Coefficients (N=205)

<table>
<thead>
<tr>
<th></th>
<th>LOG_C_PER</th>
<th>NDB</th>
<th>NIDB</th>
<th>NFDB</th>
<th>NBM</th>
<th>NIDAC</th>
<th>EC_D</th>
<th>CEO_SO</th>
<th>CEO_LTB</th>
<th>LOG_OWN_CONC</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOG_C_PER</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NDB</td>
<td>-0.207***</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NIDB</td>
<td>-0.209***</td>
<td>0.838***</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NFDB</td>
<td>-0.358***</td>
<td>0.399***</td>
<td>0.521***</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NBM</td>
<td>0.053</td>
<td>-0.294***</td>
<td>-0.183**</td>
<td>-0.061</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NIDAC</td>
<td>-0.289***</td>
<td>0.291***</td>
<td>0.484***</td>
<td>0.432***</td>
<td>0.076</td>
<td>1.000</td>
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<td></td>
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<tr>
<td>EC_D</td>
<td>0.313***</td>
<td>0.090</td>
<td>0.186***</td>
<td>0.021</td>
<td>-0.014</td>
<td>0.044</td>
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<tr>
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<td>-0.029</td>
<td>0.223</td>
<td>0.253***</td>
<td>0.105</td>
<td>-0.004</td>
<td>0.048</td>
<td>0.0134***</td>
<td>0.541***</td>
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<td>-0.115*</td>
<td>-0.087</td>
<td>-0.028</td>
<td>0.002</td>
<td>-0.031</td>
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<td>LOG_MANAG_OWN</td>
<td>0.029</td>
<td>-0.172*</td>
<td>-0.289***</td>
<td>-0.096</td>
<td>-0.111</td>
<td>-0.278***</td>
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<td>-0.049</td>
<td>-0.053</td>
<td>-0.153***</td>
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<td>-0.072</td>
<td>0.075</td>
<td>0.062</td>
<td>0.143**</td>
</tr>
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<td>LEV</td>
<td>0.135**</td>
<td>0.085</td>
<td>-0.039</td>
<td>0.130**</td>
<td>-0.007</td>
<td>-0.084</td>
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<td>-0.181***</td>
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<td>-0.044</td>
</tr>
<tr>
<td>LOG_TOBINSQ</td>
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<td>0.418***</td>
<td>0.428***</td>
<td>0.333***</td>
<td>-0.059</td>
<td>0.316***</td>
<td>-0.258***</td>
<td>0.147**</td>
<td>0.109</td>
<td>-0.089</td>
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<td>-0.276***</td>
<td>0.171***</td>
<td>0.097</td>
<td>-0.309***</td>
<td>0.012</td>
<td>-0.135**</td>
<td>-0.146**</td>
<td>-0.107</td>
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<td>INTSECTOR</td>
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<td>-0.125*</td>
<td>-0.348***</td>
<td>-0.089</td>
<td>-0.169***</td>
<td>-0.199***</td>
<td>0.135**</td>
<td>0.130**</td>
<td>0.061</td>
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<th>LEV</th>
<th>LOG_TOBINSQ</th>
<th>LOG_CAPINT</th>
<th>INTSECTOR</th>
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<td>0.059</td>
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<td>LOG_TOBINSQ</td>
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<td>0.462***</td>
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<td>0.197***</td>
<td>1.000</td>
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<td>LOG_CAPINT</td>
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<td>-0.186***</td>
<td>0.041</td>
<td>0.056</td>
<td>-0.189***</td>
<td>1.000</td>
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</tr>
<tr>
<td>INTSECTOR</td>
<td>-0.054</td>
<td>-0.140**</td>
<td>0.104</td>
<td>-0.091</td>
<td>-0.163***</td>
<td>0.229***</td>
<td>1.000</td>
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</tbody>
</table>

Notes: *, ** and *** denote significance at the 10%, 5%, and 1% levels, respectively, based on two-tailed tests. All variables are described in model development section and Tables 3.3 & 3.4 for variable definitions.
4.6 Multivariate Analysis and Hypotheses Testing

As has been illustrated in Chapter Three, Ordinary Least Squares (OLS) multiple regression analysis is the primary model used in this study to examine all the hypotheses. OLS regression has been generalised using linear modelling technique that may be used to model a single response variable (dependent variable) which has been recorded on at least an interval scale. This techniques may be applied to single or multiple explanatory variables and also categorical explanatory variables that have been appropriately coded (Hutcheson & Sofroniou, 1999). OLS have been also considered as a powerful technique since it is relatively easy to check the model assumptions such as linearity, constant variance and the effect of outliers using simple graphical methods. So, four equations of regression model have been employed to test the impact of various corporate governance mechanisms on carbon performance. The first model was employed to test the impact of board structure (e.g. board size, board independence, board meetings …etc.) on carbon performance while the second model was utilised to investigate whether board structure and ownership structure have any influence on a firm’s carbon performance. Model three was used to examine the effect of board structure and ownership structure including control variables which might have an influence on carbon performance namely: firm size, profitability, leverage, Tobin’s Q and Capital Intensity, without the Intensive Sector in the model (i.e. industry dummy variables are not presented), whereas model four was performed to investigate the impact of all governance variables and all control variables on carbon performance. The results of the OLS models are shown in the Table 4.4.
### Table 4.4: results of OLS Regression between Governance Variables and Carbon Performance

<table>
<thead>
<tr>
<th>Variables</th>
<th>Pred. Sign</th>
<th>Model (1) Board Structure</th>
<th>Model (2) Board Structure and Ownership Structure</th>
<th>Model (3) Mode (1)+Model (2)+ control variables without Intensive sector variable</th>
<th>Model (4) Model (3)+ Intensive sector variable</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Coef.</td>
<td>P-value</td>
<td>Coef.</td>
<td>P-value</td>
</tr>
<tr>
<td>NDB</td>
<td>+</td>
<td>0.149</td>
<td>1.27</td>
<td>0.135</td>
<td>1.14</td>
</tr>
<tr>
<td>NIDB</td>
<td>+</td>
<td>-0.299**</td>
<td>-2.34</td>
<td>-0.289**</td>
<td>-2.22</td>
</tr>
<tr>
<td>NFDB</td>
<td>+</td>
<td>-0.525***</td>
<td>-3.05</td>
<td>-0.507***</td>
<td>-2.92</td>
</tr>
<tr>
<td>NBM</td>
<td>-</td>
<td>0.024</td>
<td>0.73</td>
<td>0.023</td>
<td>0.70</td>
</tr>
<tr>
<td>NIDAC</td>
<td>+</td>
<td>-0.172</td>
<td>-1.38</td>
<td>-0.200</td>
<td>-1.57</td>
</tr>
<tr>
<td>EC_D</td>
<td>+</td>
<td>1.388***</td>
<td>5.81</td>
<td>1.361***</td>
<td>5.68</td>
</tr>
<tr>
<td>CEO_SO</td>
<td>+</td>
<td>-0.405</td>
<td>-1.37</td>
<td>-0.497*</td>
<td>-1.65</td>
</tr>
<tr>
<td>CEO_LTB</td>
<td>+</td>
<td>0.275</td>
<td>0.66</td>
<td>0.378</td>
<td>0.86</td>
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<tr>
<td>LOG_OWN_CONC</td>
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<td>1.33</td>
<td>0.091</td>
<td>1.83</td>
</tr>
<tr>
<td>LOG_MANAG_OWN</td>
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<td>-0.038</td>
<td>-0.71</td>
<td>-0.055</td>
<td>-1.09</td>
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<td>FSIZE</td>
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<td></td>
<td>0.075</td>
<td>1.27</td>
</tr>
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<td>ROA</td>
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<td>0.55</td>
<td>0.289</td>
<td>0.55</td>
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<td>LEV</td>
<td>?</td>
<td></td>
<td></td>
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<td>2.47</td>
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<tr>
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<td></td>
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<td>LOG_CAPINT</td>
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<td>INTSECTOR</td>
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<tr>
<td>Constant</td>
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<td>-1.682**</td>
<td>-2.05</td>
<td>-1.802**</td>
<td>-2.19</td>
</tr>
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<td>Observations</td>
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<td>205</td>
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<tr>
<td>F-Value</td>
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<td>10.11(.000)</td>
<td></td>
<td>8.31(.000)</td>
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<tr>
<td>Adjusted R2</td>
<td></td>
<td>26.32%</td>
<td></td>
<td>26.38%</td>
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</table>

Notes: *, ** and *** denote significance at the 10%, 5%, and 1% levels, respectively, based on two-tailed tests. All variables are described in the model development section and Tables 3.3 & 3.4 for variable definitions.
4.6.1 Discussion of statistical Results

This section provides the results obtained from regressing the carbon performance variable on the various independent variables. Table 4.4 reports an adjusted $R^2$ are 26.32%, 26.38%, 43.64% and 52.73%, and the F-Values are 10.11, 8.31, 11.53 and 15.22 respectively for the four models and are highly statistically significant at the 1% level. These results indicate that all four models show a high explanatory power of the relationship between the dependent and independent variables.

Results of model 1

The first model examines the association of the eight variables that proxy for board structure with carbon performance. The results from model 1, reported in the third column of Table 4.4, show that a strong significant positive association between the presence of environmental committee and carbon performance ($\beta= 1.388$, $p < 0.01$, two-tailed). The results also indicate that board independence is negatively and significantly related to carbon performance at the 5% level ($\beta= -0.299$, $p < 0.05$, two-tailed). The result also shows that the number of female directors in the board is negatively and significantly associated with carbon performance ($\beta= -0.525$, $p < 0.01$, two-tailed). On the other hand, the regression result observed that no significant association is documented between carbon performance and board size, board meetings and the independence of audit committee. Turning to the findings for the compensation package, the results indicate CEO Stock Options and CEO Long Term Bonus are both statistically insignificantly related to carbon performance, with coefficient estimate of -0.405 and 0.275 and a $p$-value of -1.37 and 0.66, respectively. The adjusted $R^2$ of this model is 26.32%, indicating that 26.32% of variance in carbon performance can be explained by the model in the current study. The F-Value for this model is 10.11 and is highly statistically significant at the 1% level. These results indicate that the model shows a reasonably acceptable explanatory power of the relationship between the dependent and independent variables.
Results of model 2

The second model tests the joint impact of board structure and ownership structure on carbon performance. The findings in this model, stated in the fifth column of Table 4.4, observe that the presence of an environmental committee is statistically significantly positively associated with carbon performance ($\beta= 1.361, p < 0.01$, two-tailed). The empirical results also show that board independence is significant and has a negative association with carbon performance ($\beta= -0.289, p < 0.05$, two-tailed). The result also indicates that the number of female directors in the board is negatively and significantly associated with carbon performance ($\beta= -0.507, p < 0.01$, two-tailed). Nevertheless, the regression result displays that no significant association is found between carbon performance and board size, board meetings and the independence of audit committee. Regarding compensation structure, the result of regression indicates that the CEO stock options has a slightly significant negative association with carbon performance ($\beta= -0.497, p < 0.1$, two-tailed). However, the CEO long term bonus has a positive, but insignificant, association with coefficient of 0.378 and a p-value of 0.86. In respect of ownership structure, the results suggest that two aspects of ownership structure, namely ownership concentration and managerial ownership have insignificant association with carbon performance, with coefficient estimate of 0.074 and -0.038 and a p-value of 1.33 and -0.71, respectively. The adjusted R2 of the model is 26.38 %, indicating that 26.38% of variance in carbon performance can be explained by the current model; the F-Values for this model is 8.31 and is highly statistically significant at the 1% level. These results indicate that the models show a high explanatory power of the relationship between variables.

Results of model 3

The third model tests the relationship between all corporate governance variables and carbon performance, including control variables, but without the Intensive Sector variable. The findings from model 3, described in the fourth column of Table 4.4, imply that two variables of corporate governance characteristics, namely board independence and the presence of environmental committee are significantly associated with carbon performance at the 1% level. However, for the other corporate governance characteristics including board size, board diversity, board
meetings and the independence of audit committee, the results indicate the insignificant relationship with carbon performance. Concerning the two aspects of compensation packages, the results of OLS regression indicate that the two variables of executive compensation, namely the CEO stock options and the CEO long term bonus have insignificant association with carbon performance, with coefficient of – 0.151 and 0.629 and a p-value of – 0.56 and 1.59 respectively. With reference to ownership structure, this model provides the same results at the second model, which shows that neither of the two aspects of ownership structure, namely ownership concentration and managerial ownership was found to be significant related to carbon performance, with coefficient of 0.091 and – 0.055, a p-value of 1.83 and – 1.09 respectively.

Among the control variables, only leverage, Tobin’s Q and Capital Intensity are found to be significantly related to carbon performance at the 1% level. Nonetheless, no significant relationship is detected between carbon performance and firm size and profitability. The adjusted R2 of this model is 43.64% indicating that 43.64 per cent of variance in carbon performance can be explained by the model in the current study; the F- Values for this model is 11.53 and is highly statistically significant at the 1% level. These results indicate that the model shows a high explanatory power of the relationship between the dependent and independent variables.

**Results of hypothesis testing for the fourth model**

This study developed ten principal testable hypotheses to investigate the impact of corporate governance on carbon performance. In this section, based on descriptive statistics and Pearson’s correlation coefficients, this study performed the Ordinary Least Squares (OLS) multiple regression model to testing this relationship. The rule of decision in this study is based on the significances of the t-statistics which are symbolized by the p-value flagged by the statistical packages used.

The results from regression model 4, reported in the sixth column of Table 4.4, indicates that the adjusted R2 of the model is 52.73% indicating that 52.73 per cent of variance in carbon performance can be explained by the primary model in the current study, the F- Values for this model is 15.22 and is highly statistically significant at the 1% level. These results indicate that the model showed an
acceptable high explanatory power of the relationship between the dependent and independent variables.

The results of regression model in column 6 of Table 4.4 showed that the coefficient of board size is positive but not statistically significant associated with carbon performance, with coefficient estimate of 0.112 and a p-value of 1.09, which is inconsistent with my expectation (H1). This result implies that larger boards are ineffective in improving carbon performance. One of the possible reasons is companies with large board may be more likely to suffer from agency problems. Larger boards might have a lack of coordination, communication and have free rider problems, which leads to slower and less-efficient decision-making and decreased board efficiency (Lipton & Lorsch, 1992; Jensen, 1993; Yermack, 1996). In an Australian context, the size of Australian boards is usually small with an average number of less than 10 directors (Kiel & Nicholson, 2003; Stapledon & Lawrence, 1996 & Bonn, 2004). This implies that board size of Australian companies tends to be smaller than optimal. In sum, this result failed to find support for hypothesis H1, but is in line with findings that were gathered by Hafsi & Turgut (2013), who failed to find any significant association between board size and social performance. The result, however, differs with the findings of Walls et al. (2012) who provides evidence that board size is positively related to environmental concerns. The result also contradicts the findings of de Villiers et al. (2011) who indicate that environmental performance is higher in firms that have larger boards. As for board independence, the result shows that the board independence is not statistically significantly related to carbon performance. The coefficient estimate on independent directors is -0.128 with a p-value of -1.18, this is inconsistent with my hypothesis H2. The result implies board independence may be less effective as monitors of management (Barako et. al. 2006) because they might not be provided sufficient information on a company’s carbon activities. Another possible explanation is that the NIDB prefer to focus on corporate financial performance rather than environmental performance. Although the finding is inconsistent with Zhang et al, (2013); Dunn & Sainty (2009) and Johnson & Greening (1999), who found positive association in contrast with Kassinis & Vafeas (2002), who report negative association between board independence and environmental litigations The result is consistent with previous study by Ibrahim et al (2003); and Ibrahim & Angelidis
(1995) who document an insignificant relationship between outside directors and the legal and ethical dimensions of CSR and also similar to McKendall, Sanchez, & Sicilian, (1999) who were unable to find a significant relationship between board independence and environmental violations. Overall the hypothesis H2 in this study is supported based on the statistical results.

With regards to board diversity measured by the number of female directors on the board; inconsistent with this study’s expectation, the empirical result displays that an insignificant negative association between the numbers of female directors on the board and carbon performance. It produced a coefficient estimate of -0.055 and with a p-value of -0.36. The plausible explanation for this could be that because the percentage of females on the board is relatively small (as seen in the descriptive statistics section, the average of females on the board is 1), which hinders the ability of female directors to exert influence on board. According to critical mass theory, firms that have one or two women on their board may not be sufficient for change to happen (Konrad et al. 2008). Also, as Rosener (1995) indicates, one woman on the board is often regarded as a token, two women on the board might not be enough to influence the board’s decision process. In this respect, this result is consistent with previous empirical findings of Coffey & Wang, (1998) who found insignificant relationship between the percentage of women board members and corporate philanthropy. However, it is contradictory to the evidence presented by Hafsi & Turgut, (2013); Boulouta (2013) & Zhang et al (2013), who found a positive and significant relationship exists between the proportion of women directors on the board and corporate social responsibility (CSR) performance. Hence, this study does not find support for the prediction that there is a positive association between corporate board diversity and carbon performance.

Concerning the board meeting, the regression result depicts that insignificant association observed between the frequency of board meetings and carbon performance, with a coefficient estimate of 0.022 and a p-value of 0.78. Therefore, this finding does not support hypothesis H4 which anticipated that the number of board meetings is negatively related to carbon performance. This result is in line with the argument that board meetings are not necessarily useful to shareholders (Ntim & Osei, 2011 & Vefeas, 1999a) because the limited time directors spend together is not used for the meaningful exchange of ideas with directors or management (Vefeas,
1999a; Lipton & Lorsch, 1992). This result is consistent with previous findings that board size is unrelated to carbon performance. If a large board does not effectively monitor management and a large board would have more meetings, then the more meetings of a large board should have less impact on carbon performance. Currently, there are few empirical studies investigating the relationship between board meetings and carbon performance in particular. However, previous research on Corporate Social Responsibility in general found mixed results. Although Prado et al. (2009b) did not find any significant impact of the number of annual meetings of the administration on the volume of information on Corporate Social Responsibility, Prado-Lorenzo & Garcia-Sánchez, (2010) opined that the number of meetings held by the board of directors during a financial year is negatively and significantly associated with the dissemination of information on GHG.

As for the independence of audit committee, the result of regression indicates that the independence of audit committee is insignificantly negatively related to carbon performance. The regression produced a coefficient estimate of -0.046 and a p-value of -0.44. This is inconsistent to my expectation indicated in H5. A possible explanation for this result is the majority of firms do not undertake any social or environmental audit.

Referring to the environmental committee, the results of the regression model displayed the presence of an environmental committee is strongly and positively associated with carbon performance at the 1% level (p-value < 0.01, two-tailed), which is consistent with H6. The result suggests firms that created an environmental committee are likely to adopt a proactive environmental strategy and they probably have an environmental orientation in their decision-making. Such a strategy can translate into detailed carbon reduction programs that facilitate carbon performance. In addition, the presence of an environmental committee can be viewed as a means to better monitor management in terms of their environmental actions and performance and as an effective way to provide advice to management when addressing the environmental issues (Rodrigue et al. 2013). Furthermore, the setting up of an environmental committee can be seen as a way of addressing stakeholders' interests and resolving the problem of legitimacy gap (Michelon & Parbonetti, 2012). In this regard, this result can be deemed consistent with Walls et al. (2012), who indicated that an environmental board committee is positively associated with both
environmental strengths and environmental concerns. The result also is in line with the argument of Lam & Li (2008) who pointed out that firms with an environmental committee on their board are related to a significant increase in environmental performance for high polluting firms. However, the result contradicts the evidence presented by Rodrigue et al. (2013), who failed to find significant association between the existence of an environmental committee on the board and environmental performance which is measured in terms of regulatory compliance, pollution prevention and environmental capital expenditures, as with McKendall et al. (1999), who also failed to find significant association between social responsibility committee and environmental violations.

Regarding CEOs, the empirical result indicates that neither of the two components of compensation for CEOs was found to be significant at the 1% or 5% levels in all the four models. The findings in the sixth column of Table 4.4 show that the CEO stock options are not statistically significantly associated with carbon performance the coefficient estimate on CEO stock options is -0.233 with a p-value of -0.95. Such insignificant and negative association is inconsistent to my expectation. A possible reason for this result is due to excessive focus on a financial performance even in the longer term goals that may be detrimental to the promotion of social and environmental objectives (Mahoney & Thorne, 2006). In this respect, this result supports the argument of Coombs & Gilley (2005), who suggested no relationship between stock options and any CSR dimensions. This result is also similar to the findings from the exploratory study by McGuire et al. (2003), who failed to find relationship between long term incentives including stock options and good social performance. The result, however, is in contrast to the findings of Mahoney & Thorne, (2005, 2006); Deckop et al. (2006) and Callan & Thomas, (2012), who document positive association between the CEO stock options in long term and corporate social performance and also in contrast with Berrone & Gomez-Mejia, (2009a) who provide evidence that long term pay such as stock options is positive and highly significant for pollution prevention performance. Thus, based on the result, the current study does not reject hypothesis H7 that the CEO stock options in the long term are not positively associated with carbon performance.

The sixth column of Table 4.4 shows that CEO long term bonus has a positive coefficient, which is consistent with my expectation. However, the coefficient value
is 0.359 and a p-value of 0.99, so it is not statistically significant. Thus, the result does not strongly reject H8. Recently, there is no empirical study that linked CEO long term bonus to carbon performance. Nevertheless, in the context of social performance in general, Callan & Thomas (2012), provides evidence that the long term compensation which includes restricted stock, stock options and long term incentive plans, is positively associated with social performance, whereas Rekker et al. (2014), found that there is a negative relation between long term compensation such as long-term bonus and socially responsible firms.

With reference to ownership structure, as can be observed in the column 6 of Table 4.4, ownership concentration is not statistically significantly correlated with carbon performance, with the coefficient value of 0.068 and a p-value of 1.48. This is in keeping with my expectation. A possible explanation for this finding could be that, carbon activities incur costs (Liao et al. 2014) and the existence of substantial shareholders may prevent managers from engaging in conspicuous social and environmental activities. Another possibility is that ownership concentration may give firms less freedom to pursue carbon policies that go above and beyond compliance. This is consistent with the result provided by Brown et al. (2006) who did not find any significant relationship between the concentration of ownership and corporate Philanthropy, and Adams & Hardwick (1998), who failed to find any connection between concentration ownership and corporate giving. This result, on the other hand, is inconsistent with the work of Earnhart & Lizal. (2006) who found that greater concentration of ownership in the company leads to better environmental performance with respect to absolute emissions. Therefore, this result does not reject hypothesis H9, that there is no significant association between ownership concentration and carbon performance.

The results described in the last column of Table 4.4 indicate the managerial ownership is negatively but not significantly related to carbon performance, with coefficient of – 0.055 and a p-value of – 1.20. This is also consistent with this study's earlier expectation. The plausible explanation for this result may be due to the fact that the level of managerial ownership in the current study sample is negligible. Another possibility is that managers with less shares in the companies are relatively less concerned about social and environmental activities. This result is in line with the work of Paek et al. (2013), who provide evidence that managerial ownership has
an insignificant association with CSR performance in terms of community, environment, and product dimensions but, however, not inconsistent with Jia & Zhang (2013), who found that managerial ownership had a positive and significant association with CSP factors such as donation probability and charity. The result also disagrees with Johnson & Greening (1999), who found a positive association between top management equity share and social performance in terms of environment and product quality. This result also in contrast to the findings of Oh et al. (2011), who documented that managerial ownership is significantly negatively associated with CSR rating of the firms, and with Simerly & Bass (1998) who provide evidence of significant negative relationship between a firm’s corporate social performance and the proportion of stock equity owned by top management. Therefore, Results reported in Table 4.4 fail to reject hypothesis H10 that no association exists between managerial ownership and carbon performance.

Among the control variables, the results in the last column of Table 4.4 show that the coefficient of leverage is significantly positive associated with carbon performance at the 1% level. The findings suggest that companies with higher degrees of leverage might be inclined to improve carbon performance. This result corroborates the study by De Villiers et al. (2011) & Walls et al. (2012), who found that leverage is positively associated with environmental performance. Similarly, Capital Intensity has significant and positive relationship with carbon performance at the 1% level ($\beta= 0.176$, $p < 0.01$, two-tailed). This result indicates that companies with higher sustaining capital expenditures may want to signal their environmental type through more disclosures regarding their environmental performance. This result is consistent with the previous literature of Russo & Fouts, (1997) & Walls et al. (2012). It is also observed that Intensive Sectors is positively associated with carbon performance at the 1% level. This finding indicates that companies operating in the higher level of carbon emissions will lead to increased carbon exposure so that these companies tend to promote carbon performance. The results also display that the coefficient of Tobin’s Q is statistically significantly and negatively associated with carbon performance ($\beta= -1.059$, $p < 0.01$, two-tailed). The result is consistent with prior work by Delmas & Nairn-Birch (2011), who found that increasing carbon emissions negatively impact on market based measures of financial performance (using Tobin’s Q) in US companies. On the other hand, the results indicate that the coefficient of
firm size is not statistically significant associated with carbon performance ($\beta=0.064$, $p$- value = 1.18). This result is inconsistent with the prediction that bigger companies tend to provided more information on GHG emissions than smaller companies (Luo et al. 2013). In addition, it is argued that firms that are smaller in size may not exhibit high level socially responsible behaviours as do larger firms (Waddock & Graves, 1997; Busch & Hoffmann, 2011). One possible explanation is that the majority of firms in the sample study are the largest Australian companies. This result is congruent with the work of Grant, Jones, & Bergesen, (2002) who documented that firm size is not related to pollution prevention performance. Similarly, profitability is statistically insignificant associated with carbon performance ($\beta=0.226$, $p$- value = 0.35). Although it can be argued that firms with more profit could more easily afford the expenditures needed for carbon activity (Luo & Tang, 2011), Delmas & Nairn-Birch (2011) found that direct carbon emissions have insignificant association with ROA in 1100 US companies.

4.7 Further analysis and Robustness Checks

In this section I provided several tests that could validate the robustness of the main results. That is, board size measured using a cut-off basis, audit committee independence measured using a cut-off basis and alternative measure for firm size

4.7.1 Board Size measured using a cut-off basis.

Following Jensen (1993), who suggested that more than eight members on a board are less likely to function effectively in the US, this study used eight members as the cut-off basis as an alternative measure for board size. Therefore, the current study measured board size as a dummy variable by taking the value of 1 if board size is equal or more than eight members, and 0 otherwise. The summaries of analysis (which are un-tabulated) confirm the initial evidence that board size is an insignificant factor influencing carbon performance. The findings on other variables are the same as those reported in Table 4.4.
4.7.2 Audit committee independence measured using cut-off basis.

Prior studies, such as Klein (2002a), Bedard, Chtourou & Courteau (2004), Davidson et al. (2005) and Baxter & Cotter (2009), examined the sensitivity of audit committee independence to specific cut-offs. In order to confirm the credibility of the results of regression analyses, this study repeated the OLS regression model with alternative measures of audit committee independence, where measured as a dummy variable by taking the value of 1 if the audit committee is composed solely of independent directors and 0 otherwise. The current study has chosen 100% threshold as the cut-off point, following the published literature and governance reports e.g. Menon & Williams, (1994); BRC, (1999); ASX, (2003) & Davidson et al. (2005), who suggested that an audit committee should consist exclusively of non-executive or independent directors. The results (un-tabulated) confirm that audit committee independence has no significant effect, which is consistent with the original results of the regression analyses. While the results for the other variables are virtually similar to those reported in Table 4.4, except board independence, which had a weak relationship with carbon performance at the 10% level.

4.7.3 Alternative measure for company size

A number of prior studies, such as Stanwick & Stanwick, (2001) & Berrone et al. (2010) have employed the logarithm of the firm’s total sales as a proxy for firm size. Therefore, the current study used this measure as an alternative measure for firm size. The analysis results (which are un-tabulated) confirmed that firm size as measured by logarithm of the firm’s total sales has no significant influence on carbon performance, which is consistent with the main test results. The rest of other variables have similar results to those presented in Table 4.4. Furthermore, instead of using the total assets, I have re-tested my results again by using the total market capitalisation as another alternative measure of firm size. The findings (which are un-tabulated) show similar results to those in Table 4.4.

4.7.4 Alternative Measures of independent variable

Another additional test is carried out to investigate the surprising results of an insignificant association between CG and CP. I used the proportion proxy of board
independence, board diversity, audit committee independence, compensation committee independence and nomination committee independence as alternative measures instead of using the actual numbers of these variables, for example, NIDB to NDB as board independence, NFBD to NDB as female percentage, NIDAC to NAC as the proportion of independent directors on the audit committee, NIDCC to NCC as the proportion of independent directors on the compensation committee and NIDNC to NNC as the proportion of independent directors on the nomination committee. The results of these alternative variables (not reported) are consistent with the continuous variable results in the key regression.

4.7.5 Endogeneity Test

Previous studies (e.g. Demsetz and Lehn, 1985; Kole, 1996 & Himmelberg et al. 1999) argue that the firm’s ownership structure is endogenously determined. Endogeneity occurs when ownership and performance are interdependent (a causality problem), or when unobserved firm characteristics affecting both variables present (a missing variable problem). Therefore, in order to check whether endogeneity exists between the dependent variables (e.g. carbon performance) and independent variable (e.g. managerial ownership) in this study, the Hausman test was performed (Gujarati and Porter, 2008). The results of Hausman test (which are un-tabulated) display insignificant evidence of an endogeneity bias (p-value = 0.44), suggesting that the results do not seem to suffer from the problem of endogeneity. Thus, I can remain with OLS regression analysis as the original results.

4.8 Concluding Comments

This chapter aimed to investigate empirically the impact of corporate governance mechanisms, namely: board size, board independence, board diversity, board meetings, audit committee independence, presence of environmental committee, CEO stock option, CEO long term bonuses, ownership concentration and managerial ownership, on carbon performance in a sample of the largest Australian companies over the period of four years from 2009 to 2012. The association between corporate governance mechanisms and carbon performance has been performed based on a variety of statistical techniques and analyses, including descriptive statistics, correlation coefficient analysis and the multivariate analysis with a regression
analysis. This chapter begins by providing the descriptive statistics for all variables (dependent, independent, and control variables) performed in the empirical model. Table 4.1 indicates that some variables had high values for skewness and kurtosis. This means that these variables were not normally distributed, so transformations of these variables are needed. In addition, this study has performed the VIF and correlation coefficient to test the existence of multicollinearity in the empirical model. These results indicate that there is no multicollinearity issue between the independent and control variables. Therefore, these variables can be fitted into the empirical model.

In addition, an OLS regression model is adopted in order to explain the impact of various corporate governance mechanisms on carbon performance. In order to determine the validity of the underlying OLS multiple regression, the data have been examined to validate the OLS regression assumptions. These assumptions are linearity, independence of errors, homoscedasticity, normality and multicollinearity. Based on the findings of the empirical section, it is concluded that only the presence of an environmental committee was statistically significantly positively associated with carbon performance. However, other variables of corporate governance mechanisms (board size, board independence, board diversity, board meetings, audit committee independence, CEO stock option, CEO long term bonus, ownership concentration and managerial ownership) are not statistically significant associated with carbon performance. Further, the results also indicate that leverage, Tobin’s Q, Capital Intensity and industry types, as a control variable, have a strong positive association with carbon performance. In contrast, the study did not provide any evidence that firm size and profitability are related to carbon performance. Finally, several additional tests were undertaken to check the robustness of the main regression model.
CHAPTER FIVE: EXAMINING THE ASSOCIATION BETWEEN CORPORATE GOVERNANCE AND CARBON DISCLOSURE

5.1 Introduction

The previous chapter provided the first phase of this thesis which focused on a quantitative investigation of the impact of various corporate governance mechanisms on carbon performance. The purpose of this chapter is to explore the second stage of this thesis to provide an overview of the data analysis based on statistical techniques used to investigate the association between corporate governance mechanisms and the extensiveness of carbon disclosure in Australian companies. Therefore, this chapter begins by providing five statistical assumptions to determine the validity of the regression model in this study. The chapter then outlines a comprehensive descriptive analysis of the variables used in the second part of this empirical work, which aims to examine the impact of corporate governance mechanisms on the extensiveness of carbon disclosure. In addition, this chapter conducts a correlation coefficients analysis to detect the problem of collinearity and multicollinearity among variables. The chapter also conducts a Multicollinearity check by way of a variance inflation factor (VIF) analysis to test the existence of multicollinearity in the empirical model. Furthermore, the chapter presents multiple regression results of testing the hypotheses established in Chapter Three. The chapter further discusses an additional analysis to check the robustness of the main regression analysis. Finally, this chapter ends by presenting a brief summary of the statistical techniques used and their results.

5.2 Testing the validity of the regression model

As previously explained, the main model of the current study is Ordinary Least Squares (OLS) multiple regression analysis to test ten hypotheses that have been discussed in section 3.3.2 in Chapter Three. Consequently, in order to determine the validity of the underlying regression model, previous studies (e.g., Gujarati, 2003; Pallant, 2007 & Hair et al. 2010) point out that the regression analysis is not applicable for inference beyond the sample if the following assumptions are not met:
first, assumption of linearity: this assumption indicates that the relationships between the predictors and the outcome variable should be linear. As mentioned in chapter 4, section 4.2.1, the plot of residuals in a graph has been performed in this study to determine the existence of a linear relationship among the variables, which is the most common method of assuring the linearity. Therefore, the results, which are un- tabulated, suggest that the majority of variables met the condition of linearity assumption. Second, independence of errors: this assumption suggests that the errors associated with one observation are not correlated with the errors of any other observation. As mentioned, the Durbin-Watson test is used to determine the independence of error terms (Durbin & Watson, 1951). According to Field (2005, 2009) the Durbin-Watson statistic ranges in value from 0 to 4 with a value of 2 meaning that there is no autocorrelation in the sample. In this study, the Durbin-Watson test statistics were 1.63 for the final model (un-tabulated) being close to 2, which is the ideal value for independence of error terms; this means that the distribution of the errors was independent. Third, homoscedasticity assumption: this assumption requires the error variance of the dependent variable has the same values of an independent variable or constant variance (Hair et al. 2010). As illustrated earlier, the graphical method, by plotting the residuals in a graph, has been employed in the current study to check the assumption of independent error terms, which is accomplished relatively easily with popular software packages such as STATA, SPSS, and SAS. Therefore, the graphs of residual scatter plots (un- tabulated) indicate that the assumption of homoscedasticity was satisfied. Fourth, normality assumption: this assumption asserts that the sampling distribution of the mean is normal. As acknowledged earlier, this assumption is tested by conducting two statistical approaches: graphical approaches and numerical approaches. The normal probability plot of the residuals (P.P plot) and histogram of residuals have been performed in this study to assess the normality assumptions, which indicate that the residuals are normally distributed, which are not reported. In addition, skewness and kurtosis test statistics are conducted (see Table 5.1) to test the normality assumption. Table (5.1) shows skewness and kurtosis values of all variables are within the normal range, which means that the presented data are largely distributed normally. Hence, the statistical technique used in this study has met the condition of normality. Finally, the assumption of multicollinearity: this assumption refers to the existence of a linear relationship among one or more of the explanatory variables of the regression model.
As discussed earlier, this assumption was tested by conducting the Variance Inflation Factor (VIF) and correlation coefficient among the variables. When a Pearson's rank correlation coefficient is less than 0.90, the limit or cut off correlation percentage, prior studies suggest multicollinearity is likely not to exist (see Field, 2009; Hair et al. 2010; Tabachnick & Fidell, 2013). Nonetheless, there has been no definitive criterion for the level of correlation that constitutes a serious multicollinearity problem (Tsui, Ashford, StClair, and Xin, 1995; Chen and Francesco, 2003). While some researchers indicated that correlations of 0.8 or higher are problematic (e.g., Gujarati, 2003; Cooper & Schindler, 2003) others suggest that the general rule of thumb is that it should not exceed 0.75 (e.g. Tsui, Ashford, StClair, and Xin, 1995; Green, 1978). The Pearson correlations in Table 5.3 showed that the highest correlation coefficient that existed between board size and board independence is 0.838, implying that multicollinearity is not likely to be a potential problem. In addition, the tolerance (TOL) and variance inflation factor (VIF) of all the independent and control variables have been calculated. It can be observed in Table 5.2 that the highest VIF value is 5.60 and the mean VIF is 1.90, the lowest tolerance coefficient is 0.179, indicating that there is no problem as the VIF is < 10 and the tolerance coefficient is > 0.10 (Myers, 1990; Gujarati, 2003). Therefore, the results of the values of TOL and VIF confirm that there is no serious problem of multicollinearity in this model. In general, if any of these assumptions are violated by the nature of the data, then the forecasts, confidence intervals, and economic insight yielded by a regression model may be inefficient or seriously biased. In this case, non-parametric tests have become more appropriate (Balian, 1982).
5.3 Descriptive Statistics

Table 5.1 displays the descriptive statistics for all variables used in this study over the sample years, 2009-2012 inclusive.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
<th>Std. D</th>
<th>Median</th>
<th>Min</th>
<th>Max</th>
<th>Skewness</th>
<th>Kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>C_DIS</td>
<td>71.278</td>
<td>13.576</td>
<td>71</td>
<td>23</td>
<td>97</td>
<td>-0.253</td>
<td>3.019</td>
</tr>
<tr>
<td>NDB</td>
<td>8.234</td>
<td>1.900</td>
<td>8</td>
<td>5</td>
<td>13</td>
<td>0.409</td>
<td>3.070</td>
</tr>
<tr>
<td>NIDB</td>
<td>6.385</td>
<td>1.969</td>
<td>7</td>
<td>2</td>
<td>12</td>
<td>0.123</td>
<td>2.920</td>
</tr>
<tr>
<td>NFDB</td>
<td>1.254</td>
<td>0.807</td>
<td>1</td>
<td>0</td>
<td>4</td>
<td>0.296</td>
<td>2.950</td>
</tr>
<tr>
<td>NBM</td>
<td>11.741</td>
<td>3.650</td>
<td>11</td>
<td>4</td>
<td>24</td>
<td>0.750</td>
<td>3.647</td>
</tr>
<tr>
<td>NIDAC</td>
<td>3.693</td>
<td>1.124</td>
<td>4</td>
<td>2</td>
<td>9</td>
<td>1.560</td>
<td>8.521</td>
</tr>
<tr>
<td>NIDCC</td>
<td>3.043</td>
<td>1.463</td>
<td>3</td>
<td>0</td>
<td>7</td>
<td>-0.792</td>
<td>3.425</td>
</tr>
<tr>
<td>NIDNC</td>
<td>3.312</td>
<td>2.555</td>
<td>3</td>
<td>0</td>
<td>11</td>
<td>0.353</td>
<td>2.566</td>
</tr>
<tr>
<td>EC_D</td>
<td>0.429</td>
<td>0.496</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0.286</td>
<td>1.081</td>
</tr>
<tr>
<td>LOG_OWN_CONC</td>
<td>0.293</td>
<td>2.187</td>
<td>0</td>
<td>-3.034</td>
<td>4.579</td>
<td>0.488</td>
<td>1.901</td>
</tr>
<tr>
<td>LOG_MANAG_OWN</td>
<td>-6.044</td>
<td>2.430</td>
<td>-6.668</td>
<td>-11.077</td>
<td>0</td>
<td>1.099</td>
<td>3.472</td>
</tr>
<tr>
<td>ROA</td>
<td>0.037</td>
<td>0.153</td>
<td>0.031</td>
<td>-0.467</td>
<td>1.795</td>
<td>7.553</td>
<td>89.022</td>
</tr>
<tr>
<td>LEV</td>
<td>0.236</td>
<td>0.133</td>
<td>0.226</td>
<td>0.002</td>
<td>0.695</td>
<td>0.801</td>
<td>3.979</td>
</tr>
<tr>
<td>LOG_TOBINSQ</td>
<td>1.169</td>
<td>0.801</td>
<td>0.969</td>
<td>-0.268</td>
<td>3.493</td>
<td>0.700</td>
<td>2.867</td>
</tr>
<tr>
<td>LOG_CAPINT</td>
<td>-2.480</td>
<td>1.720</td>
<td>-2.587</td>
<td>-7.118</td>
<td>1.635</td>
<td>-0.056</td>
<td>2.350</td>
</tr>
<tr>
<td>INTSECTOR</td>
<td>0.357</td>
<td>0.480</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0.601</td>
<td>1.361</td>
</tr>
</tbody>
</table>

Notes: All variables are described in the model development section and Tables 3.3 & 3.4 for variable definitions. N is the number of observations.

As shown in the above table, the mean (median) of carbon disclosure for the whole sample is 71.28% (71%) out of 100 indicating disclosing companies have a good level of understanding and awareness regarding carbon related issue and management. It ranges from a minimum of 23 to a maximum of 97 among the sampled firms, suggesting considerable variation in the extent of disclosures made in responses to their CDP questionnaire. The mean (median) board size in this study sample is 8.234(8) directors, of which 6.385 are independent directors, indicating that board size in Australia seems to be smaller than board size in US companies (e.g., the median value of board size in US companies is approximately 11 in Bhagat & Black, 2002), and the majority of the directors are independent, which is in line with the ASX Good Governance Principles and Recommendations of (2003; 2007). In addition, there is a substantial variability in board size, ranging from a minimum of 5 directors to a maximum of 13 directors. The data show that the average of the number of female directors on the board is 1.253, with standard deviation of .807. In
addition, on average 11.741 board meetings were held each year, with a wide range from a minimum of 4 to a maximum of 24. With respect to board committees, the average (median) number of directors in audit, remuneration, and nomination committee are 3.693(4), 3.043(3) and 3.312(3), respectively, with standard deviation of 1.124, 1.463 and 2.555, respectively, and 42.6% of surveyed firms had established a board-level environmental committee. With regards to ownership structure, it can be observed that the mean level of ownership concentration which is measured as the percentage of ordinary shares owned by substantial shareholder is 29.3%. Managerial ownership, measured by the percentage of total outstanding shares held by all directors, has a mean of -6.044 (median -6.668), with standard deviation of 2.430. It can also be seen in the above table that the ownership concentration and managerial ownership had high values for skewness and kurtosis. Thus, a natural logarithm has been used to transform these variables to reduce the skewness and kurtosis statistics to a lower and acceptable level. A log of ownership concentration reduced skewness from 2.070 to 0.488 and kurtosis from 7.087 to 1.901. A log of managerial ownership reduced skewness from 3.959 to 1.099 and kurtosis from 18.533 to 3.472. Finally, regarding the control variables, Table 5.1 shows that the mean (median) value of firm size measured as the natural logarithms of total assets is approximately 16.284 (15.807), indicating that the sample of this study comprises relatively larger companies in Australia, with a standard deviation of 2.171, a minimum size and a maximum of 12.360 and 23.337, respectively. The data also show that the mean (median) value of ROA are 3.7 % (3.1%) and leverage are 23.5 % (22.6%), respectively. The mean (median) of Tobin’s Q and Capital Intensity are 1.169 (.969), -2.480 (-2.587), respectively, with a standard deviation of .801 and 1.720. The Tobin’s Q and Capital Intensity variables initially had very high values for skewness and kurtosis. Thus, following previous study (e.g. Al-Akra & Ali, 2012; Delmas & Nairn-Birch, 2011; Iwata and Okada, 2011), these variables have been transformed by using a natural logarithm transformation. A log transformation of Tobin’s Q and capital intensity provided the most suitable distribution. A log of Tobin’s Q mitigated skewness from 2.439 to 0.700 and kurtosis from 9.566 to 2.867. A log of capital intensity mitigated skewness from 6.253 to -0.056 and kurtosis from 55.723 to 2.350. The average number of firms in emission intensive sectors is 35.7%, ranging from a minimum of zero to a maximum of one.
5.4 Results of Multicollinearity check

The VIF has been undertaken as another effective method for testing the multicollinearity in the regression model. According to previous studies (e.g., Myers, 1990; Gujarati, 2003) there is no problem if the VIF is < 10 and the tolerance coefficient is > 0.10. As can be presented in Table 5.2 below, the highest VIF value is 5.60 and the mean VIF is 1.90. Moreover, the lowest tolerance coefficient is 0.179. Consequently, the below results of the values of tolerance (TOL) and VIF values indicate that there is no multicollinearity issue between the independent and control variables. Therefore, the overall results show that there is no alert for a multicollinearity threat when performing a regression analyses.

**Table 5.2: Variance Inflation Factor (VIF) of corporate governance structures and control variables**

<table>
<thead>
<tr>
<th>Variables</th>
<th>VIP</th>
<th>Tolerance (1/VIF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIDB</td>
<td>5.60</td>
<td>0.179</td>
</tr>
<tr>
<td>NDB</td>
<td>4.58</td>
<td>0.218</td>
</tr>
<tr>
<td>NFDB</td>
<td>1.82</td>
<td>0.550</td>
</tr>
<tr>
<td>LOG_TOBINSQ</td>
<td>1.81</td>
<td>0.553</td>
</tr>
<tr>
<td>NIDAC</td>
<td>1.76</td>
<td>0.569</td>
</tr>
<tr>
<td>FSIZE</td>
<td>1.71</td>
<td>0.583</td>
</tr>
<tr>
<td>NIDNC</td>
<td>1.44</td>
<td>0.693</td>
</tr>
<tr>
<td>LOG_MANAG_OWN</td>
<td>1.44</td>
<td>0.696</td>
</tr>
<tr>
<td>NIDCC</td>
<td>1.43</td>
<td>0.700</td>
</tr>
<tr>
<td>NBM</td>
<td>1.34</td>
<td>0.743</td>
</tr>
<tr>
<td>INTSECTOR</td>
<td>1.35</td>
<td>0.739</td>
</tr>
<tr>
<td>EC_D</td>
<td>1.33</td>
<td>0.744</td>
</tr>
<tr>
<td>LOG_CAPINT</td>
<td>1.26</td>
<td>0.792</td>
</tr>
<tr>
<td>LEV</td>
<td>1.19</td>
<td>0.837</td>
</tr>
<tr>
<td>ROA</td>
<td>1.17</td>
<td>0.856</td>
</tr>
<tr>
<td>LOG_OWN_CONC</td>
<td>1.14</td>
<td>0.878</td>
</tr>
</tbody>
</table>

**Mean VIF** 1.90

*Note: Definition of variables are described in the model development section*

5.5 Correlation Coefficients Analysis

Table 5.3 provides the Pearson correlation coefficients for all variables (dependent, independent, and control variables) performed in the empirical model. The results show that the carbon disclosure is significantly positively correlated with the board size, board independence, board diversity which is measured by number of female directors on the board and audit committee independence (p < 0.01, two-tailed). In
contrast, the correlation coefficients for carbon disclosure and nomination committee independence and the presence of environmental committee are positive but not significant, while there is a negative but insignificant relationship between carbon disclosure and each of board meetings, compensation committee independence, ownership concentration and managerial ownership. The analysis of the Pearson correlation coefficient also indicates that carbon disclosure is significantly positively correlated with each of the natural logarithms of total assets, Tobin’s Q and negatively with Intensive Sector at the 1% level (p < 0.01, two-tailed). In contrast, positive but not significant correlations are identified between carbon disclosure and profitability, while the coefficients for carbon disclosure and leverage and Capital Intensity are negative but not significant.

A number of significant correlations also existed between the numerous independent variables. More specifically, number of directors serving on the board is positively correlated with board independence, number of female directors on the board, audit committee independence, nomination committee independence and compensation committee independence at the 1% level (p < 0.01, two-tailed), and significant negative correlations with board meetings and with managerial ownership. Nonetheless, there is not any significant correlation existing between board size and the presence of an environmental committee or with ownership concentration. The correlations analysis indicates that board independence is positively correlated with audit committee independence, nomination committee independence, compensation committee independence and the presence of environmental committee at the 1% level (p < 0.01, two-tailed), and significant and negatively correlated with both board meetings and managerial ownership at the same level. However, no significant correlation is confirmed between board independence and ownership concentration. In addition, the number of female directors on the board has significant positive correlation with the audit committee independence, compensation committee independence and nomination committee independence at the 1% level. Furthermore, the number of board meetings is significantly negatively correlated with nomination committee independence at the 1% level but weakly correlated with compensation committee independence at the 10% level. Moreover, audit committee independence is statistically significantly positively correlated with both compensation committee independence and nomination committee independence at the 1% level, but
negatively correlated with managerial ownership at the same level. The Pearson Correlation analyses also show that compensation committee independence have significant and positive correlation with nomination committee independence at the 1% level, whereas weak correlation exists between compensation committee independence and the presence of environmental committee at the 10% level. The independence of nomination committee has a weak correlation with ownership concentration at the 10% level. In addition, managerial ownership has negative correlation with each of the presence of environmental committee, compensation committee independence and nomination committee independence at the 1% level, but significantly positively correlated with ownership concentration at the 5% level. Finally, for the correlations between independent variables and control variables, board size, board independence, board diversity as measured by number of female directors on the board, board meetings and audit committee independence, are positively correlated with the natural logarithms of total assets at the 1% level (p < 0.01, two-tailed). However ownership concentration has significant and negative correlation with the natural logarithms of total assets at the same level. In addition, Tobin’s Q is statistically significantly positively correlated with each of board size, board independence, board diversity as measured by number of female directors in the board, audit committee independence and nomination committee independence at the 1% level, but significantly negatively correlated with both compensation committee independence and ownership concentration at the same level. Moreover, board meetings is significantly negatively correlated with profitability at the 5% level, but significantly positively correlated with ownership concentration at the same level. Whereas, weak correlation exists between board size and profitability at the 10% level (p < 0.10, two-tailed). In addition, Capital Intensity is significantly negatively correlated with each of board size, board independence, board diversity as measured by number of female directors in the board, audit committee independence and nomination committee independence. The analysis also indicates that both the number of female directors in the board and audit committee independence are negatively correlated with Intensive Sector at the 1% level (p < 0.01, two-tailed). But, significant and positive correlations are identified between the existence of environmental committee and Intensive Sector at the same level. While, a weak sign exists board independence and Intensive Sector at the 10% level.
Table 5.3: Pearson’s Correlation Coefficients (N=205)

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<th>NIDB</th>
<th>NFDB</th>
<th>NBM</th>
<th>NIDAC</th>
<th>NIDCC</th>
<th>NIDNC</th>
<th>EC_D</th>
<th>LOG_OWN_CONC</th>
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</tr>
<tr>
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<td>-0.289***</td>
<td>-0.096</td>
<td>-0.111</td>
<td>-0.278***</td>
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<td>-0.171***</td>
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<td>-0.072</td>
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<td>-0.159**</td>
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<td>INTSECTOR</td>
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<td>-0.125*</td>
<td>-0.348***</td>
<td>-0.089</td>
<td>-0.169***</td>
<td>0.082</td>
<td>0.005</td>
<td>0.199***</td>
<td>0.061</td>
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<th>ROA</th>
<th>LEV</th>
<th>LOG_TOBINSQ</th>
<th>LOG_CAPINT</th>
<th>INTSECTOR</th>
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<tr>
<td>INTSECTOR</td>
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<td>-0.140**</td>
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<td>-0.091</td>
<td>-0.163***</td>
<td>0.229***</td>
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Notes: * *, ** and *** denote significance at the 10%, 5%, and 1% levels, respectively, based on two-tailed tests. All variables are described in model development section and Tables 3.3 & 3.4 for variable definitions.
5.6 Multivariate Analysis and Hypotheses Testing

As has been illustrated in Chapter Three, Ordinary Least Squares (OLS) multiple regression analysis is the primary model used in this study to examine all the hypotheses. OLS regression has been generalised linear modelling technique that may be used to model a single response variable which has been recorded on at least an interval scale. This technique may be applied to single or multiple explanatory variables and also categorical explanatory variables that have been appropriately coded (Hutcheson & Sofroniou, 1999). OLS have been also considered as a powerful technique since it is relatively easy to check the model assumption such as linearity, constant variance and the effect of outliers using simple graphical methods. So, four equations of regression models have been employed in this chapter. The first model was employed to test the impact of board structure (e.g. board size, board independence, board meetings……etc.) on carbon performance while the second model was utilised to investigate whether board structure and ownership structure have any influence on a firm’s carbon performance. Model three was used to examine the effect of board structure and ownership structure including control variables which might have an influence on carbon performance namely: firm size, profitability, leverage, Tobin’s Q and Capital Intensity, without the Intensive Sector in the model (i.e. industry dummy variables are not presented), whereas model four was performed to investigate the impact of all governance variables and all control variables on carbon performance. The results of the OLS models are shown in the Table 5.4.
### Table 5.4: results of OLS Regression between Governance Variables and Carbon Disclosure

<table>
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<tr>
<th>Variables</th>
<th>Pred. Sign</th>
<th>Model (1) Board Structure</th>
<th>Coef Est.</th>
<th>P-value</th>
<th>Model (2) Board Structure and Ownership Structure</th>
<th>Coef Est.</th>
<th>P-value</th>
<th>Model (3) Mode (1)+Model (2)+ control variables without Intensive sector variable</th>
<th>Coef Est.</th>
<th>P-value</th>
<th>Model (4) Model (3)+ Intensive sector variable</th>
<th>Coef Est.</th>
<th>P-value</th>
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<td>-1.583</td>
<td>-1.583</td>
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<td>2.637**</td>
<td>2.83</td>
<td>3.993***</td>
<td>3.496***</td>
<td>3.58</td>
<td>2.063***</td>
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<td>3.898***</td>
<td>3.262***</td>
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<td>-0.09</td>
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<td>24.73%</td>
<td>26.85%</td>
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<td>26.54%</td>
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Notes: *, ** and ***denote significance at the 10%, 5%, and 1% levels, respectively, based on two-tailed tests. All variables are described in model development section and Tables 3.3 & 3.4 for variable definitions.
5.6.1 Discussion of statistical Results

This section serves to describe the results gathered from regressing the carbon disclosure variable on the various independent variables. Table 5.4 reports an adjusted R2 are 24.27%, 24.73%, 26.85% and 26.54%, and the F-Values are 9.17, 7.07, 5.99 and 5.61 respectively for the four models and are highly statistically significant at the 1% level. These results indicate that all four models have statistically significant explanatory power of the association between the dependent and independent variables.

Results of Model 1

The first model of this chapter is to investigate the relationship between the eight variables that proxy for board structure and the extensiveness of carbon disclosure. The results of the third Column of Table 5.4 (Model1) report that board independence is significantly positively related to the extensiveness of carbon disclosure at the 1% level ($\beta= 2.637, p < 0.01$, two-tailed), supporting hypothesis H2.2. The results also displayed that the number of female directors on the board is positively associated with the extensiveness of carbon disclosure at the 1% level ($\beta= 4.104, p < 0.01$, two-tailed), which is consistent with hypothesis H2.3. In contrast, the results analyses shows that a negative, but not significant, association between the extensiveness of carbon disclosure and board size, board meetings, with coefficient estimate of -0.565 and -0.021 and a p-value of -0.66 and -0.09. With respect to the board committee variable, the findings indicate that compensation committee independence is statistically significantly negatively associated with the extensiveness of carbon disclosure at the 1% level ($\beta= -3.301, p < 0.01$, two-tailed). Therefore, this result provided statistical support for H2.6. In contrast, the independence of the audit committee, nomination committee independence, and the presence of environmental committee have positive, but not significant, associations with the extensiveness of carbon disclosure, with coefficient estimate of 1.243, 0.060, and 0.704 and a p-value of 1.34, 0.16, and 0.41. The value of 24.27% for the adjusted R2 indicates that the model explains 24.27% of variation in the extensiveness of carbon disclosure. Therefore, there is a 75.73% of variation in the extensiveness of carbon disclosure that is not explained by the variables included in the model. The F-Value for this model is 9.17 and is highly statistically significant at the 1% level. These results indicate that
the model has statistically significant explanatory power of the relationship between the dependent and independent variables.

**Results of Model 2**

The second model examines the joint effect of board structure and ownership structure on the extensiveness of carbon disclosure. The regression results of model (2) in the fourth column of Table 5.4 show that board independence and board diversity, as measured by the number of female directors on the board, are positively related to the extensiveness of carbon disclosure and significant at the 1% level (β= 3.993 and β= 3.898, respectively), which is consistent with hypotheses H2.2 and H2.3. Nonetheless, positive but insignificant associations of board meetings is confirmed with the extensiveness of carbon disclosure, with coefficient estimate of 0.047 and a p-value 0.19, while, the result of a negative, but not significant, association is identified between board size and the extensiveness of carbon disclosure. Turning to the findings for board committees variables, the results show that the coefficient on compensation committee independence is statistically significantly negative associated with the extensiveness of carbon disclosure at the 1% level (β= -3.369, p < 0.01). This finding is consistent with hypothesis H2.6. In contrast, the independence of the audit committee, nomination committee independence, the existence of environmental committee, and their coefficients are positively, but not significantly, associated with the extensiveness of carbon disclosure. Regarding ownership structure, the analysis results in column 4 of Table 5.4 show that the positive sign on the coefficient of managerial ownership is confirmed with the extensiveness of carbon disclosure and significant at the 10% level (β= 0.610, p < 0.1). In contrast, no significant relationship is detected between concentration ownership and the extensiveness of carbon disclosure. The value of 24.73% for the adjusted R Squared indicates that the model explains 24.73% of variation in the extensiveness of carbon disclosure. Therefore, there is 75.27% of variation in the extensiveness of carbon disclosure that is not explained by the variables included in the model. The F-Value for this model is 7.07 and is highly statistically significant at the 1% level. These results show that the current model has statistically significant explanatory power of the relationship between the dependent and independent variables.
Results of Model 3

In column 5 of Table 5.4 (model 3), which examined the relationship between all corporate governance variables and carbon performance, including control variables but without the intensive sector variable, results display that both board independence and board diversity, as measured by the number of female directors on the board, are statistically significantly positively associated with the extensiveness of carbon disclosure ($\beta = 3.496$ and $\beta = 3.262$, two-tailed, respectively). These results are the same as in previous models. In addition, the result provides weak evidence that board size is significantly negatively associated with the extensiveness of carbon disclosure ($\beta = -1.585$, $p < 0.1$). However, a negative but not significant association is found between board meetings and the extensiveness of carbon disclosure, with a coefficient estimate of -0.101, and a p-value of -0.39. Concerning the board committees variables, the results of OLS regression indicate that only compensation committee independence has a negative association with the extensiveness of carbon disclosure and significance at the 1% level ($\beta = -3.184$, $p < 0.01$, two-tailed). In contrast, the coefficients of the audit committee independence, nomination committee independence and the existence of environmental committee are positive but not significantly associated with the extensiveness of carbon disclosure, with a coefficient estimate of 1.270, 0.297, and 1.343 and a p-value of 1.33, 0.78, and 0.72. Regarding the two aspects of ownership structure, the results of the regression analysis show that the coefficient of managerial ownership is statistically significantly positively associate with the extensiveness of carbon disclosure at the 1% level ($\beta = 0.989$, $p < 0.01$, two-tailed). Nonetheless, no significant association is identified between concentration ownership and the extensiveness of carbon disclosure, with a coefficient estimate of 0.139 and a p-value of 0.35. Among the control variables, the results in the fifth column of Table 5.4 show that the coefficient of firm size, as measured by the natural logarithms of total assets, is positively related to the extensiveness of carbon disclosure and significant at the 1% level ($\beta = 1.414$, $p < 0.01$, two-tailed). However, for the other control variables, including profitability, leverage, Tobin’s Q, capital intensity and intensive sectors, the results show an insignificant relationship to the extensiveness of carbon disclosure. An adjusted coefficient of determination (R2) indicates that 26.85% of the variation in the extensiveness of carbon disclosure is explained by variation in the independent variables. The F-Value for this model is 5.99 and is highly statistically significant at the 1% level. These results show that the present model has a statistically significant explanatory power of the model.
Results of hypothesis testing for the fourth model

As discussed earlier, this study developed ten principal testable hypotheses to investigate empirically the impact of corporate governance mechanisms on the extensiveness of carbon disclosure. In this section, based on descriptive statistics and Pearson’s correlation coefficients, this study conducted the Ordinary Least Squares (OLS) multiple regression model to test this association. The rule of decision was based on the significances of the t-statistics which are symbolized by the p-value flagged by the statistical packages used. The adjusted coefficient of determination in this model is 26.54%, indicating that 26.54% of the variation in the extensiveness of carbon disclosure is explained by variation in the whole set of independent variables, indicating that the explanatory power of the model seems to be satisfactory given the nature of the sample. The F-statistic for this model is statistically significant at the 1% level.

In the sixth column of Table 5.4 (model 4), the result provides weak evidence that board size is significantly negative associated with the extensiveness of carbon disclosure at the 10% level ($\beta = -1.583$, $p < 0.1$, two-tailed). This result does not support hypothesis 2.1, which assumed that board size is positively associated with the extensiveness of carbon disclosure. One of the possible reasons for this is that firms with large boards may face a number of barriers in reaching a consensus on important decisions, particularly those related to carbon activities. Another possible reason is that the large numbers on the board may thwart the effectiveness of the board in ensuring that the companies are responsive to strategic actions (Goodstein et al. 1994). My empirical finding is consistent with prior studies. For example, Aburaya, (2012) did not confirm a significant association between board size and environmental disclosure, and Halme & Huse (1997) and Cheng & Courtenay, (2006) did not find any significant results with voluntary disclosure in general. Nevertheless, the results disagree with the results of Liao et al. (2014) & Cormier et al. (2011), who found a positive association between board size and GHG disclosure and environmental disclosure.

Both bivariate and multivariate analyses indicate that board independence measured by the number of independent directors in the board is a significant variable. Table 5.4 shows that there is a strong significant positive association of board independence with the extensiveness of carbon disclosure at the 1% level ($\beta = 3.487$, $p < 0.01$, two-tailed), which is consistent with my expectations. This result indicates that the presence of independent directors on a board is more concerned about sustainability (Ibrahim et al. 2003; Webb, 2004). Another possible
explanation is that board independence may assist the firm in building environmental credibility by demanding environmental audit, and therefore disclose environmental performance information (Post et al. 2011). This result is consistent with the finding of Liao et al. (2014) who provided evidence of a positive significant association of board independence and the voluntary disclosure of GHG in the UK. Furthermore, my results coincide with the findings of Post et al. (2011) and Rupley et al. (2012), who documented that the percentage of independent non-executive directors is positively associated with environmental disclosure. The result also agrees with evidence from previous studies that companies with boards dominated by a majority of independent directors have a significantly positive association with the higher levels of voluntary disclosure (Cheng & Courtenay, 2006; Lim et al. 2007; Donnelly and Mulcahy, 2008). However, my results are in contrast to the findings of Eng & Mak, (2003); Barako et al. (2006), who reported a negative association between board independence and voluntary disclosure in general. My results also contradict the results of Brammer & Pavelín, (2006), who were unable to confirm a significant association between outside directors and environmental disclosure. Therefore, based on my statistical results, this result supports hypothesis H2.2, which anticipated that there is a positive association between board independence and the extensiveness of carbon disclosure.

Turning to board diversity, it can be observed that board diversity, measured by the number of female directors on the board, is significantly and positively associated with the extensiveness of carbon disclosure at the 1% level ($\beta = 3.063, p < 0.01$, two-tailed), which is consistent with this study’s expectation. This result is opposite the argument of critical mass theory which suggested that having one or two women on its board may not be sufficient for changes to happen (Konrad et al. 2008). Descriptively, it can be seen that the percentage of females on the board is relatively small (the average is 1 female on the board), which means that board members are skewed-male. Therefore, the results suggest that a single female on the board can make a difference in GHG disclosure decisions (Liao et al, 2014). This result is in line with earlier evidence by Liao et al. (2014), who reported a significant positive relationship between gender diversity (measured as the percentage of female directors on the board) and the voluntary disclosure of GHG emissions. My result is also consistent with Rupley et al. (2012), who documented that the proportion of females on the board is positively associated with the quality of voluntary environmental disclosures. The result also coincides with the findings of Bear et al. (2010), who found that the number of female board members is positively associated with the strength of corporate social responsibility
disclosures. However, this result is contradictory to the findings of Prado-Lorenzo & Garcia-Sanchez (2010), who failed to find any association between gender diversity and GHG emission disclosure, as well as the study of Nalikka, (2009), who confirmed an insignificant relationship between the proportion of female board members and voluntary information disclosure in company annual reports. Therefore, this result confirms hypothesis H2.3 that board diversity is positively associated with the extensiveness of carbon disclosure.

Regarding board meetings, the statistical results show that board meetings have an insignificant association with the extensiveness of carbon disclosure, with a coefficient estimate of -0.112 and a p-value of -0.43, which was opposite to my expectations. This implies that boards that meet more often as a group do not appear to foster transparency. A possible explanation for this could be that companies that have too many meetings may have some difficulties in reaching agreements on certain aspects regarding carbon activities. This finding is considered to be consistent with the earlier results of Liao et al. (2014), who confirm that there is no significant association between board meeting frequency and the voluntary disclosure of GHG emissions. Authors such as Nelson et al. (2010) were unable to find any significant association between board meeting frequency and the executive stock option disclosures in Australian listed companies. The results, however, are inconsistent with the findings of Allegrini & Greco (2013), who found that the number of board meetings is significantly positively related to the level of voluntary disclosure. The result also differs with the evidence of Aburaya (2012), who confirmed that board meeting frequency is statistically significantly positively associated with the quantity and quality of environmental disclosure as well as the study of Laksmana (2008), who provided evidence of a significant and positive association between the frequency of board meetings and a voluntary disclosure of executive compensation practices. Thus, this result does not support hypothesis H2.4 regarding the positive association between the number of board meetings and the extensiveness of carbon disclosure.

With regard to audit committee independence, the empirical result of testing H2.5 shows that the independence of the audit committee is statistically insignificant with the extensiveness of carbon disclosure, which is contradictory to my expectations. Although an audit committee, which consists of a majority of independent directors, can enhance the quality of voluntary disclosure (Cerbioni & Parbonetti, 2007), the role of independent directors on the audit committee may not be obvious for disclosing the details of GHG emission information. The plausible explanation could be that there are not yet definitive requirements to audit the GHG
emission information in the majority of companies. No specific study has investigated the relationship between audit committee independence and the extensiveness of carbon disclosure. However, my results corroborate those of Li et al. (2012), who did not find any significant association between the independence of audit committee and intellectual capital disclosure by UK listed firms. The results are also consistent with Allegrini & Greco, (2013), who found that the existence of an audit committee and its independence are insignificantly associated with voluntary disclosure as well as the study of Akhtarudin et al. (2009), who failed to find any relationship. Therefore, results do not support hypothesis H2.5, which assumed a positive association.

Concerning the independence of a compensation committee, as indicated in Table 5.4, there is a negative and significant association between compensation committee independence and the extensiveness of carbon disclosure at the 1% level ($\beta = -3.144$, $p < 0.01$, two-tailed), which is contrary to my expectation. This result implies that independent directors on compensation committees may limit the GHG information disclosed. A possible explanation could be that the compensation committees in most companies have not yet achieved the degree of independence that enables them to discharge their responsibilities and duties effectively. There is no empirical evidence that has explicitly and directly examined whether there is a link between compensation committee independence and the extensiveness of carbon disclosure. However, my finding supports the earlier contentions of Cerbioni & Parbonetti (2007), who reported that the existence and independence of a remuneration committee are significantly negatively associated with the level of voluntary disclosure on intellectual capital in European biotechnology firms. This result is also consistent with Allegrini & Greco, (2013), who confirmed that the existence of a compensation committee in the board and its independence are insignificantly associated with the amount of information voluntarily disclosed. However, this result is in contrast to the earlier arguments of Aburaya (2012), who found a positive but not significant relationship between remuneration committee independence and voluntary environmental disclosure in the UK. The findings are inconsistent with O’Sullivan et al. (2008), who provided evidence of a positive association between the presence and independence of a compensation committee and voluntary disclosure of forward-looking information. This was not consistent with Laksmana (2008), who reported a positive relationship between the independence of a compensation committee and the voluntary disclosure of executive compensation practices. In sum, the empirical result failed to find support for hypothesis H2.6, which predicted a positive association.
As for the independence of a nomination committee, the results of the regression model show that the coefficient of nomination committee independence has a positive but insignificant relationship to the extensiveness of carbon disclosure, with a coefficient estimate of 0.307 and a p-value of 0.80, which is inconsistent with my expectations. The results indicate that a nomination committee composed of a majority of independent directors is less likely to disclose more of their GHG emissions information. The possible explanation for this could be that when independent directors are involved in the inner dynamics of boards, they may limit the information disclosed. To the best of my knowledge, there is no known Australian study that has examined the association between nomination committee independence and the extensiveness of carbon disclosure. However, on a more general level, my result is inconsistent with the earlier findings of Aburaya (2012), who found evidence that nomination committee independence is significantly and negatively associated with environmental disclosure in the UK. My results are also inconsistent with Allegrini & Greco (2013), who documented that the existence and independence of a nomination committee are not significantly negatively associated with the amount of information voluntarily disclosed. Therefore, based on the results of the regression model, hypothesis H2.7 is not supported.

With reference to an environmental committee, the results of this study find that the existence of an environmental committee has a positive but not significant relationship with the extensiveness of carbon disclosure, which does not support hypothesis H2.8. This result is in contrast to my arguments that firms with an environmental committee are more likely to disclose their emissions information. This result highlights the complexity of the role an environmental committee plays for carbon transparency. Prior literature documents mixed findings. For example, while Aburaya (2012), Liao et al. (2014) and Peters & Romi (2011; 2013) documented that corporate environmental responsibility (CER) has a strong significant positive relationship to voluntary environmental/GHG disclosure, Rupley et al. (2012) and Rankin et al. (2011) were unable to find a significant association between CER and environmental disclosures. The result of the current study suggests that mere presence of the environmental committee in itself does not guarantee adequate voluntary GHG disclosures. Instead, environmental committee characteristics are also important. These characteristics include, e.g. committee size, number of committee meetings, expertise of committee members, etc., (Berthelot and Robert, 2012; Peters & Romi, 2013). Particularly, if a committee that has a lack of female directors or/and independent directors perhaps is unable
to have significant influence, and this committee may be just symbolic (Berrone and Gomez-Mejia 2009).

Regarding the two aspects of ownership structure, the analysis results of the regression model indicate that managerial ownership has a significant positive association with the extensiveness of carbon disclosure at the 1% level (β= 0.984, p < 0.01, two-tailed), which is consistent with my prediction indicated in hypothesis H2.9. The results seem to imply that owner managers may tend to disclose more information about carbon activity. It is possible that the increase in the percentage of shares owned by all directors can reduce the agency problem (Leung & Horwitz, 2004) and drive environmental transparency (Liao et al. 2014). There is no existing study that has investigated the relationship between managerial ownership and the extensiveness of carbon disclosure. This result can be deemed consistent with Liao et al. (2014), who found a positive association between the percentage of ordinary shares owned by all non-executive directors and GHG disclosure in the context of the UK. On a more general level, the result is also in line with the argument of Leung & Horwitz, (2004), who reported that managerial ownership is positively related to voluntary disclosure in Hong Kong. Nevertheless, the results of my analysis are inconsistent with previous studies (Eng & Mak, 2003; Baek et al. 2009; Ghazali, 2007; Chau & Gray, 2010; Oh et al. 2011; Khan et al. 2013), which provided a negative association. Thus, hypothesis H2.9 is supported which indicates that managerial ownership is positively associated with the extensiveness of carbon disclosure.

According to the results of the regression described in table 5.4, ownership concentration is not significantly related to the extensiveness of carbon disclosure, with a coefficient estimate of 0.146 and a p-value of 0.37; this result is also opposite to my expectation presented in H2.10. This result suggests that firms with a high concentrated ownership disclose less voluntary information about their carbon emission disclosures. One possible explanation for this unexpected relationship could be that because lowering monitoring costs (Demsetz, 1983) incur the cost of carbon activities (Liao et al. 2014). This result is in keeping with Hollindale (2012), who provided evidence that ownership concentration does not have a statistically significant association with voluntary GHG disclosure. In the general level of voluntary disclosure, the result is also in line with the results of Eng and Mak, (2003), who did not find a relationship between ownership concentration and voluntary corporate disclosure. However, the result contradicts earlier evidence presented by Liao et al. (2014), who confirmed that ownership concentration is negatively associated with the voluntary
disclosure of GHG emissions. Similarly, in the context of environmental disclosure, a negative relationship between ownership concentration and environmental disclosure has been recorded by Cormier et al. (2005); Brammer & Pavelin, (2006) & Aburaya (2012). On a more general level, the results of my regression model are also inconsistent with the evidence of Hossain et al. (1994); Barako et al. (2006) and Garcia-Meca & Sánchez-Ballesta (2010), who found a negative association between ownership concentration and voluntary disclosure.

With respect to control variables, firm size measured by the natural logarithm of total assets is statistically significantly positively associated with the extensiveness of carbon disclosure in the full model at the 1% level ($\beta = 1.424$, $p < 0.01$, two-tailed), indicating that large companies tend to disclose more of their GHG emissions information. The results of my analysis regarding firm size are consistent with prior studies (Deegan & Gordon 1996; Neu et al., 1998; Eng & Mak, 2003; Cormier et al., 2005; Brammer & Pavelin, 2006, 2008; Clarkson et al. 2007; Stanny & Ely, 2008; Prado-Lorenzo et al. 2009; Jiang & Habib, 2009; Cormier et al. 2011; Peters & Romi, 2011; Rupley et al. 2012; Luo et al., 2013; Wegener et al. 2013; Liao et al. 2014; Shan & Taylor, 2014; Peng et al. 2015). However, profitability (ROA) has no significant relationship with the extensiveness of carbon disclosure. This implies that profitability may not influence voluntary GHG disclosures. This result is congruent with the work of Rankin et al. (2011), who found that return of assets (ROA) is not significantly related to GHG emissions disclosure in Australian firms. The results are also in line with previous studies (Patten, 1991; Eng & Mak, 2003; Freedman & Jaggi, 2005; Stanny & Ely, 2008; Prado-Lorenzo et al. 2009; Cotter & Najah, 2011; Peters & Romi, 2011; Wegener et al. 2013), which showed an insignificant association between profitability and environmental disclosure. Similarly, leverage has a positive but not significant relation to the extensiveness of carbon disclosure, showing that leverage does not play a significant role in GHG emissions disclosure. This result is consistent with the earlier evidence of Freedman & Jaggi, (2005); Stanny & Ely, 2008; Rankin et al. (2011) & Luo et al, (2012), who found that leverage is an insignificant predictor of GHG emissions disclosure. On a more general level, the result is also in line with Craswell & Taylor (1992) & Raffournier (1995), who documented an insignificant association with voluntary disclosure decisions. The results also show that the coefficient of Tobin’s Q does not show a significant association with the extensiveness of carbon disclosure. This result indicates that this variable does not play a notable role in the extensiveness of carbon disclosure. This result is consistent with prior studies by Stanny & Ely, (2008); Luo et al. (2012); He et al. (2013) & Wegener et al. (2013), who confirmed that
Tobin’s Q does not show a significant association with carbon disclosure. My results from the regression analysis further indicate that capital intensity is statistically not significantly associated with the extensiveness of carbon disclosure. This result is also consistent with prior studies (e.g. Stanny & Ely, 2008), which were unable to find any association between capital intensity and carbon disclosure. Finally, my results show that Intensive Sectors is not significant with the extensiveness of carbon disclosure.

5.7 Sensitivity and Robustness Checks

The current chapter has also conducted several robustness tests to assess the reliability of the regression model described in Table 5.4, namely, board size measured using a cut-off basis, audit committee independence measured using a cut-off basis, and an alternative measure for firm size.

5.7.1 Board Size measured using a cut-off basis

Following Jensen (1993), who suggested that more than eight members on a board are less likely to function effectively, I have employed eight board members as the cut-off basis for an alternative measure of board size. Therefore, the current chapter has used the same technique to measure board size, where board size was measured as a dummy variable by taking the value of 1 if board size is equal to or more than eight members, and 0 otherwise. The results of my analysis (which are un-tabulated) show that the coefficient on board size has become insignificant, while the coefficient of NIDAC was marginally significant at the 10% level. However, this result does not appear to have a significant effect on the rest of the initial results reported in Table 5.4.

5.7.2 Audit committee independence measured using a cut-off basis

As previously discussed, this chapter has also used a 100% threshold as the cut-off point following published literature and governance reports, e.g., Menon and Williams, 1994; BRC, 1999, ASX, 2003, Davidson et al. 2005, who suggested that the audit committee should consist exclusively of non-executive or independent directors. In addition, previous studies such as Klein, (2002a); Bedard, Chtourou, & Courteau (2004), Davidson et al. (2005) and
Baxter and Cotter (2009), examined the sensitivity of audit committee independence to specific cut-offs. This chapter has conducted the same technique to measure the independence of an audit committee measured as a dummy variable by taking the value of 1 if the audit committee is composed solely of independent directors and 0 otherwise. The results of my analysis (which are un-tabulated) are the same to those described in Table 5.4, with the coefficient for board size and board diversity significant at the 0.05 and 0.01 levels.

5.7.3 Alternative measure for company size

Previous studies such as Stanwick & Stanwick (2001) and Berrone et al. (2010) have employed the logarithm of the firm’s total sales as a proxy for firm size. Thus, the present section employed this measure as an alternative measure for firm size. The results of my analysis (which are un-tabulated) are the same to those reported in Table 5.4, with the coefficient for firm size and board diversity are significant at the 0.1 and 0.01 levels. Another alternative measure of firm size were performed, which was the total market capitalisation and the results (which are not reported) are consistent with the main findings.

5.7.4 Alternative Measures of independent variable

I have re-run my results with alternative definitions of board independence, board diversity, audit committee independence, compensation committee independence and nomination committee independence by using the proportion proxy instead of using the actual numbers of these variables, for example, NIDB to NDB as board independence, NFBD to NDB as female percentage, NIDAC to NAC as the proportion of independent directors on the audit committee, NIDCC to NCC as the proportion of independent directors on the compensation committee and NIDNC to NNC as the proportion of independent directors on the nomination committee. I find that the results (which not tabulated) do not alter my main findings.

5.7.5 Endogeneity Test

I test the regression model for the endogeneity problem that could potentially affect the results of my analysis. Following previous studies (e.g. Lim et al., 2007 and Gisbert & Navallas, 2013). I, first, conducted the Durbin–Wu–Hausman test to determine whether or not endogeniety exists between C_DIS and LOG_MANAG_OWN in our paper. By using this
technique, the results of Durbin–Wu–Hausman test (which not tabulated) indicate that the coefficient of managerial ownership was significant in the model, implying that my main findings were affected by the endogeneity issue. To address endogeneity problem properly, I resort to a two-stage least methodology. In the first equation, I regressed the endogenous variable (LOG_MANAG_OWN) with all exogenous variables to obtain the fitted value of LOG_MANAG_OWN. In the second stage analysis, I estimate the fitted values of LOG_MANAG_OWN derived from the first stage and re-run the main model again. The findings (which not tabulated) of the two-stage least squares remained the same, but the effect of managerial ownership on C_DIS becomes insignificant. Therefore, I can continue with OLS regression analysis as the main results.

5.8 Concluding Comments

This chapter has reviewed the empirical results with regard to the second part of this thesis which examined the association between corporate governance mechanisms and the extensiveness of carbon disclosure in the largest Australian companies over a four year period (2009 to 2012). This chapter began by testing the validity of the regression model. In this section I described the fundamental assumptions that can determine the validity of the underlying regression model. After I applied the multiple regression technique to assess the relationship between corporate governance mechanisms and carbon disclosure, I provided descriptive statistics for all variables: dependent, independent, and control variables that performed in the empirical model. In this chapter, I further conducted the variance inflation factor (VIF) and correlation coefficient to test the existence of multicollinearity in this model. The results show that there is no issue of multicollinearity between the independent and control variables. In addition, an OLS regression model was adopted in order to explain the impact of corporate governance mechanisms on the extensiveness of carbon disclosure. Based on the overall results, it can be concluded that the coefficient of board independence (NIDB), board diversity (NFDB), and managerial ownership (LOG_MANAG_OWN) are significantly positively associated with the extensiveness of carbon disclosure (C_DIS); however, compensation committee independence (NIDCC) is negatively related to the extensiveness of carbon disclosure and board size (NDB) is marginally significant with carbon disclosure (C_DIS). In respect to other variables of corporate governance mechanisms; board meetings (NBM), audit committee independence (NIDAC), nomination committee independence (NIDNC), the existence of environmental committee (EC_D), and
ownership concentration (LOG_OWN_CONC) are not significantly associated with the extensiveness of carbon disclosure. Among the control variables, the results also indicate that only firm size (FSIZE) has a positive association with the extensiveness of carbon disclosure. Finally, this chapter has carried out a number of additional tests to check the robustness of the main regression model.
CHAPTER SIX: CONCLUSIONS, IMPLICATIONS, AND FURTHER RESEARCH AVENUES

6.1 Introduction

Carbon emissions have sharply grown since the Industrial Revolution began roughly 250 years ago. So modern day companies have been encouraged by their stakeholders to reduce their carbon emissions and disclose carbon information (Peng et al. 2015). Although Australian companies and industry are considered to be one of the major contributors of GHG emissions, little public policy has been published to guide large companies to address climate change (Pearse, 2009). Thus, the Australian Governments has introduced programs, initiatives and legislation designed to reduce carbon emissions as evidenced by the Australian National Greenhouse and Energy Reporting (NGER) Act, 2007 and Australian Government Department of Climate Change and Energy Efficiency, 2010 which laid down GHG measurement requirements and GHG emissions reporting.

Consequently, this thesis set out to achieve three main objectives. The first was to examine the influence of corporate governance mechanisms on carbon performance. My second objective was to investigate whether the corporate governance indicators are linked with the extensiveness of carbon disclosure. The third objective was to explore whether existing conceptual framework can explain the association between corporate governance and carbon performance and carbon disclosure. It used sample from the largest Australian companies which participated in the CDP over the 2009 - 2012 period. Therefore, the main research question to be answered was: To what extent is good corporate governance related to relatively better carbon performance and/or carbon disclosures? In order to answer the research question, the current study has developed a number of hypotheses based on the previous studies and theoretical background. These hypotheses have been examined in the empirical sections by using the Ordinary Least Squares (OLS) multiple regression analysis.

The rest of this chapter is structured as follows. Section 6.2 briefly concludes the overview of main results of this thesis; section 6.3 discusses the fundamental research contributions that can contribute to the empirical literature followed by section 6.4 which covers the potential implications of research results that can provide for policy makers, managers and researchers;
section 6.5 provides several limitations of this study; while section 6.6 highlights recommendations for future research; section 6.7 summarises this chapter.

6.2 Overview of the Main Results

The purpose of this empirical study was to consider the impact of corporate governance on carbon performance and the extensiveness of carbon disclosure. It was based on the largest Australian companies which participated in the CDP over the period of 2009 - 2012. This section will summarise the research results of the previous. Specifically, subsection 6.2.1 will summarise the research result based on the relationship between corporate governance mechanisms and carbon performance. Subsection 6.2.2 will present a summary of the research results based on the association between governance mechanisms and carbon disclosure.

6.2.1 Corporate Governance Mechanisms and Carbon performance

The results of the first empirical work indicated that most of the corporate government strength is not significantly related to carbon performance (except for environmental committee). More specifically, consistent with hypothesis H1.1, that there is no significant association between board size and carbon performance. The results suggest that board size is not significantly related to carbon performance. Furthermore, the results of analysis found strong support that the presence of an environmental committee was positively associated with carbon performance, which is in line with hypothesis H1.6. In addition, the results of my analysis indicate that the two aspects of compensation structure (CEO stock option, CEO long term bonus), were insignificantly associated with carbon performance, which is consistent with my hypotheses H1.7, H1.8. The findings also indicate that managerial ownership and ownership concentration are not statistically significant with carbon performance, which is keeping with my hypotheses H1.9, H1.10. Among to the control variables, the results also indicate carbon performance is sensitive to some financial indicators such as leverage, Tobin’s Q, and capital intensity. The results are summarised in Table 6.1. These results were consistent with several robustness checks.
Table 6.1: Overview of the Results

<table>
<thead>
<tr>
<th>Hypotheses</th>
<th>findings</th>
</tr>
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<tbody>
<tr>
<td>H1.1: There is no significant association between the number of directors in the board and carbon performance.</td>
<td>Supported</td>
</tr>
<tr>
<td>H1.2: There is significant association between board independence and carbon performance.</td>
<td>Not supported</td>
</tr>
<tr>
<td>H1.3: There is a positive association between corporate board diversity and carbon performance.</td>
<td>Not supported</td>
</tr>
<tr>
<td>H1.4: There is a positive association between the number of board meetings and carbon performance.</td>
<td>Not supported</td>
</tr>
<tr>
<td>H1.5: There is a positive association between the independence of an audit committee and carbon performance.</td>
<td>Not supported</td>
</tr>
<tr>
<td>H1.6: There is a positive association between the presence of environmental committee and carbon performance.</td>
<td>Supported</td>
</tr>
<tr>
<td>H1.7: There is no significant association between CEO stock options and carbon performance.</td>
<td>Supported</td>
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<tr>
<td>H1.8: There is no significant association between the CEO long term bonus and carbon performance.</td>
<td>Supported</td>
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<tr>
<td>H1.9: There is no significant association between ownership concentration and carbon performance.</td>
<td>Supported</td>
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<tr>
<td>H1.10: There is no significant association between managerial ownership and carbon performance.</td>
<td>Supported</td>
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</table>

6.2.2 Corporate Governance Mechanisms and the extensiveness of Carbon Disclosure

The results of the second phase of this research showed that four variables of corporate governance were associated with the extensiveness of carbon disclosure; three positively and one negatively. More specifically, the results revealed that board independence were significantly and positively associated with the extensiveness of carbon disclosure, supporting hypothesis H2.2. In addition, the statistical results indicate a positive relationship between board diversity and the extensiveness of carbon disclosure, which is also consistent with my hypothesis H2.3. Moreover, hypothesis H2.10 assumes that managerial ownership will be positively associated with the extensiveness of carbon disclosure. As expected, a positive relationship between managerial ownership and the extensiveness of carbon disclosure is found. On the other hand, the result of testing H2.1 indicates that board size was significantly and negatively associated with the extensiveness of carbon disclosure, however, the result was only significant at the 10% level. With respect to control variables, only firm size was significantly positively associated with the extensiveness of carbon disclosure.
Whereas, other control variables (leverage, profitability, Tobin’s Q, Capital intensity and Intensive Sector) are not related to the extensiveness of carbon disclosure. The results are summarised in Table 6.2.

Table 6.2: Overview of the Results

<table>
<thead>
<tr>
<th>Hypotheses</th>
<th>findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>H2.1: There is a positive association between the number of directors in the board and the extensiveness of carbon emissions disclosure.</td>
<td>Not supported</td>
</tr>
<tr>
<td>H2.2: There is a positive association between the independent boards of directors and the extensiveness of carbon disclosure.</td>
<td>Supported</td>
</tr>
<tr>
<td>H2.3: There is a positive association between the number of female on the board and the extensiveness of carbon emissions disclosure.</td>
<td>Supported</td>
</tr>
<tr>
<td>H2.4: There is a positive association between the number of board meetings and the extensiveness of carbon emissions disclosure.</td>
<td>Not supported</td>
</tr>
<tr>
<td>H2.5: There is a positive association between the independence of an audit committee and the extensiveness of carbon emissions disclosure.</td>
<td>Not supported</td>
</tr>
<tr>
<td>H2.6: There is a positive association between the independence of compensation committee and the extensiveness of carbon emissions disclosure</td>
<td>Not supported</td>
</tr>
<tr>
<td>H2.7: There is a positive association between the independence of nomination committee and the extensiveness of carbon emissions disclosure.</td>
<td>Not supported</td>
</tr>
<tr>
<td>H2.8: There is a positive association between the presence of an environmental committee and the extensiveness of carbon emissions disclosure.</td>
<td>Not supported</td>
</tr>
<tr>
<td>H2.9: There is a positive association between ownership concentration and the extensiveness of carbon emissions disclosure.</td>
<td>Not supported</td>
</tr>
<tr>
<td>H2.10: There is a positive association between managerial ownership and the extensiveness of carbon emissions disclosure.</td>
<td>Supported</td>
</tr>
</tbody>
</table>

6.3 Research Contributions

There are few studies that have predominantly investigated the relationship between corporate governance and environmental disclosure. And even fewer studies specifically address carbon performance and disclosure in Australia. In this respect, the current study contributes to two different branches of accounting research. First, this study contributes to the corporate governance literature by analysing whether corporate governance mechanisms serve to monitor, guide and reward carbon actions. Whilst previous work has investigated the relationship between corporate governance and environmental performance (Kassinis & Vafeas, 2002; de Villiers et al. 2011; Walls et al. 2012), few studies have examined the link...
between individual corporate governance mechanisms and environmental and social reporting (Haniffa & Cooke, 2005; Rankin et al. 2011; Michelon & Parbonetti, 2012; Kathyayini et al, 2012) The study’s results also contribute to the recent literature (e.g. Rankin et al. 2011; de Villiers et al. 2011,2013; Ben-Amar & McIlkenny,2014 & Liao et al. 2014) by examining a comprehensive set of corporate governance mechanisms and their impacts on carbon performance and disclosure. Second, this study adds to the environmental research by providing archival evidence of the impact of corporate governance mechanisms on carbon performance and disclosure. This study focuses on carbon emissions performance and disclosure, while much of previous studies, for example, Kassinis & Vafeas, (2002); Haniffa & Cooke, (2005); de Villiers et al. (2011); Walls et al. (2012); Michelon & Parbonetti, (2012) & Kathyayini et al. (2012) focused on general sustainability (social and environmental) performance and disclosures. The present study also provides evidence of corporate governance mechanisms and a number of company-specific characteristics as control variables on carbon performance and disclosures in Australia, where there is a lack of empirical evidence specifically focused on this association. Currently the literature is limited to the issues related to water and toxic chemical pollution rather than carbon pollution. Moreover, the current study will fill the gap and to my knowledge this is the first study to examine the issue in Australia by using comprehensive corporate governance indicators. The study chooses Australian firms because Australia is one of the highest per capita carbon emitters in the world and Australia will be significantly and negatively affected by global warming (Lue & Tang, 2014). Additionally the Australian government has introduced a series of GHG legislation which signal a new era of transition toward a carbon constrained economy. For the majority of Australian firms, the exposure to carbon liability has much more financial implication than general environmental exposure. This is due to the fact that these firms do not have water or toxic chemical air pollution problem, but any carbon emission is subject to carbon tax existed in Australia recently and it was repealed in 2014. Therefore, the results of my study contribute to a growing literature on corporate governance, in association with climate change and presents new evidence of how carbon performance and disclosure are impacted by corporate governance.
6.4 Research Implications

In addition, the results of this study provide a valuable insight to policy makers/ regulators, corporate governance standard setters, investors and academics who may be interested in global climate change and GHG emissions and corporate governance practice. A brief discussion of each of these implications follows.

The results of this study should provide a useful insight for policy makers in Australian companies to pinpoint the aspects of corporate governance that could affect the firm's carbon performance and disclosures. More specifically, the policy makers should recognise the vital role played by the presence of an environmental committee on the board as one of corporate governance’s characteristics in driving carbon performance of companies. One potential explanation for the inclusion of environmental committees on boards is that environmental committees are much more expedient in responding to institutional pressures to reduce carbon emissions (Berrone & Gomez-Mejia, 2009a). They also can use my results to emphasise governance mechanisms that may enhance carbon activities in their company. In addition, in respect of regulators, they also play an important role in helping companies to better manage carbon activities and reduce their emissions. Thus, it is expected that regulators in government can use this result to identify good elements of corporate governance that may deserve further regulatory focus in order to achieve the carbon policy objectives. Regulators can be using these results to consider the potential aspects of corporate governance that could impact on the carbon legislation. Furthermore, the findings also should provide a useful guide to corporate governance standard setters, especially in Australia, about the importance of sound corporate governance in understanding the determinants of GHG emissions disclosure. Thus, can use my results as empirical support to evaluate the role of corporate governance in improving the carbon performance and carbon disclosure. Moreover, investors are becoming more concerned about GHG emissions and corporate responses to it. Therefore, it is expected that investors urge companies to analyse and disclose more information relating to the firm’s GHG emissions. My results are of interest to investors as they provide a useful basis for understanding the impact of corporate governance on carbon performance and disclosure that may inform investors on how to foster reliable carbon information, so that they can make better decisions in their investment. Finally, my results can extend academic research attempting to enhance my understanding of the impact of
corporate governance in their different aspects on carbon performance and the extensiveness of carbon disclosure.

6.5 Research Limitations

As with other studies, the results of this thesis have some limitations that should be acknowledged and could help future researches. The first limitation of this study is that the sample size is relatively small and restricted to those firms that completed the CDP 2009 - 2012 questionnaire in Australia. Therefore, the result may suffer from the self- selection bias due to the limited availability of firm-level carbon data. Further, the sample of this research is limited to largest Australian companies this can also lead to some self-selection bias and consequently the results may not extend to small- and medium-sized firms and cannot be generalised to other types of firms. In addition the issue of unbalanced panel data could be biased to my results. At the same time, this study only ran for four years, which appears a relatively short period and therefore the result may not be generalised to longer periods of time. The second limitation of the study pertains to the fact that since my analysis is restricted to carbon performance and carbon disclosures, the results cannot extrapolate to social /environmental performance and disclosures more broadly. The third limitation is that my study only looks at the carbon emission that related to carbon performance and relies on the total Scope 1 and Scope 2 emissions divided by the total sales at the end of fiscal year to measure this variable. Scope 3 carbon emissions were not considered for this thesis because it is still not well-defined; thus, a lot of companies do not disclose this information (He et al. 2013). Regarding the carbon disclosure, this study focuses on CDP reports in my analysis, therefore my results to information disclosed cannot be generalised via other media such as a company’s website or a press release. Another possible limitation in my study is that the sample of the current study includes only internal governance mechanisms, although other external governance mechanisms may influence a company’s carbon activities. In addition, this study has been concentrated only on the individual aspects of corporate governance but did not consider the interaction effects that can occur among independent variables.

6.6 Future Research Avenues

This thesis raises a number of new potential avenues that could be rectified in future research. One possible avenue for future research is that the data collection could be extended to include companies in non-Australian contexts or to small- and medium-sized companies that
could yield some interesting comparative results. A second possible avenue of study could be to extend the analysis to a longer period of time to examine whether an improvement of corporate governance would lead to improved carbon performance and disclosures. Another possible avenue for future study is examining the alternative measures of a firm’s carbon performance that might be more likely to draw more attention than others. For example, the valuation relevance of a firm’s carbon emissions which have been examined by Krishnan (2003), cited in Luo and Tang, (2014b). Also, (He et al. 2013) recommended using the impact of carbon activities on share price for carbon performance. A further potential avenue for future research is testing the integrated effect of internal and external corporate governance mechanisms that may influence a company’s carbon activities. Moreover, future research may consider the combined effect of any interaction among corporate governance that could provide further useful insights as to whether corporate governance mechanisms have any role to play in GHG emissions disclosures. Although the endogeneity problems typically occur in much of the corporate governance variables and disclosure quality, future studies can replicate this study with other more sophisticated methodologies (e.g. two-stage least squares (2SLS) approach) to address this issue that may produce other meaningful results.
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