

VOLUNTARY CLIMATE CHANGE DISCLOSURE IN SOUTH AFRICA



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I hereby declare that I have read and understood the regulations governing the submission of Master of Commerce dissertations, including those relating to length and plagiarism, as contained in the rules of the University, and that this dissertation conforms to those regulations.

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“A time to be born, and a time to die; a time to plant, and a time to pluck what is planted”

– Ecclesiastes 3:2

ABSTRACT

There is increasing evidence that anthropogenic carbon dioxide emissions are the major cause for global warming. A changing external environment and societal pressure is driving companies to respond to climate change and to limit further contribution where possible. Despite carbon emissions still being largely unregulated and carbon disclosure not being mandatory, many companies in South Africa have voluntarily decided to reduce emissions and make disclosures to the Carbon Disclosure Project (CDP). Institutional, socio-political and economic voluntary disclosure theories all indicate that there is a pressure for companies to monitor their climate mitigation, evaluate the costs of disclosing and manage stakeholders' pressures by producing voluntary climate change disclosure. The CDP scores the disclosure made by each company as a measure of the company's progress towards environmental stewardship. The highest CDP score indicates that a company has leadership in its efforts to environmental stewardship and so addressed stakeholders' concerns. This study aims to determine which factors, either company specific or individual company responses within the CDP questionnaire, influence a high CDP climate change score for South African companies. The top 100 South African companies were selected using a full Johannesburg Stock Exchange (JSE) listing as at 31 March 2017 and the climate change programme score and individual company responses to the climate change questionnaire were obtained from the CDP for the five-year period from 2013 to 2017. A random effect model was used to examine the determinants of voluntary disclosure of carbon information. The results indicate that while CDP scores have improved post the signing of the Paris Agreement in December 2015, providing incentives for managing climate change has also led to improvements in the CDP score which results in improved climate change disclosure. Furthermore, the longer the company assesses climate change risks and opportunities into the future, the better its CDP score. This research contributes a more thorough understanding of disclosure theories, as established from these results. In terms of institutional theories, institutional investors should call for incentives to motivate for climate change management because companies might then be more likely to receive a better CDP score. In terms of socio-political theories, this study's findings indicate that managers should be made aware that the further into the future they consider climate change risk management the better because this practice will result in the

company obtaining an improved CDP score, while simultaneously managing stakeholders' perceptions of the company. Additionally, this study contributes by making recommendations for companies and policy makers.

TABLE OF CONTENTS

Acknowledgments	ii
Abstract	iii
Table of contents	v
List of Tables	vi
List of Figures	vi
List of Acronyms	vi
Introduction.....	1
Literature review	0
Introduction	0
Climate change	0
Climate change scientific and intergovernmental organisations	2
Climate change in South Africa	5
Business and climate change.....	7
Voluntary disclosure	8
The Carbon Disclosure Project (CDP).....	9
Theoretical basis of voluntary disclosure.....	11
Institutional theories	11
Economic theories	12
Socio-political theories	14
Conclusion	15
Methodology	17
Data collection.....	17
The CDP questionnaire	18
Data cleaning	21
Descriptive statistics.....	22
Research approach.....	35
Limitations	37
Results.....	38
Predictors of CDP score	39
Incentives	43
Conclusion and recommendations	46
Areas for future research	49
References	50
Appendix A	63

Appendix B	68
Appendix C	69

LIST OF TABLES

Table 1: Variables	31
Table 2: Summary statistics for the continuous variables.....	37
Table 3: Summary statistics for the binary variables.....	38
Table 4: Predictors of CDP score for all companies	44
Table 5: Predictors of CDP score for all companies (categorical incentive variable)	44
Table 6: South African companies' responses to the CDP questionnaire	69
Table 7: Summary statistics for the continuous and binary independent variables after winsorising	74

LIST OF FIGURES

Figure 1: Histogram of the CDP score overall	29
Figure 2: Histogram of the CDP score per period	30
Figure 3: Industry analysis of sampled companies by year.....	39
Figure 4: Future Risk variable	40
Figure 5: Disclosure theories and variables	52
Figure 6: Histogram of CDP score 2013 to 2015	73
Figure 7: Histogram of CDP score 2016 to 2017	73

LIST OF ACRONYMS AND ABBREVIATIONS

CDP:	Carbon Disclosure Project
DEA:	Department of Environmental Affairs
GHG:	Greenhouse gases
IPCC:	International Panel on Climate Change
MtoB:	Market-to-book
ROA:	Return on Assets
UNFCCC:	United Nations Framework Convention on Climate Change

INTRODUCTION

Climate change is referred to as the “greatest challenge of our time” (DEA, 2016, p. 4). Climate scientists have indicated that anthropogenic¹ greenhouse gas emissions (GHG) are the biggest contributor to climate change (Cook et al., 2016; IPCC, 2014b). A changing external environment and societal pressure are driving companies to respond to climate change and limit further contribution where possible (Luo, Lan, & Tang, 2012). Despite carbon emissions still being largely unregulated and carbon disclosure not being mandatory, many companies in South Africa have voluntarily decided to reduce emissions and make disclosures to the Carbon Disclosure Project (CDP) (NBI, 2016). The CDP measures a company’s progress towards environmental stewardship and awards the company a score (CDP, 2016b). A company that has the highest score indicates to stakeholders that the company has a leadership progress to environmental stewardship. Understanding what drives good disclosure of climate change might result in improved disclosure (Qian & Schaltegger, 2017), and thus contribute to tackling the “greatest challenge of our time” (DEA, 2016, p. 4). This claim motivates for this study to investigate what factors influence a South African company to achieve a high CDP score.

The International Panel on Climate Change (IPCC) has stated that there has been human influence on the climate system which, in turn, has impacted humans and animals (IPCC, 2014b). The IPCC is the global authority on climate science and is responsible for assessing the direct impact of climate change on temperature, rainfall and the resultant impact on humans, plants, animals and how this impact is transmitted to world trade (IPCC, 2014b). The IPCC’s assessments on climate change have called for anthropogenic sources of greenhouse gases (GHG) to be limited. Thus, the changing climate has required intergovernmental co-ordination of mitigation strategies under the Kyoto Protocol and, more recently, in the Paris Agreement. Where both the Kyoto Protocol and the Paris Agreement are international sub-treaties under the United Nations Framework Convention on Climate Change (UNFCCC) that call for the reduction of GHGs (Gupta & Mason, 2016).

¹ Anthropogenic¹ is a term which means caused by human activity (IPCC, 2014a).

In South Africa climate change is notable in temperature changes, rainfall variations and rising sea levels (National Planning Commission, 2011). As such the South African Department of Environment Affairs (DEA) acceded to the Kyoto Protocol (DEA, 2004; Eskom, 2011) and signed the Paris Agreement declaring its commitment to become a low carbon economy (UNFCCC, 2017). South Africa's involvement in the Paris Agreement has also called for the involvement of companies in the private sector (DEA, 2017). Furthermore, the South African DEA stated that it will evaluate the private sector's transition to a lower carbon economy, based on their participation and activities disclosed in their responses to the CDP (DEA, 2017).

Climate change could result in a direct change in a company's external environment. This alteration, therefore, will impact on its ability to acquire, retain and grow the six capitals² that is required to create value; and, therefore, result in a cost to the company (Promethium Carbon & The Climate Disclosure Standards Board, 2013; Yow, M Rubin, 2017). Additionally, societal pressure has driven companies to respond to climate change and to limit further contribution to climate change (Less & Kauffmann, 2009; Okereke, Wittneben & Bowen, 2012).

Voluntary climate change disclosure is used by companies to acknowledge the gravity of the climate issue and to support the conclusions reached by the IPPC and Kyoto Protocol (Ihlen, 2009). As such many companies voluntarily disclose carbon information to appease stakeholders who want to see a response to climate change (Chow & Wong-Boren, 1987). Disclosure made to the CDP is an example of voluntary disclosure.

The rationale for producing disclosure is explained by three voluntary disclosure frameworks, namely Institutional theories, Economic theories and Socio-political theories. Hahn, Reimsbach & Schiemann (2015) indicated that a large portion of prior literature did not use a theoretical foundation when developing their hypothesis and instead relied on prior empirical evidence. This study will attempt to clarify this claim by linking each variable to one of the three theoretical foundations. Furthermore, prior studies made use of the CDP for its final score only (Luo et al., 2012; Stanny & Ely, 2008) but did not incorporate any of the qualitative questions from within the CDP

² Six capitals is defined as financial, human, social, relational, manufactured and intellectual capital by the International Integrated Reporting Council in the Integrated Reporting Framework (IIRC, 2013).

questionnaire. Thus, the research question for this study is: *Which factors, either company specific or individual company responses, within the CDP questionnaire influence a high CDP climate change score for South African companies.*

A sample comprising one hundred South African companies was selected using a full Johannesburg Stock Exchange (JSE) listing as at 31 March 2017. Additionally, the climate change programme score and individual company responses to the climate change questionnaire were obtained from the CDP. This study will be looking at the CDP scores over the full five-year period from 2013 to 2017. This study will use a panel data model to conduct the quantitative analysis of the impact of the variables. More specifically, the random effect model will be used to examine the determinants of voluntary disclosure of carbon information, thereby testing the said hypothesis.

This study had three findings. Firstly, the Paris Agreement variable is positively statistically significant which suggests that South African companies are considering the seriousness of addressing the climate change issue post the signing of the Paris Agreement. Secondly, the Future Risk variable, which was also positively statistically significant, indicates that there is likely to be better environmental stewardship the further into the future the companies' management considers climate change and because the longer-term view leads to better behaviour across a range of issues. Lastly, where companies provide incentives for the management of climate change issues, these companies are more likely to have a higher CDP score. Therefore, companies should consider the structure of incentives for managing climate change issues.

This research contributes to literature by making recommendations for companies and policy makers. Additionally, a more thorough understanding of disclosure theories was established from these results. In terms of Socio-political theories, this study's findings indicate that managers should be made aware that the further into the future they consider climate change risk management the better because this practice will result in the company obtaining an improved CDP score, while simultaneously enhancing stakeholders' perceptions of the company. If a company wants to improve its CDP score, it should ensure that it is incentivising its staff to manage climate change. Policymakers in South Africa could draw attention to the research findings that a company's CDP score improves if future risk is considered further into the future and

encourage companies to align their disclosure to the objectives of the Paris Agreement. Furthermore, this process could assist policy makers to get their policies implemented sooner.

This study is not claiming to assess what drives good responses to climate change, only the assessment of company's disclosure to the CDP on climate change. This limitation does not hinder the relevance of this research because disclosure of climate change to the CDP is indicative of companies acknowledging the importance of the climate change issue (Doran & Quinn, 2009) and companies detailing their risk exposure to climate change which previously has been lacking in practice (Doran & Quinn, 2009).

This study will initially present a review of prior related literature. This review will include a discussion of what climate change is, its history and the applicability of climate change in South Africa. Subsequently, the reasons why companies need to consider climate change will be detailed together with an explanation of what voluntary disclosure is and how it relates to climate change. Then, the review will conclude by presenting studies that have considered the theoretical bases for voluntary climate change disclosure. After this exposition, the method of analysis to be utilised in this study will be presented and the mode of testing discussed. The research question will be posed, following which the results of this study will be presented to answer the research question. Lastly, the researcher's conclusions, based on the results, will be presented.

LITERATURE REVIEW³

INTRODUCTION

This study's aim is to explore which factors, either company specific or individual company responses, within the CDP questionnaire, influence a high CDP climate change score. This study will focus its literature review on the relevance of voluntary climate change reporting both globally and in South Africa.

This literature review begins by examining what climate change is, its history and the applicability of climate change in South Africa. Subsequently, why companies need to consider climate change will be detailed together with an examination of what voluntary disclosure is and how it relates to climate change. The review will conclude by presenting studies that have considered the theoretical basis for voluntary climate change disclosure.

CLIMATE CHANGE

Climate change is referred to as the “greatest challenge of our time” (Department of Environmental Affairs, 2016, p. 4). The term ‘climate’ can be narrowly defined as the average variability of the weather over a period of time, ranging from months to thousands or millions of years (IPCC, 2014a, p. 119). The climate is generally underpinned by the natural phenomena: electromagnetic radiation. Electromagnetic radiation is transferred from sunlight and when the sunlight enters the atmosphere of the earth, streams of photons are transferred from the sun and this energy is absorbed by the earth, causing its temperature to increase (Dessler & Parson, 2010, p. 10). This flow of energy from the atmosphere was discovered by Joseph Fourier and has become known as the greenhouse effect (Dessler & Parson, 2010; Pierrehumbert & Archer, 2011). Interference with this natural phenomenon causes changes to the climate system.

In the nineteenth century, Swedish chemist Svante Arrhenius and English physicist John Tyndall established that the Industrial Revolution was causing increased amounts of carbon dioxide, one of the greenhouse gases (GHGs), to be released into

³ Extracts from this chapter have been compiled as a conference paper. These extracts have not been separately identified throughout the chapter.

the atmosphere (NASA, 1998; Stern, 2006). Svante predicted that as the consumption of fossil fuels increases so will the concentrations of carbon dioxide (NASA, 1998). The work of Svante, Tyndall and others led to the understanding of 'global warming'. The term 'global warming' refers to the gradual increase of the Earth's temperature from heightened GHG emissions, particularly carbon dioxide (IPCC, 2014a, p. 124). This increased presence of carbon dioxide is anthropogenic and could lead to ramifications such as increased global temperatures.

Climate science contains many uncertainties (Oreskes, 2004) because it relies on models which make predictions which could lead to uncertainties in the timing, magnitude and regional patterns of climate change (IPCC, 1990). Ninety percent of publishing climate scientists agree that anthropogenic GHG emissions are the highest in history (Cook et al., 2016; IPCC, 2014b). The remainder of scientists question whether the GHG emissions are entirely anthropogenic (Cook et al., 2016; Dessler & Parson, 2010).

The International Panel on Climate Change (IPCC) has stated that there has been human influence on the climate system which, in turn, has impacted humans and animals (IPCC, 2014b). From observations since the 1950s, global warming of the earth's surface has caused the atmosphere and the ocean to warm, which subsequently leads to diminishing ice and rising sea levels (IPCC & WMO, 1990). In addition to this, there are altering precipitation patterns (IPCC, 2014b). Other evidence of climate change has been seen in the shift in the geographical ranges, seasonal activities and migration patterns of many terrestrial, freshwater and marine species (IPCC, 2014b).

The above effects of climate change could be intensified by the continued emissions of carbon dioxide at present rates, which could commit global populations to heightened concentrations of GHGs for centuries (IPCC, 2018b). For example, estimated anthropogenic GHG emissions due to past and ongoing emissions is currently increasing at 0.2°C per decade according to IPCC's data released on 8 October 2018 (IPCC, 2018a). Furthermore, the impact on the environment is considered to be progressively severe, pervasive and irreversible (Department of Environmental Affairs, 2016).

Various scientific and intergovernmental organisations have been formed to provide scientific information and guidance on climate change to policy makers (IPCC, 1990). Examples include the IPCC and the UNFCCC. These two organisations have coordinated their actions and were instrumental in developing the Kyoto Protocol and the Paris Agreement. Background information on the IPCC, the UNFCCC, the Kyoto Protocol and the Paris Agreement will follow below.

CLIMATE CHANGE SCIENTIFIC AND INTERGOVERNMENTAL ORGANISATIONS

The IPCC was formed by the World Meteorological Organization and the United Nations Environmental Programme in 1989 to establish a peer-review basis for scientific literature to help evaluate the state of climate science (IPCC, 2014b). Since 1989, the IPCC has released five full assessments on climate change. The scope and number of contributors to each assessment completed by the IPCC has added to the credibility of their work. The early work of the IPCC concentrated on assessing the direct impact of climate change on temperature, rainfall and the resultant impact on humans, plants and animals (IPCC, 2014b). However, the IPCC's Fifth Assessment Report indicates a shift in research to further understanding of how the effects of climate change are transmitted to world trade and this transferal (IPCC, 2014b). This transferal therefore creates the context for this research. Given the above information, the IPCC is the main authority for the study of climate science.

The IPCC's assessments on climate change have called for anthropogenic sources of GHG to be limited. In recognition of this need for reduction, the United Nations Framework Convention on Climate Change (UNFCCC) was formed by the International community in 1992 (Lisa & Schipper, 2006). The UNFCCC operates as a multilateral treaty calling for greater transparency in addressing climate change through a framework of global legal policy (Gupta & Mason, 2016). The majority of the IPCC's work, since its first assessment on climate change, has focused on mitigation measures for climate change and not adaption measures (Lisa & Schipper, 2006). Where 'mitigation of climate change' requires human intervention to reduce the sources of GHG emissions, 'adaption' is understood to be the process of adjustment due to the climate and its effects (IPCC, 2014a, p. 118 & p. 125). Similarly, the

UNFCCC's policy on climate change is primarily a mitigation policy to limit GHG (Lisa & Schipper, 2006).

In the United Framework Convention on Climate Change Article 2, the UNFCCC states that its ultimate objective is "to achieve stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system" (UNFCCC, 1995, p. 5). This long-term perspective of the UNFCCC's climate policy encapsulates the key scientific, economic and political components of the climate change debate (Oppenheimer & Petsonk, 2005). The UNFCCC facilitates climate mitigation (Hermwille, Obergassel & Ott, 2015). At the level of nation states this goal is achieved by implementing treaties and, subsequently, facilitates the development of national laws for climate change mitigation (Hermwille et al., 2015). Two recent UNFCCC treaties, in line with Article 2, are the Kyoto Protocol and the Paris Agreement.

The Kyoto Protocol, a sub-treaty under the UNFCCC, was negotiated on 11 December 1997 at the third session of the Conference of Parties (COP 3) in Kyoto, Japan (UNFCCC, 1998). The Kyoto Protocol laid down mandatory emissions reduction targets to be achieved during the period from 2008 to 2012 (Gupta & Mason, 2016) and was the first International treaty to try and limit GHG emissions (Barrett, 1998). Eight years later, on 16 February 2005, in accordance with Article 23, the Kyoto Protocol was effective (Spash, 2016; UNFCCC, 1998).

The Kyoto Protocol promised substantial emission reductions for the developed world compared to "business-as-usual emissions" (Barrett, 1998, p. 1). Supporters of the Kyoto Protocol praised it for its incorporation of targets and timetables for the ceilings of GHG emissions and deadlines for the targets to be achieved (Böhringer, 2003). The proponents of the agreement suggest that the Kyoto Protocol was a "reasonable first step" (Rosen, 2015, p. 2). However, the majority criticised the Kyoto Protocol as being flawed because it was considered economically inefficient, politically impractical and inadequate to address the issue of global warming (Böhringer, 2003; Rosen, 2015). For example, there were inconsistencies in its application in different countries. Many nations failed to ratify the Kyoto Protocol (e.g. United States); others participated in negotiations, withdrew and then re-joined the Kyoto Protocol later (e.g. Australia); while others were not required by the Kyoto Protocol to reduce their emissions at all

(e.g. China, India and the rest of the developing world) (Rosen, 2015). Moreover, developing countries were exempt from creating binding emission targets under the Kyoto Protocol, despite accounting for a growing share of emissions (Böhringer, 2003). Even with the introduction of the UNFCCC and the negotiations of the Kyoto Protocol emissions, GHG emissions continued to rise steadily (Falkner, 2016). Something more was needed.

At the 21st Conference of the Parties (COP-21) to the UNFCCC, held on 12 December 2015, a new climate treaty was agreed to: The Paris Agreement (Falkner, 2016; Wolfgang et al., 2016). The debate around climate change has been strengthened by the ratification of the Paris Agreement which acknowledges that domestic politics around climate change vary from nation to nation and, therefore, allows countries to set their own climate change mitigation strategies (Falkner, 2016). In terms of Article Two of the Agreement, national parties undertake to hold to the average global temperature increase to below 2°C while “recognising that this would significantly reduce the risks and impact of climate change” (UNFCCC, 2015, p. 5). The Paris Agreement is the first treaty negotiated in 25 years that envisages all countries partaking in climate action (Wolfgang et al., 2016) and has been adopted by 195 countries as at 18 December 2018 (Gupta & Mason, 2016; UK Telegraph, 2018; UN, 2018). The Paris Agreement is, therefore, considered a turning point for climate action (DEA, 2016), particularly, since under the Kyoto Protocol, only 35 countries were prepared to limit their greenhouse gas emissions (Spash, 2016).

A further difference between the Paris Agreement and the Kyoto Protocol is that under the Paris Agreement developing countries must commit to reducing their emissions (Stowe, 2015). The national parties of the Paris Agreement aim to limit GHG emissions as soon as possible and it was acknowledged that developing countries will likely take longer to achieve this (UNFCCC, 2015) because they have not been previously engaged in climate mitigation strategies and some are prone to a reliance on fossil fuels (Hermwille et al., 2015). Moreover, the Paris Agreement signals that, despite the global challenge, a transition into a low-carbon economy is possible. Article 2 of the Paris Agreement stipulates that parties will make finance available for the transition to climate-resilient development (CDP, 2017b; DEA, 2016; UNFCCC, 2015). Furthermore, in line with the UNFCCC’s mission for greater transparency for climate

change (UNFCCC, 2015), the Paris Agreement requires national parties to communicate their contributions to the UNFCCC in terms of Article 4 of the Agreement. This disclosure is presented every five years (UNFCCC, 2015).

This sub-section aimed to detail what climate change and its history is through a discussion of both climate change fundamentals and the formation of some scientific and intergovernmental organisations. The rest of this review will attempt to establish how climate change is relevant in South Africa and how voluntary disclosure plays a role in addressing climate change.

CLIMATE CHANGE IN SOUTH AFRICA

Climate change effects are evident in South Africa. The IPCC (2007) established that countries within the Southern African region are currently experiencing longer dryer seasons and more uncertain rainfall than that in the past which is forcing adaptive measures to be implemented by these countries (IPCC, 2007). The African continent is particularly vulnerable to climate change (Eskom, 2011). Factors such as a lack of infrastructure, under-development, poor disaster management processes and lack of institutional capacity, indicate that Africa generally has a limited ability to respond and adapt to climate change (Eskom, 2011; UNEP, 2012).

Temperature changes, rainfall variations and rising sea levels are already impacting South Africa (National Planning Commission, 2011). This situation has a resultant effect on South Africa's food security, health infrastructure and water resources (DEA, 2015; Ziervogel et al., 2014).

South Africa, like many other developing countries, is susceptible to the impact of climate change (DEA, 2017). Further evidence from the Global Climate Risk Index ranked South Africa as the seventh African country most affected by climate change (Kreft, Eckstein & Melchior, 2017). Furthermore, South Africa has high per capita GHG emissions compared to other African and global countries (Ziervogel et al., 2014). This fact has attracted the attention of the South African government for a number of years (Ziervogel et al., 2014). As a middle income developing country suffering from climate change, national development is necessary, particularly given South Africa's high levels of poverty and social inequality (DEA, 2011b, 2011a; Ziervogel et al., 2014).

South Africa has a role to play in becoming a low carbon economy by developing a national response to climate change. In 1998 the DEA signed the UNFCCC and in July 2002 acceded to the Kyoto Protocol (DEA, 2004; Eskom, 2011). In line with these International treaties, the South African DEA produced a government white paper⁴ on how to deal with climate change in South Africa (DEA, 2004). The white paper, together with the National Development Plan for 2030, was released in 2011 and details how South Africa needs to mobilise its financial, human and knowledge resources for an effective response to climate change (DEA, 2011a, 2017).

The South African DEA determined that the national response should be a mitigation of climate change, rather than adaption to climate change (DEA, 2011a). Therefore, the South African DEA's mitigation approach includes defining desired emission reductions for each significant sector of the South African economy and adopting a carbon budget approach for companies in the relevant sectors (DEA, 2011a). A carbon budget is the "tolerable quantity of GHG emissions that can be emitted in total over a specified time" (WWF, 2014, p. 1). The South African DEA further requires companies from each significant sector of the South African economy, as mentioned above, to prepare and submit mitigation plans that detail how they intend to achieve the desired emissions reduction (DEA, 2011a). However, while the white paper proposed proactive steps to reduce GHG emissions, it did not bind South Africa to a specific emission reduction target.

After the South African white paper had been operating for a few years the Paris Agreement came into effect. Following changes in International climate change treaties, the then South African Minister of Environmental Affairs, signed the Paris Agreement on 26 April 2016 (UNFCCC, 2017). By signing the Paris agreement, South Africa has declared its commitment to implementing policies to enable transition to a low carbon economy (DEA, 2017; NBI, 2016; South African Government News Agency, 2017; UNFCCC, 2017). To satisfy South Africa's commitment to the UNFCCC, the DEA has been producing an annual climate change report (DEA, 2019). This annual report details the country-wide monitoring and evaluation of South Africa's

⁴ The term 'white paper' refers to the broad statements of government policy drafted by the relevant government department (The Guardian, 2009).

transition to a lower carbon economy in order to achieve South Africa's first five year emissions reduction target to the UNFCCC (DEA, 2016).

BUSINESS AND CLIMATE CHANGE

Before the early 1990s, the climate change issue was generally considered to have been neglected by businesses worldwide (Kolk, Levy & Pinkse, 2008). This situation was potentially due to the fact that companies operated purely in the pursuit of financial growth (Simpson, 2018). Therefore, societal and scientific debate about climate change has, in recent years, centred on companies and corporations in the private sector (Hahn et al., 2015).

The societal pressure for businesses to respond to climate change is driven by government policies, pressure from consumers and other stakeholders (Less & Kauffmann, 2009). The rationale behind this pressure has been that businesses need to implement effective responses to climate change. Their response needs to harness the financial, technological and organisational resources of their business to address their exposure to climate change and limit further contribution to climate change (Okereke et al., 2012).

Climate change could result in a direct change in a company's external environment. This transformation will impact on its ability to acquire, retain and grow the capitals that are required to create value and, therefore, result in a cost to the company (Promethium Carbon & The Climate Disclosure Standards Board, 2013). This negative outcome indicates that organisations should effectively manage their environmental impact and natural resource stewardship (Ernst and Young & Boston College Centre, 2014). While the IPCC (2014b) is uncertain about what the global economic impact of climate change will be, it is anticipated that the financial costs of climate change will be carried by companies in the private sector (IPCC, 2014b).

Organisations will be affected by climate change, albeit in different ways (Wittneben & Kiyar, 2009). For example, a financial service organisation may need to introduce insurance for climate change effects, while a food retailer may need to source alternative suppliers of food. Therefore, climate change poses potential strategic effects on organisations (Kolk & Pinkse, 2004). Prior research concurs that the impact of climate change will vary for companies; and that this impact can be attributed to

different factors such as size, location and industry-type (Oreskes, 2004; Wittneben & Kiyar, 2009). Consequently, it is important for any business to look at its operations and its production of GHGs to limit its contribution to climate change (Wittneben & Kiyar, 2009). Climate change consequences for companies are fast becoming more immediate and tangible than ever before (Halldórsson & Kovács, 2010).

South Africa's involvement in the Paris Agreement and climate change management has called for the involvement of civil society and the private sector (DEA, 2017). The private sector together with non-governmental organisations have made "significant financial contributions" to lower carbon emissions in South Africa (RSA Department of Environmental Affairs, 2016, p. 19). Similarly, South Africa's private sector has been a forerunner in responding to climate change (CDP, 2017b; DEA, 2017). The political and public attention that climate change has attracted has resulted in the development of voluntary carbon disclosure initiatives such as the Carbon Disclosure Project (CDP) (Hahn et al., 2015). The South African DEA (2017) stated that they will evaluate the private sector's transition to a lower carbon economy based on their participation and activities disclosed in their responses to the CDP (DEA, 2017). Given that societal pressure has resulted in the development of voluntary carbon disclosure initiatives, the next aspect of this review will expand on what is meant by the term 'voluntary disclosure' and explain who the CDP is.

VOLUNTARY DISCLOSURE

Voluntary disclosure occurs when information is provided by a company even though there is no legal requirement to produce this disclosure (Meek, Roberts & Gray, 1995). Voluntary disclosure, therefore, represents management's choice to provide information that it deems to be decision-useful (Meek et al., 1995). There is an information gap between information providers (managers) and users (stakeholders) because companies have a separation of ownership and management (Elfeky, 2017). Hence, voluntary disclosures are often aimed at managing the conflicts among stakeholders (Chow & Wong-Boren, 1987).

Globally, voluntary carbon disclosure gained corporate attention following the ratification of the Kyoto Protocol in 2005 (Hahn et al., 2015). Prior research indicates that companies headquartered in countries that were signatories of the Kyoto Protocol

tended to disclose more carbon-related information than those in non-signatory countries (Hahn & Lülfs, 2014). The disclosure by these companies acknowledges the importance of the 'global warming' issue and provides support for the conclusions reached by the IPCC and Kyoto Protocol (Ihlen, 2009). Therefore, voluntary carbon disclosure propels companies to measure and understand their impact on the environment (Simpson, 2018). Moreover, this disclosure indicates to stakeholders that the company is "preparing for the future, cutting costs and building resilience" (Simpson, 2018, p. 1).

The voluntary reporting of climate change developed from the debate over the relationship between business and its environment. In South Africa, carbon disclosure, which is an aspect of sustainability reporting, is entirely voluntary and, therefore, the reporting of climate change is also voluntary (Dillard & Brown, 2013).

All JSE listed companies must comply with the King Code (IoDSA, 2016; JSE, 2017). King IV is the most recent version of the King Code and is effective on or after 1 April 2017 (IoDSA, 2016). Of relevance for this research is that King IV recognises climate change as a driver of change and states that "continuing business as usual" in light of climate change is simply "no longer possible" (IoDSA, 2016, p. 3). In addition to this, Principle 3 of King IV states that "the governing body should ensure that the organisation is, and is seen to be, a responsible corporate citizen" (IoDSA, 2016, p. 45). Furthermore, the recommended practice suggests that all JSE listed companies should have oversight and be monitoring their impact on the environment in order to be, and to be seen as, a responsible corporate citizen (IoDSA, 2016). King IV is a set of voluntary principles and all users must demonstrate their compliance with these principles or explain any instances of non-compliance (IoDSA, 2016). There are no sanctions or penalties if a company does not comply with King IV, thus King IV merely suggests practices for companies which again demonstrates that climate change disclosure in South Africa is entirely voluntary. However, there has been a growing demand for better corporate sustainability disclosure due to the increased importance of corporate social responsibility (Manning, 2017).

THE CARBON DISCLOSURE PROJECT (CDP)

The CDP is considered to be an important player in voluntary carbon disclosure (Hahn et al., 2015). The CDP is a global not-for-profit company whose primary focus is to

work with the finance and investment community (NBI, 2015). The CDP wants to help create a world where capital is efficiently allocated to ensure “long-term prosperity instead of having a short-term gain at the expense of the environment” (National Business Initiative, 2015, p. 2). The CDP sends out three separate questionnaires pertaining to climate change, forests and water security to cities and companies worldwide (CDP, 2017b). This practice is conducted on behalf of 803 institutional signatories representing assets in excess of US \$100 trillion (Cotter & Najah, 2012). The CDP believes that the collection of accurate information and its related disclosure is an important element of a company’s responsible conduct (Kauffmann & Less, 2010).

This principle aligns with the CDP’s climate change questionnaire which aims to encourage companies to disclose and measure information relating to climate change. The CDP’s hope is that as companies are recording their emissions, they will be more aware of their operations’ contribution to climate change and that, over time, a transition towards a low carbon economy is possible (CDP, 2017b). The forest questionnaire encourages companies to disclose information regarding deforestation risks to encourage companies to reduce these risks and support the environment (CDP, 2017c). The water security questionnaire aims to enable companies and investors to understand their role in delivering a water-secure world (CDP, 2017a).

More than 570 cities, 100 states and 6 300 companies world-wide participate in disclosing their environmental data every year to the CDP (Appleby, 2018; CDP, 2017b; Cotter & Najah, 2012). In South Africa the CDP selects the JSE Top 100 companies by market capitalisation each year and requests that they participate in the CDP questionnaire (NBI, 2015). The CDP has been operational since 2001 (Gupta & Mason, 2016) and due to the positive response from companies and cities, they offer the largest directory of environmental information (Doda, Gennaioli, Gouldson, Grover & Sullivan, 2016; Hahn et al., 2015). The completed company questionnaires are available on the CDP’s website. The CDP makes use of a scoring methodology to incentivise companies participating in its questionnaire to measure and manage their impact on climate change, water and forests (CDP, 2016b). Detailed scoring methodologies are available to companies responding to the CDP so companies know what they are aiming for (CDP, 2016b). Following the discussion of climate change

and voluntary disclosure, the next aspect of this study will expand on the theoretical basis of voluntary disclosure.

THEORETICAL BASIS OF VOLUNTARY DISCLOSURE

Upon reviewing the literature on carbon disclosure the research of Hahn et al. (2015) noted that a significant number of articles did not state any theoretical foundation for their research and instead relied on prior empirical evidence to develop their hypotheses (Hahn et al., 2015). To this end, this study discusses three theoretical foundations relating to the issues of carbon disclosure, namely: Institutional theories, Economic theories and Socio-political theories of voluntary disclosure. While each of these theories will be examined separately, this study acknowledges that the determinants of these theories are not mutually exclusive (Hahn et al., 2015).

Institutional theories

Institutional theories state that an organisation is driven by the requirements of different institutions and not only the organisation's aim to maximise profits (Jepperson, 1991). This claim implies that institutions create pressure which cause organisations to adjust their behaviours and social performance (Jepperson, 1991). The idea of 'social performance' is defined as a company satisfying the needs, expectations and demands from institutions beyond those required directly by the company for its product and market (Ullmann, 1985, p. 3). By performing in a socially acceptable manner, corporations increase their legitimacy and survival prospects. Therefore, there is value for these companies in responding to institutional pressure (Tolbert & Zucker, 1996).

With voluntary disclosures, research has examined the role of institutional actors, such as the Carbon Disclosure Project (CDP), who use this disclosure as a method of monitoring companies' climate change mitigation actions and performance (Guenther, Guenther, Schiemann & Weber, 2016; Gupta & Mason, 2016; Luo et al., 2012; Stanny & Ely, 2008). Companies who voluntarily disclose information about their activities meet the demands imposed by institutional stakeholders for information and are essentially responding to public pressure. Consequently, legitimacy theory and voluntary disclosure coincide. As the purpose of voluntary environmental disclosure is to manage the public's impression of a company's activities (Cormier, Magnan, & Van Velthoven, 2005), investors and stakeholders will utilise this information to gain a more

thorough understanding of the company's carbon performance and its responses to climate change (Jaggi, Allini, Macchioni & Zampella, 2017). Furthermore, voluntary carbon disclosures should reduce information asymmetry and enable investors to make investment decisions after evaluating a company's risk exposure to climate change (Jaggi et al., 2017). Environmental information disseminated in voluntary disclosures further alleviates information asymmetry and contributes to investment decisions because it helps interpret managerial behaviour (Giannarakis, Zafeiriou, Arabatzis & Partalidou, 2018).

The last factor to consider in relation to institutional theories relates to the quality of the disclosures produced. High quality carbon disclosures are those in which consistent methodologies are used and all information and assumptions included in the report are explained (Jaggi, et al., 2017). Furthermore, the response to institutional pressure is consistent with either what other companies in the same industry have disclosed and/or what companies have disclosed because of routine and regulation (Cormier et al., 2005).

Economic theories

Economic theories of voluntary disclosure propose that organisations evaluate the costs associated with the voluntary disclosure of environmental information to interested stakeholders against the related benefits (Clarkson, Li, Richardson & Vasvari, 2008). The possible costs incurred by a company to produce carbon information could include human resources costs, investment into implementing a standard from the Global Reporting Initiative (GRI)⁵ (Dagilienė, 2013), and costs associated with the value of the information provided. The more scrutiny a company is under from stakeholders, the higher the cost of not disclosing environmental information (Stanny & Ely, 2008).

Carbon disclosure, such as those contained in a sustainability report, is meant to provide a complete and balanced picture of the corporate's sustainable environmental performance (Hahn & Lülfs, 2014). However, because of the voluntary element of this

⁵ The Global Reporting Initiative (GRI) is an organisation which has developed a framework for companies to utilise in the development of voluntary reporting to improve comparability, usefulness and quality of information reported on environmental, social and economic impact and performance (Willis, 2003).

report, 'greenwashing'⁶ can be prevalent as managers tend to opportunistically not report on the 'bad' sustainability information (Hahn & Lülfes, 2014). Therefore, potential reputational costs exist if investors consider the information to be 'greenwashing'.

The benefits of disclosure should also factor into a company's decision to voluntarily disclose information because these benefits may outweigh the costs. For example, signalling theory proposes that investors and analysts value proactive disclosure as it attempts to solve the asymmetry of information, created by the separation of ownership and management (Clarkson et al., 2008; Hahn et al., 2015). By providing this disclosure, management appears honest and trustworthy because they are seen to be more transparent and reducing information asymmetry⁷ (Hahn et al., 2015). Thus, because stakeholders value transparency, signalling can improve management's reputation. Furthermore, with management disclosing information about the environment it is also signalling that management is taking responsibility for environmental issues (Hahn et al., 2015).

It should also be noted that costs of disclosing climate change information must not be confused with the costs of mitigating climate change. The costs and challenges of mitigating climate change can be reduced with substantial reductions of GHG emissions over the next few decades (IPCC, 2014b). Furthermore, the extent of these costs vary depending on the methodologies and assumptions applied by the IPCC in making its estimates (IPCC, 2014b). While individual companies are more likely to be able to determine their costs for mitigating climate change, few companies have recorded these costs in their disclosure (Stanny & Ely, 2008).

In terms of the literature which includes theoretical underpinning, much of the literature which examines economic theories of voluntary disclosure suggests a relationship between financial performance metrics and voluntary disclosure. These studies indicated the following four findings:

⁶ 'Greenwashing' is a term which was first used in 1986 by Jay Westerveld which refers to companies presenting themselves as environmental stewards, when in fact they are engaging in environmentally unsustainable practices (Watson, 2016).

⁷ 'Information asymmetry' is a concept which refers to the situation in which one individual possesses more or better information than another individual (Do, 2003).

- There is a negative relationship between economic performance (as measured by return on assets (ROA)) and the CDP climate change score (Jaggi et al., 2017). Jaggi, et al. (2017) conducted a longitudinal analysis of listed Italian firms.
- Similarly economic pressure is inversely associated with the decision to disclose to the CDP (Luo et al., 2012). This result comes from the study conducted by Luo et al. (2012) who investigated the Global 500 companies⁸.
- Predicators of carbon disclosure included profitability and affiliations with a carbon-intensive industry (Hahn et al., 2015). Furthermore the most commonly applied control variables were market-to-book (MtoB) ratios, leverage and size (Hahn et al., 2015). These results come from Hahn et al. (2015) who recorded contradictory findings. They examined 13 studies which analysed the relationship between financial performance and carbon disclosure and discovered mostly insignificant findings (Hahn et al., 2015).
- The size of the company is considered to be an influential factor when examining climate change disclosure according to the results of the study conducted by Stanny and Ely (2008) for the US Standard and Poor's (S&P) 500 companies.

Economic theories of voluntary disclosure, therefore, suggest that companies need to balance the costs of disclosing against the benefits of disclosing. Furthermore, each of these economic determinants (return on assets, industry, size and leverage) imply a relationship between financial performance and voluntary disclosure.

Socio-political theories

Socio-political theories of voluntary disclosure explain that the disclosure produced by organisations is due to political and/or social pressure from multiple stakeholders (Hahn & Lülfs, 2014; Hahn et al., 2015). Disclosure produced in response to such coercion tends to vary based on the social or political focus of the time, particularly when the disclosure is not required by regulation (Gray, Kouhy, & Lavers, 1995).

⁸ The Global 500 companies consists largest 500 companies globally by market cap as per the CDP's 2009 report (Luo et al., 2012).

Socio-political theories can be further subdivided into stakeholder theory and legitimacy theory.

Stakeholder theory refers to an organisation implementing different strategies in the interests of different stakeholder groups (Roberts, 1992). According to stakeholder theory, the social pressure for climate change information explains the need for carbon disclosure (Hahn et al., 2015). The urgency of a company's response depends on the power of the stakeholders (Hahn et al., 2015) and thus varies from one company to another.

Legitimacy theory refers to how the actions of an organisation are considered appropriate because of societal norms and values (Suchman, 1995). Legitimacy theory also motivates for carbon disclosure in reaction to external social or political pressure and improves the public's perception of a company's sustainability performance (Hahn et al., 2015; Hummel & Schlick, 2016; Suchman, 1995).

Environmental disclosure essentially maintains a social contract between the company and society (Hahn et al., 2015). The higher the level of stakeholder engagement, the higher the incentive for companies to safeguard their legitimacy (Manning, 2017). If this contract between the company and society is broken, companies will be under greater scrutiny (Hahn et al., 2015; Stanny & Ely, 2008). Larger companies are pressured to legitimize their actions since they are usually more visible and have greater media exposure (Hahn et al., 2015). Therefore, the size of the company is a determinant that needs to be considered under legitimacy theory, because there is a greater probability that larger companies will have carbon disclosures (Stanny & Ely, 2008).

Institutional theories, economic theories, and socio-political theories all play a role in influencing companies to disclose information about climate change. This aspect of this review aimed to define each theoretical framework and demonstrate how all three frameworks are relevant for voluntary climate change disclosure.

CONCLUSION

The climate is changing due to increased amounts of anthropogenic GHGs released into the atmosphere (NASA, 1998; Stern, 2006). The changing climate has required

intergovernmental co-ordination of mitigation strategies under the Kyoto Protocol and the Paris Agreement.

In South Africa climate change is notable in temperature changes, rainfall variations and rising sea levels (National Planning Commission, 2011). As a result the South African DEA acceded to the Kyoto Protocol (DEA, 2004; Eskom, 2011) and signed the Paris Agreement declaring its commitment to becoming a low carbon economy (UNFCCC, 2017).

Societal pressure has driven business to respond to climate change and limit further contribution to climate change (Less & Kauffmann, 2009; Okereke et al., 2012). Voluntary climate change disclosure is used by companies to acknowledge the gravity of the climate issue and to offer support for the conclusions reached by the IPCC and Kyoto Protocol (Ihlen, 2009). Furthermore, many companies in the private sector voluntarily disclose carbon information to appease stakeholders who want to see a response to climate change (Chow & Wong-Boren, 1987).

The CDP is an example of voluntary disclosure which was discussed. Three theoretical foundations were reviewed, namely institutional, economic and socio-political theories. Prior literature has made use of the CDP for its scoring (Luo et al., 2012; Stanny & Ely, 2008), but tended not to incorporate any of the qualitative questions from within the CDP questionnaire. Prior research also tended to rely on prior empirical evidence to develop their hypotheses (Hahn et al., 2015) as opposed to a theoretical foundation. Therefore, this study aims to consider both the CDP score and the qualitative questions in its analysis of voluntary climate change disclosure and will incorporate the necessary theoretical frameworks in its design.

METHODOLOGY

The literature review has indicated a gap in the research of voluntary climate change disclosure to CDP– namely that the research tended to be limited exclusively to a quantitative or qualitative approach and limited research has analysed the responses within the CDP questionnaire. Therefore, this study aims to add to the body of literature by answering the following research question:

Which factors, either company specific or individual company responses, within the CDP questionnaire influence a high CDP climate change score for South African companies

To answer this question, the CDP score for the Top 100 JSE listed companies will be assessed against selected companies' characteristics and their responses to questions asked within the CDP questionnaire. The null hypothesis (H_0) is that no factors influence the score, while the alternative hypothesis (H_1) is that certain factors do influence the score. Next, a description of the data collected, the variables chosen and the statistical methods to be employed will be presented.

DATA COLLECTION

To begin, a sample of South African companies was selected. To do this, a full Johannesburg Stock Exchange (JSE) listing as at 31 March 2017⁹ was obtained from the INET BFA portal¹⁰. These companies were then ranked by market capitalisation (market cap) to select the Top 100 companies. This research considers it appropriate to focus on the JSE Top 100 companies because this Group represents 95.37% of the JSE market¹¹. Moreover, the literature reviewed also demonstrated that larger companies are more likely to disclose information about climate change because they are under greater “scrutiny” from investors (Stanny & Ely, 2008, p. 2). For each of the companies, select company specific variables were sourced from the INET BFA portal. Additionally, the CDP climate change programme score and individual company responses to the climate change questionnaire were obtained from the CDP's website.

⁹ The last year-end that a company can select in the 2017 CDP climate change questionnaire is 31 March 2017.

¹⁰ INET BFA is an online database and is the leading provider of African market data (Knott, 2016).

¹¹ This percentage is calculated by summing the market cap of the JSE Top 100 over the sum of the market cap of full JSE listing as per the INET BFA on 31 March 2017 i.e. $13\,901\,051\,862\,024/14\,575\,916\,810\,342 = 95.37\%$.

The first ten questionnaires were obtained freely from the CDP website, thereafter, access to further questionnaires was obtained by subscribing to the CDP for a fee. The rationale for using the CDP for this information is explained in the next section.

THE CDP QUESTIONNAIRE

The rationale for using data from the CDP is threefold: Firstly, there are 6 300 companies who elect to participate in the CDP's climate change programme every year which indicates that the CDP is a source of company specific voluntary environmental disclosure information (CDP, 2017b). Secondly, because the nature of the disclosure made to the CDP is via a questionnaire, there is a lack of discretion in the companies' answers, which allows for simplified data collection and comparison. Thirdly, there is extensive comparative data available since companies have been disclosing information to the CDP since 2001. This data has also been used in prior research (Luo et al., 2012; Stanny & Ely, 2008). Moreover, the CDP has been endorsed by 237 companies worth \$6.3 trillion in assets, following the release of the recommendations for "voluntary and consistent climate-related financial risk disclosures" from the Task Force on Climate-related Financial Disclosure (TCFD) (CDSB, 2018, p. 4; Simpson, 2017). Finally the CDP's scoring allows companies to compare themselves year on year and similarly allows comparisons to be made between companies (Appleby, 2018). This corresponds with the findings in the literature review because in terms of institutional theories what other companies in the same industry have disclosed and what companies have disclosed because of routine and regulation often encourages voluntary disclosure (Cormier et al., 2005).

The CDP climate change score is an awarded rank with ranges between A and D. Each rank corresponds to the CDP's assessment of the company's progress towards environmental stewardship (CDP, 2016b). The highest score (A) indicates leadership in climate change disclosure and their disclosure indicates a thorough understanding of their climate change risks and opportunities with formulated and implemented strategies to mitigate and capitalise on the aforementioned risks and opportunities (CDP, 2016b). The second highest score (B) indicates disclosure of good environmental management that is relevant and applicable for the company (CDP, 2016b). The third highest score (C) indicates that the company has disclosed how its business impacts the environment but it does not include any actions to address the environmental issues beyond the assessment of the business risk (CDP, 2016b). Next,

the score D indicates that company has achieved only the disclosure level of environmental stewardship (CDP, 2016b). The lowest score “E” means that the response was received by the CDP but not scored for a multitude of reasons, such as a late submission (CDP, 2016a). The CDP’s scoring, therefore, serves to provide investors with a measure which indicates a company’s commitment to environmental stewardship disclosure in terms of climate change. Consequently, the CDP climate change score will be the dependent variable for this study.

The CDP’s questionnaire is a standardised set of questions, hence there is an opportunity to compare companies’ answers across questions. This fact is beneficial because voluntary disclosure on climate change in sustainability reports is completed using the companies’ own discretion (Amran & Haniffa, 2011). This practice results in different information being presented by different companies and limits the comparability of such disclosures. The CDP has scoring methodology documents which detail how each question within the questionnaire is awarded a point but the majority of the points are awarded for the “company-specific explanations” because this evidence substantiates a company’s climate change risk management (CDP, 2016, p. 8).

Prior research using this climate change data tended to only make use of the final climate change score provided by the CDP (Luo et al., 2012; Stanny & Ely, 2008) and not the individual company responses within the questionnaire, which is one example of how this study is contributing to the body of literature in this research area. Furthermore, this study will examine the responses made by South African listed companies. Prior research has concentrated on Forbes Global 500 firms and US S&P 500 firms (Luo et al., 2012; Stanny & Ely, 2008), so this research enables a focus on South African companies. South African companies have been responding to the CDP’s climate change programme since 2007 (NBI, 2015). The CDP considers South Africa’s domestic companies to be “unquestionably performing on a par with their global peers” and “in many cases outperforming them” (NBI, 2016, p. 2). If it can be determined what factors influence a higher CDP score for South African companies, these factors might indicate the reason as to why South African companies are outperforming their global peers. Consequently, other companies in other countries could focus on improving those factors.

The CDP climate change programme has been around since 2001, and the CDP have made changes to the questionnaire over the years. The most recent CDP questionnaire data available is the 2017 climate change questionnaire which has remained substantially the same since 2013. Therefore, this study will analyse the CDP questionnaires between 2013 and 2017 ('the period') to allow for comparability.

In total a responding company must answer about 77 questions in the CDP climate change questionnaire. Each of these questions were assessed by the researcher firstly for those which are comparable and complete across the period 2013 to 2017. Furthermore, only questions which all companies must answer were selected to allow objective comparability across different companies. As a result of this, 24 questions remained which were then assessed to determine which ones aligned with the disclosure theories discussed in the literature review. 21 questions were disregarded. This resulted in three questions to be included in this analysis, namely¹²:

- *Do you provide incentives for the management of climate change issues, including the attainment of targets? If so what kind of incentive is provided.* This variable is referred to as the variable "incentive". Introducing an incentive for management of climate change issues was called for by Deegan and Islam (2012), who stated that these inducements may provide the necessary motivation that institutional investors have been wanting. Deegan and Islam (2012) further stated that providing incentives is a consideration for institutional theory.
- *How far into the future are risks considered?* This practice is referred to as the variable "future risk". How a company manages its future risk refers to one of

¹² The potential impact of mechanical correlation by incorporating three questions from within CDP questionnaire into the model has been considered. However, the following points indicate that the risk of mechanical correlation is low. Firstly, a Pearson correlation, Spearman correlation and point biserial correlation were examined and each of the three questions are not highly correlated with the CDP score. Secondly, these variables are incorporated into the model together with company specific factors which reduces this risk of mechanical correlation because the model is analysing more than just the three questions. Thirdly the CDP incorporates the answers to the questionnaire with a weighting system to derive the final CDP score. While in this model the answers to the three questions are coded and the CDP's weightings are not used. Therefore, the three questions are incorporated differently in the model than how they are incorporate in the CDP score. Fourthly only three questions have been used in this model while there are 77 questions that are used to derive the final CDP score. The CDP scoring is a complex process and therefore the potential impact of using 3 of the questions in the model is lower. Finally, each of the three questions were selected due to a basis in theory. Therefore it can be concluded that the risk of mechanical correlation is low.

the strategies that is employed to manage their stakeholders in terms of stakeholder theories, one of the theories under socio-political theory (Roberts, 1992).

- *Please provide the following information for the person that has signed off (approved) your CDP climate change response.* This approval is referred to as the variable “key management”. This term “key management” is referred to in the CDP questionnaire, although it is not defined. The degree of management’s support for environmental activities can be used as an indicator of the quality of the climate change mitigation plan (Jacques, Campbell, Lober & Bynum, 1997). Thus, understanding the level of key management involved in mitigating climate change is an indicator of the quality of the plan. However, it is important to note that generally the CEO is an expert in running the company and not necessarily an expert on managing climate change (Reynolds, 2018). Accordingly, a company should have a separate individual who is part of key management that is responsible for managing climate change risks in the business because he/she has the appropriate expertise (Reynolds, 2018). The person responsible for approving the CDP questionnaire indicates the company’s impressions about the importance of the company’s voluntary environmental disclosure. This aligns to institutional theory.

The economic theories will be incorporated in other variables in the model.

DATA CLEANING

This section will detail how the final sample was selected. This study will be looking at the CDP scores over the full five-year period from 2013 to 2017. Over the period analysed, not all the JSE Top 100 companies responded annually to the CDP questionnaire. This is partially since the JSE Top 100 companies changes every year. Given a period of 5 years, a 100% response rate would equate to 500 company responses. However, only 305 responses were available. Furthermore, of the 305 responses to the CDP, 63 responses were excluded because of incomplete information. Therefore, the final sample over the period consists of 242 responses. Appendix A includes a table indicating whether the company’s responses are included in the final sample of 242 or not.

The 242 responses can be disaggregated into the separate years with 50 responses in 2017, 53 in 2016, 55 in 2015, 38 in 2014, and 46 in 2013. The 242 responses are representative of 57 unique companies. Therefore, this study will only assess the results for these 57 companies. There is a potential limitation of scope due to the range¹³ analysed in this study and one can speculate that perhaps those companies not responding would likely have had poorer CDP scores and for that reason they did not submit or participate. This ambiguity is a recommended area for future research. Nonetheless, only analysing the 57 companies that responded to the CDP is considered appropriate because the aim of the study is to assess the factors determining the CDP score and this objective can still be achieved by limiting the analysis to these 57 unique companies, which will be referred as the 'sampled companies' for the remainder of this study. While this sample might be biased towards companies who partake in the CDP questionnaire and who have complete information, the purpose of this study is not to assess who is and who is not partaking in the CDP questionnaire. Rather the aim of this study is to determine if there are company specific or individual company responses within the CDP questionnaire which influence a high CDP climate change score. By examining the 57 unique companies this can still be achieved. Furthermore, South African companies who have been responding to the CDP are "consistently ahead of their responding global peers" (CDP, 2017b, p. 2), therefore there is value in conducting this analysis on the 57 unique companies.

DESCRIPTIVE STATISTICS

This section will present descriptive statistics of the sampled data and the variables included in the testing. The purpose is to determine which statistics tests is most appropriate. To begin, the dependant variable, the CDP score will be discussed.

¹³ The term 'range' here refers to a statistic term 'restriction of range'. Since this study is only using responding companies to the CDP, it implies that a criterion has been applied to limit the data in the population i.e. there has been a restriction of the range. Restriction of the range has a consequence for the interpretation of the results (Wiberg & Sundström, 2009). Thus, the results can only be applied to companies like those in this study's sample, i.e. they are the JSE Top 100 companies that responded to the CDP. This interpretation is still considered appropriate and simply needs to be borne in mind when reading the following chapters.

The CDP score which was ranked within a range between A and E, were recoded as A = 5, B = 4, C = 3, D = 2, and E = 1¹⁴. Where 5 (corresponding to A) indicates better environmental stewardship and 1 (corresponding to E) indicates poorer environmental stewardship. This re-coding was implemented to enable statistical analysis within Stata¹⁵. The mean score of the 242 responses is 3.67 i.e. between B and C, with a standard deviation of 0.94 and a mode of 4 i.e. B. This result indicates that most of the companies scored in the B band, indicating good environmental management (CDP, 2016a). A histogram of the CDP scores (the dependent variable in this study) is plotted in Figure 1 below.

¹⁴ The CDP score is not strictly continuous, but for this analysis it is treated as a continuous variable. Many prior studies have treated ordinal type variables as continuous variables (Pasta, 2009). Thus, it is appropriate to treat the CDP score as a continuous variable for this study.

¹⁵ Stata is a statistical software package (StataCorp, 2017).

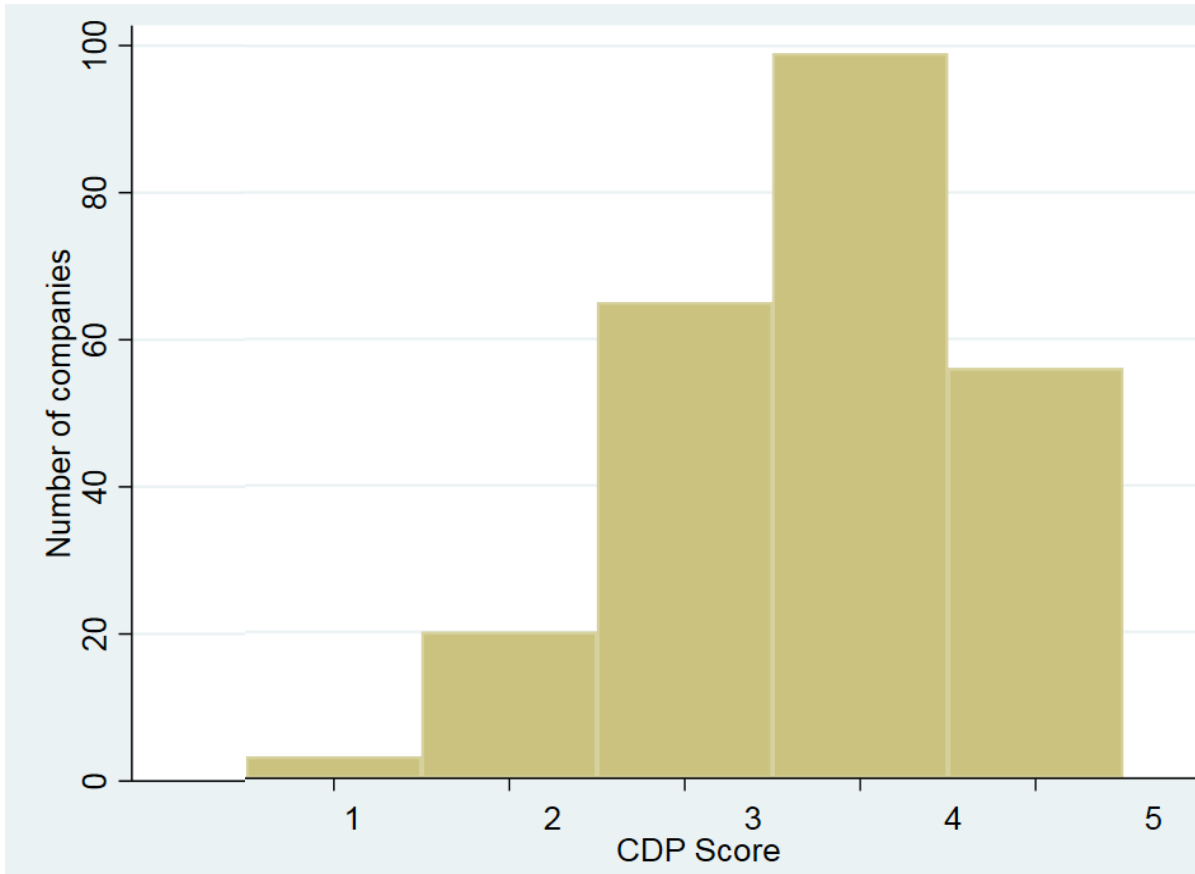


Figure 1: Histogram of the CDP Score overall

The histogram of the CDP scores plotted for the period overall in Figure 1 appears to be normally distributed with the data slightly skewed to the left. This deviance is further corroborated in Figure 2 which plots a histogram for the CDP scores per year. The slight deviation from the normal distribution is not an issue for the use of the model in this study, it merely informs the distribution of the residuals.

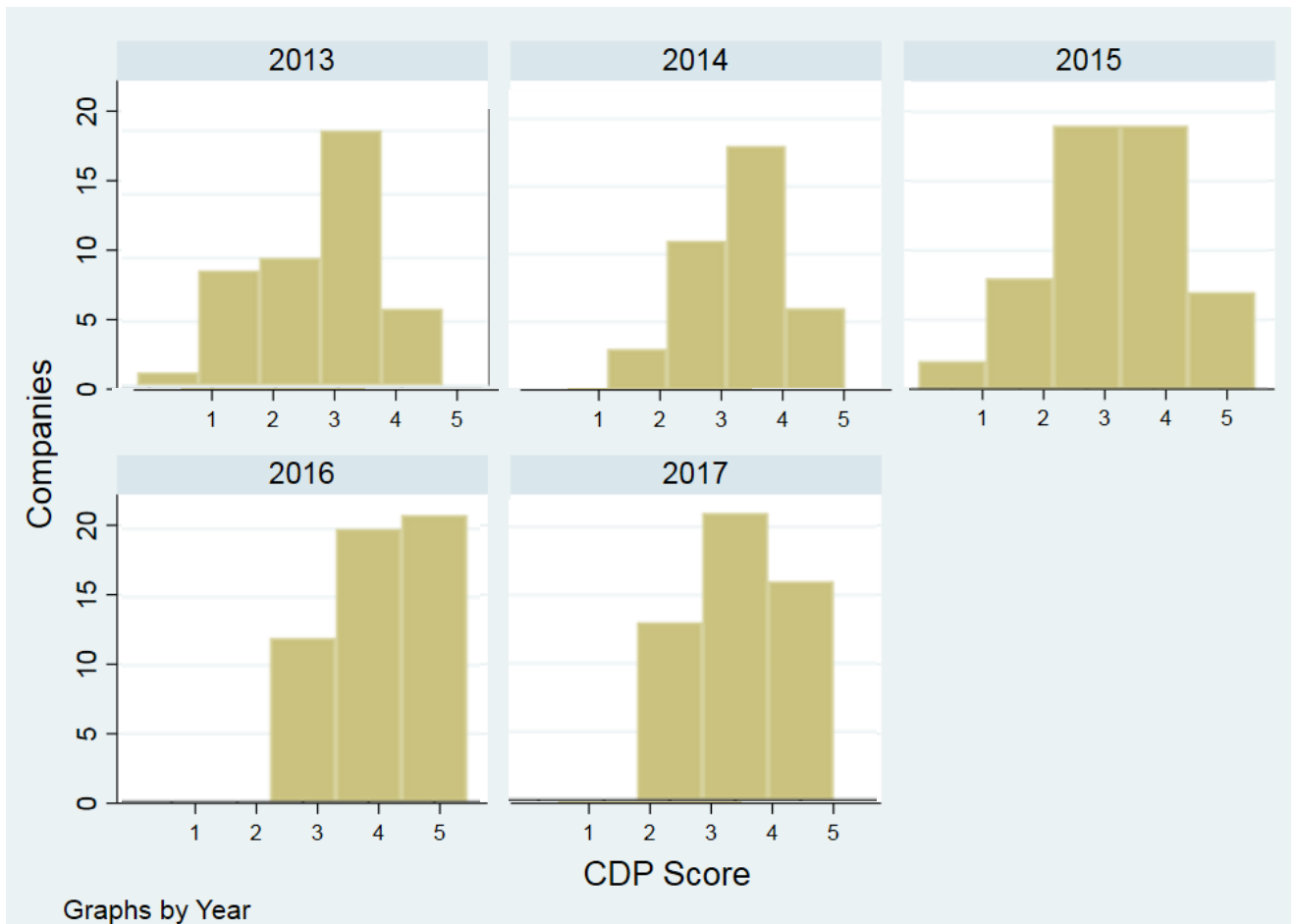


Figure 2: Histogram of the CDP Score per period

Figure 2 shows that each year in the period reflects a normal distribution, with the data slightly skewed to the left, except for the 2016 year which indicates that there is not a normal distribution in that year. However, as the data is not going to be analysed per year but rather altogether in the statistical testing, this difference does not affect the method of testing used. Furthermore, Figure 2 reflects that in 2016 and 2017, more companies scored a 5 and no companies scored a 1 or a 2, when compared to years 2013 to 2015¹⁶. Supporting this observation, the mean scores for the periods from 2013 to 2015 and 2016 to 2017 is 3.49 and 4.11 with a standard deviation of 0.97 and 0.77 respectively. A possible explanation for this difference is the adoption of the Paris Agreement on 12 December 2015 (Wolfgang et al., 2016). The adoption of the Paris Agreement could have resulted in an increased focus on climate change disclosure. Given this change in scores over the period analysed, it is requisite to analyse the

¹⁶ Therefore, this adds to the earlier discussion and suggests that there is a possibility of a restriction of range. Thus, the results can only be applied to companies like those in this study's sample, i.e. the JSE Top 100 companies that responded to the CDP.

results by introducing an indicator variable to the data representing the Paris Agreement. Where the indicator would be 0 for the years 2013 to 2015 and 1 for the years 2016 and 2017. Appendix B shows the distributions of scores for these two sub-periods indicating a normal distribution, with the data slightly skewed to the left. Therefore, the dependent variable reflects a slight deviation from the normal distribution. Understanding this distribution will inform the appropriate statistical model, which is discussed in the research approach.

Next, information on each of the selected company specific variables and the three selected climate change questionnaire responses to be included in the testing are presented in Table 1. The variable name is shown in the first column, with further descriptive information on how that variable was determined and why it is appropriate to include in the testing in the remaining columns. The final column describes the related theories which inform the use of this variable.

Table 1: Variables

Variable name	Control/ independent variable	Variable description	Explanation for inclusion, per the literature	Related theories ¹⁷
Size	Independent variable	A continuous variable calculated as market capitalization over the shareholders' equity. This ratio is often referred to as the market to book (MtoB) ratio.	Prado-Lorenzo, Rodríguez-Domínguez, Gallego-Álvarez and García-Sánchez (2009) found that there is a higher volume of carbon information disclosed when a company has a lower MtoB ratio compared to companies that have a lower MtoB ratio.	<i>Socio-political theories:</i> Companies which have poor economic performance, as indicated by a lower MtoB ratio, tend to have a higher volume of environmental disclosure to make themselves more attractive to different stakeholders (Prado-Lorenzo et al., 2009). This fact suggests that this disclosure varies based on the social focus of the time (Gray, Kouhy and Lavers, 1995).
Foreign sales percentage (FSP)	Independent variable	A continuous variable calculated as total foreign sales, divided by total turnover of a company for the year.	Companies with foreign sales are more likely to respond to the CDP questionnaire due to their greater level of "scrutiny" (Stanny & Ely, 2008, p. 2).	<i>Institutional theories:</i> When there is a positive association between the degree of disclosure and foreign sales this situation suggests that global companies are likely to have a higher degree of environmental regulation (Stanny & Ely, 2008). This fact might suggest that these companies are driven by the requirements of different institutions, such as the need to comply with the environmental regulation, and not only the company's aim to maximize profits (Jepperson, 1991).
Leverage	Independent variable	A continuous variable of the total debt divided by total assets at the end of the year.	Companies with higher levels of debt are more likely to respond to the CDP questionnaire as these firms are more closely monitored (Stanny & Ely, 2008). Furthermore, leverage stimulates managers to provide carbon information voluntarily, particularly for managers of companies belonging to carbon	<i>Economic theories:</i> Providing more information voluntarily about the environment, for example when a firm is more highly leveraged, improves management's reputation because it is being more transparent. Furthermore this practice signals that management is taking responsibility for the environment (Hahn et al., 2015)

¹⁷ For some of the variables included in this table there is an overlap with the three theories. However, the researcher has included the most relevant theory, although there is some overlap.

Variable name	Control/independent variable	Variable description	Explanation for inclusion, per the literature	Related theories ¹⁷
			intensive industries (Hahn et al., 2015; Jaggi et al., 2018).	
Return on assets (ROA)	Control variable	ROA is a proxy for a firm's profitability. This continuous variable is calculated as the earnings before interest and tax (EBIT), divided by total assets as at the end of the year.	It is necessary to include this variable as profitable firms can more readily afford the expenditures incurred to disclose information about climate change (Luo et al., 2012).	<i>Economic theories:</i> Profitability is a predictor of carbon disclosure (Hahn et al., 2015). Furthermore, in line with economic theories, economic pressure is inversely associated with the decision to disclose to the CDP (Luo, Lan and Tang, 2012).
Incentives	Independent variable	This variable is derived from a question in the CDP questionnaire. The CDP question reads "Do you provide incentives for the management of climate change issues, including the attainment of targets?" The responses are either yes or no (per a drop-down menu). Therefore, this is a binary variable . The response has been coded as 1 for yes and 0 for no.	If management is aware of the company's impact on the environment, then it can take steps to mitigate climate change (Kolk & Pinkse, 2004; Wittneben & Kiyar, 2009) Therefore, if key management want to ensure that climate change is an important issue for the company then amounts paid to key management should be linked to improvements in environmental performance (Deegan & Islam, 2012).	<i>Institutional theories:</i> If institutional investors call for integration of environmental metrics in managerial incentivisation schemes then revised reward structures are likely to be introduced by companies (Deegan & Islam, 2012).

Variable name	Control/independent variable	Variable description	Explanation for inclusion, per the literature	Related theories ¹⁷
Key management	Independent variable	<p>This variable is derived from a question in the CDP questionnaire. The question reads "Please provide the following information for the person who has signed off (approved) your CDP climate change response"</p> <p>The companies had to enter the job title of the person who was responsible for completing the CDP questionnaire. Various job titles were indicated. Where the CDP questionnaire was signed off by either the Environment/ Sustainability manager or the Group Head of Safety and Sustainable Development then a value of 1 is assigned. This shows that there is a designated person responsible for approving the questionnaire, which may indicate that the risks and opportunities associated with climate change in the organisation are designated to this person responsible for the signoff. All other job titles are coded as 0. This variable is therefore a binary variable.</p>	<p>The degree of management's support for environmental activities can be used as an indicator of the quality of the climate change mitigation plan (Jacques et al., 1997).</p> <p>If management have allocated a separate person to ensure that the risks and opportunities related to the environment and sustainability are being addressed and reported then this allocation indicates management's support for environmental activities (Reynolds, 2018). This allocation occurs because the CEO is not necessarily an expert in managing climate change (Reynolds, 2018). The company is then potentially more likely to have quality climate change mitigation plans, in the company's disclosure, if there is a separate person responsible for providing this (Deegan & Islam, 2012).</p>	<p><i>Institutional theories:</i> The level of responsibility delegated to key management to manage emissions disclosures and climate change issues is considered to enhance shareholder value (Najah & Cotter, 2012). Therefore, disclosing information about key management in voluntary environmental disclosure to CDP, manages the public's impression about the company's activities (Cormier et al., 2005). This practice aligns to institutional theories.</p>

Variable name	Control/ independent variable	Variable description	Explanation for inclusion, per the literature	Related theories ¹⁷
Paris Agreement	Independent variable	Paris Agreement is an indicator variable where the indicator is 0 for the years 2013 to 2015 and 1 for the years 2016 and 2017. The Paris Agreement is therefore a binary variable .	As demonstrated in Figure 2, under Descriptive Statistics, post the signing of the Paris Agreement, the CDP scores were higher which means better environmental stewardship i.e. 5=A. This implies an improvement in voluntary disclosure. Thus it is necessary to include this variable as companies post signing the Paris Agreement are more likely to produce disclosures to an organisation like the CDP (Kauffmann & Less, 2010).	<i>Institutional theories:</i> One of the driving factors for institutional theories disclosure is what companies have disclosed because of routine and regulation (Cormier et al., 2005). The Paris Agreement is an example of a regulation which might drive disclosure to CDP.
Industry	Control variable	The JSE has seven industries: basic materials, consumer goods, consumer services, financials, health care, industrial and telecommunications (JSE, 2013). In order to incorporate this variable into the regression it is coded as 1 for industries that are considered to be a high carbon intensive industries (industrials and basic materials)), and 0 for the other industries. This approach is consistent with Guenther et al. (2016.) This variable is therefore a binary variable .	Companies in carbon intensive industries are subject to more regulation of their emissions and as such are subject to attention from investors (Guenther et al., 2016; Stanny & Ely, 2008).	<i>Economic theories:</i> Affiliations with a carbon-intensive industry is a predictor of carbon disclosure (Hahn et al., 2015).

Variable name	Control/independent variable	Variable description	Explanation for inclusion, per the literature	Related theories ¹⁷
Future risks	Independent variable	<p>This variable is derived from a question in the CDP questionnaire. The CDP question reads “please select the option that best describes your risk management procedures with regard to climate change risks and opportunities – how far into the future is climate risk considered?”</p> <p>The drop-down for the question allows the following options, which have been coded as a categorical variable accordingly: 1 to 3 years=1; 3 to 6 years=2 ;> 6 years=3; Unknown/not provided=4.</p>	<p>How far into the future climate change risk is considered indicates how the current business is likely to overcome climate change disruption (Wessel & Christensen, 2012). Furthermore, managers are more likely to disclose their future climate change risk management than their historical climate change risk management (Najah & Cotter, 2012).</p>	<p><i>Socio-political theories</i>: Managers use their future climate change risk management activities rather than their historical carbon emissions levels to manage stakeholders’ perceptions (Najah & Cotter, 2012). This procedure refers to how companies implement different strategies to manage their stakeholders in terms of stakeholder theory¹⁸ (Roberts, 1992).</p>

¹⁸ Stakeholder theory is one of the socio-political theories as per the literature review.

Summary statistics for each of the variables in Table 1 are given in Tables 2 and 3 and Figures 3 and 4 to follow. First, Table 2 details the number of observations, the mean value, the standard deviation and the minimum and maximum values for each of the continuous variables.

Table 2: Summary statistics for the continuous variables

Variable name					
<i>Continuous variables:</i>	N	Mean	Std.Dev	Min	Max
Size	242	10.25	31.74	0.06	302.16
Foreign sales percentage (FSP)	242	37%	0.35%	0%	100%
Leverage	242	0.54	0.21	0.00	0.95
Return on assets (ROA)	242	9%	0.10%	-26%	64%

The four continuous variables i.e. FSP, Size, ROA, and Leverage, are all financial ratios. The largest company in the sample, with a MtoB ratio of 302, is British American Tobacco PLC. The average MtoB ratio for the sampled companies of 10. African Rainbow Minerals, with a MtoB ratio of 0.06, is the smallest company in the sample. There were some observed outliers for this variable above the 75th percentile. Outliers need to be considered for their effect on the testing and will be further assessed in the research approach.

Of the sampled companies, the average proportion of total revenue that is earned from foreign sales is 37%. The maximum of 100% was obtained by six companies (Anglo American PLC, British American Tobacco PLC, Capital & County Properties PLC, Glencore Xstrata PLC, Hammerson PLC and Intu Properties PLC) who solely generate revenue outside of South Africa. No outliers were observed for this variable.

For the Leverage variable, the calculated ratio of total debt divided by total assets cannot be greater than 1, in order for the accounting equation to balance (Prado-Lorenzo et al., 2009). Accordingly, the maximum value of 0.95 for MMI Holdings Ltd shows that the company has a risky level of debt because it is more dependent on creditors than the other sampled companies (Guenther et al., 2016). Conversely, the minimum leverage value of 0 is for Old Mutual PLC who has no debt on its financial statements. No outliers were observed for this variable.

The average ROA, which indicates how profitable the company is, is 9%. The highest ROA percentage of 64% for Kumba Iron Ore Ltd in 2013 reflects the stronger market conditions in crude steel over that period (Kumba Iron Ore, 2013). The lowest ROA percentage is negative 26% for Telkom SA Ltd in 2013. ROA can have a negative value if a company is not profitable i.e. making losses. Telkom SA Ltd's revenue decreased to R32.5 billion in 2013 as a result of sustained pressure on fixed-line operations, which include landlines and private pay phones (Telkom SA Ltd, 2013). The ROA variable had some observed outliers at 25th and 75th percentiles, which are discussed in the research approach.

Table 3 details the number of observations, the frequency and the mean value (in parenthesis) for each of the binary variables.

Table 3: Summary statistics for the binary variables

<i>Binary variables:</i>	N	Freq
Incentives	242	190 (79%)
Key management	242	82 (34%)
Paris Agreement	242	103 (43%)
Industry	242	97 (40%)

The binary variables i.e. Incentives, Key Management, Paris Agreement and Industry, are interpreted differently to continuous variables. Being a binary variable, the frequency column shows that 79% of responses indicated that incentives are provided for the management of climate change issues. Thus, the majority of responding companies are providing incentives. A frequency of 34% for Key management which indicates that the majority (66%) of the sampled companies were not requiring either the Environment/Sustainability manager or the Group Head of Safety and Sustainable Development manager to approve the CDP questionnaire. A frequency of 43% for the Paris Agreement variable indicates that the majority (57%) of the sampled responses come from the period 2013 to 2015 i.e. pre-signing of the Paris Agreement. A frequency of 40% for Industry indicates that the majority (60%) of the sampled companies are not operating in carbon intensive industries. Further detail regarding this Industry variable is given in Figure 3.

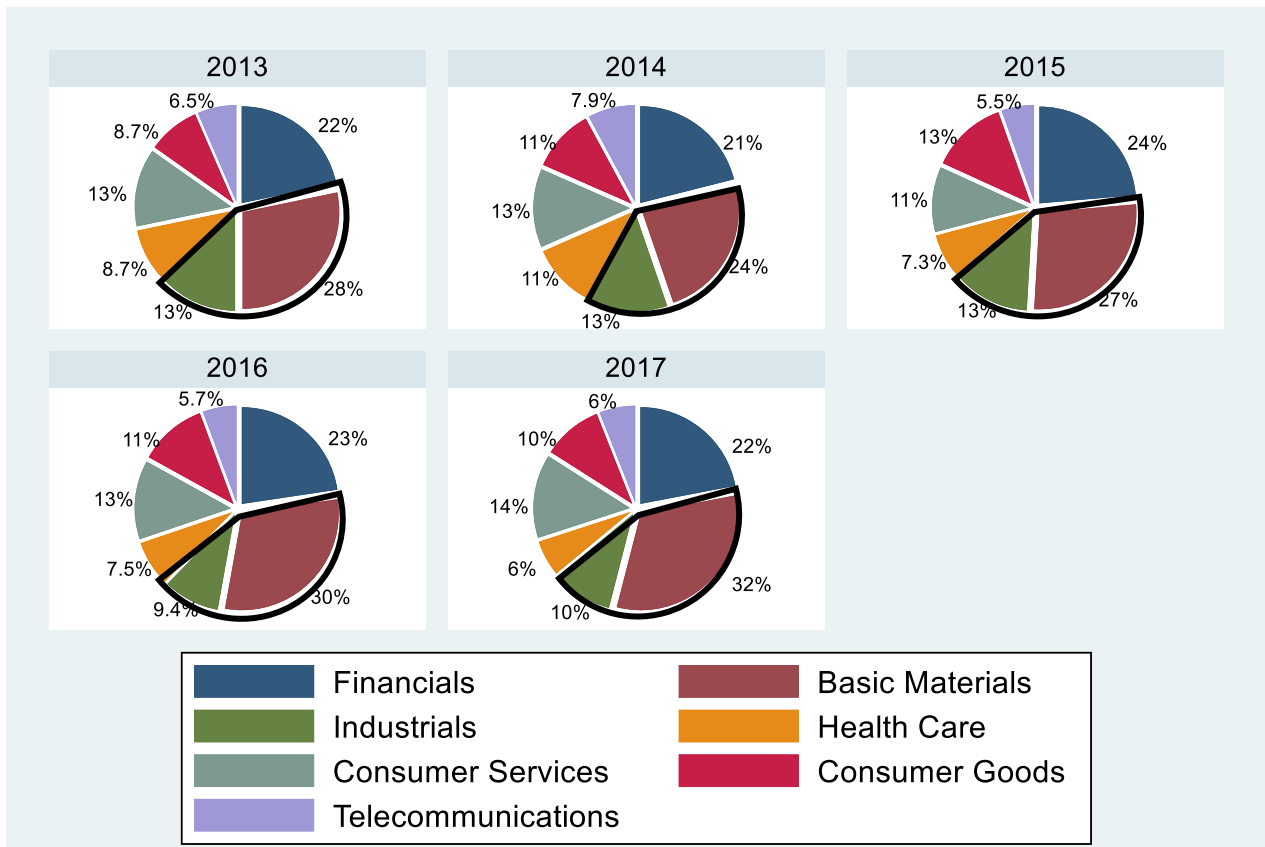


Figure 3: Industry analysis of sampled companies by year

Figure 3 indicates that the largest proportion of companies across all five years are in the basic materials industry, with the second largest proportion being in the financial industry. The telecommunications and health care industries make up the smallest proportion of the sampled companies. Included in Figure 3 is a dark black outline around the industrial and basic materials industries which are the carbon intensive industries (Guenther et al., 2016). Over the five-year period, 37% to 42% of the sampled companies are in a carbon intensive industry.

Finally, Figure 4 presents a pie chart of the categorical independent variable: Future Risks.

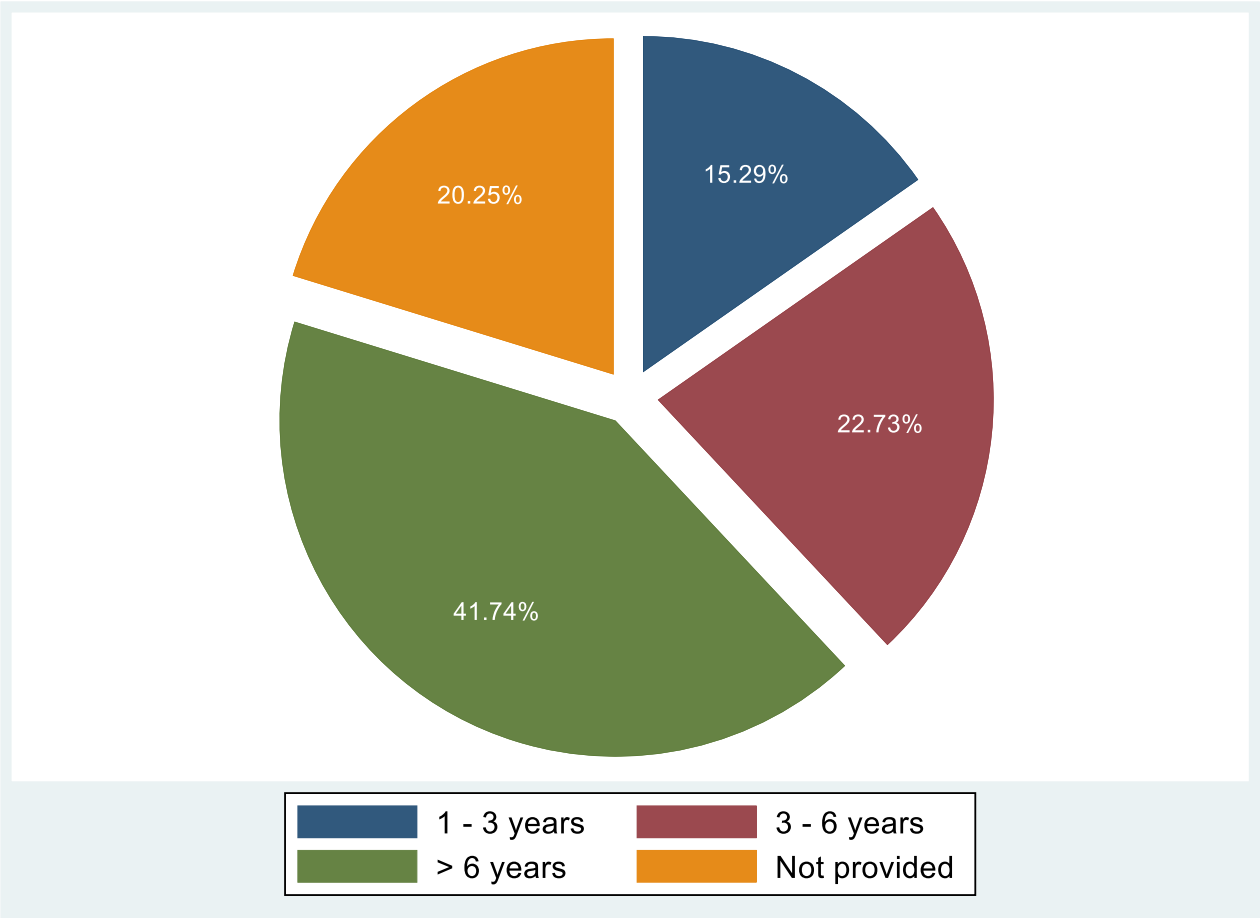


Figure 4: Future risk variable

Figure 4 indicates that the largest proportion of companies indicated that they consider climate change risk more than 6 years into the future. This fact is promising as Ziervogel et al. (2014) was concerned that in South Africa the National Climate Change Response White Paper had not yet affected longer term planning.

RESEARCH APPROACH

It is appropriate to use a panel data regression to analyse the data in this study. Panel data refers to when there are repeated measurements on the same individual at different points in time (Cameron & Trivedi, 2009), which in this case is the sampled companies over the period 2013 to 2017. Panel data allows for the control of variables that change over time but that might not change across entities (Torres-reyna, 2007). A regression

can then be used to capture the variation in the units and the variation over time (Cameron & Trivedi, 2009).

In a fixed-effect model the random individual-specific effects (a_i) are permitted to be correlated with the independent variables (Cameron & Trivedi, 2009). While in the random effects model it is assumed that a_i are purely random, implying that a_i is uncorrelated with the independent variables (Cameron & Trivedi, 2009). To establish which model is more appropriate to use for the data a Hausman's test is used. The null hypothesis of the Hausman's test is that the individual-specific effects are random (Cameron & Trivedi, 2009; Clark & Linzer, 2015). With a p value of 0.0757, this study fails to reject the null hypothesis at the 5% significance level. Therefore, it is appropriate to use the random effect panel data model for the data.

A random effect panel data model assumes that unit effects are based on an underlying, modelled distribution (Clark & Linzer, 2015), which is appropriate given that the CDP scores and the independent variables vary over the sample period. More specifically, the random effect model will be used to examine the predictors of voluntary disclosure to CDP of carbon information, thereby testing the study's hypothesis.

A Spearman's rank correlation coefficient was used to determine if there was any correlation between the dependent variable and each independent variable. In addition, correlations were inspected to determine if there was collinearity of independent variables against each other. A Spearman's rank correlation coefficient is used to measure the strength and direction of the monotonic relationship between two continuous or ordinal variables (Lund Research Ltd, 2018). Correlations indicated that none of the variables exhibited collinearity with the other independent variables. Therefore, all the variables are incorporated into the regression.

To determine the best fit for the model, the data was inspected for outliers and run three times, namely: (1) using the data in its original format (n = 242), (2) using winsorised¹⁹ data (n = 240), and (3) using the original data but excluding outliers (n = 229)²⁰. The best model fit upon examination of the residuals plotted against the model fit was for the winsorised data. Further detail regarding this analysis is given in Appendix C. Therefore, all results presented in the remainder of this study are presented for the winsorised data.

LIMITATIONS

A limitation within this study is that the scope relates to the outcome of the CDP score which measures how well a company discloses information about climate change only. This study is not claiming to assess what drives good responses to climate change, only to assess climate change disclosures made to the CDP on climate change. This limitation does not hinder the relevance of this research because disclosure of climate change is indicative of companies acknowledging the importance of the climate change issue (Doran & Quinn, 2009) and companies detailing their risk exposure to climate change which has been lacking in practice (Doran & Quinn, 2009). The next chapter follows with the results presented for the random effects model for the winsorised data.

¹⁹ Winsorisation is a technique for handling outliers, where extreme values in a data set are transformed to a specified percentile of the data. For example, when there is winsorisation at the 90th percentile this would occur when all the data below the 5th percentile would be set at the 5th percentile and all data above the 95th percentile would be set at the 95th percentile. Therefore, all the data now sits within the 90th percentile (Aguinis et al., 2013).

²⁰ Removing outliers is another technique for handling outliers which involves elimination of the outlying data points from the analysis (Aguinis et al., 2013).

RESULTS

This chapter will begin by presenting the regression output for all sampled companies using winsorised data. As indicated in the Methodology chapter the results of the Hausman's test revealed that the random effect panel data model is appropriate to use for the data. The formula for the random effect panel data model is presented below (Equation 1).

$$\begin{aligned} CDP\ Score = & \beta_1 Size + \beta_2 FSP + \beta_3 Leverage + \beta_4 ROA + \beta_5 Incentives \\ & + \beta_6 Key\ management + \beta_7 Paris\ Agreement + \beta_8 Industry \\ & + \beta_{9-11} Future\ risks + u_{it} + \varepsilon_{it} \end{aligned}$$

Equation 1

In Equation 1 β_{1-11} indicates the coefficient for each of the independent variables (Cameron & Trivedi, 2009), u_{it} refers to the between-entity error term and ε_{it} is the within-entity error (Torres-reyna, 2007). For all regression analyses performed, the reference Group for the Future Risk variable will be the time period of 1 to 3 years. As an example, the regression output will only present coefficients and standard errors for the remaining time frames i.e. 3 to 6 years, > 6 years, and unknown/not provided. All these coefficients are measured in relation to the timeframe of 1 to 3 years in determining their influence on the dependent variable.

Standard diagnostics were performed on the variables for all testing performed. Examination of the Variance Inflation Factor(VIF)²¹ indicated no problems with multicollinearity²² across the independent variables, using a VIF of 10 as a rule of thumb

²¹ Variance Inflation Factor (VIF) is widely used as a measure of multicollinearity across independent variables (O'Brien, 2007).

²² The purpose of a regression is to estimate the parameters of dependency of a relationship (Donald & Glauber, 1967). Multicollinearity is where there is an interdependency condition (Donald & Glauber, 1967). Multicollinearity is thus a threat to the structural relationship sought in a regression (Donald & Glauber, 1967).

(Meek et al., 1995; O'Brien, 2007). Plots of residuals²³ and fit were also checked for each variable and indicated no serious mis-specification of the models (Meek et al., 1995).

PREDICTORS OF CDP SCORE

Table 4 presents the coefficient and the associated z-score for each of the independent variables using the random effects model specified in Equation 1.

Table 4: Predictors of CDP Score for all companies

	Coefficient	z
Size	0.01 (0.01)	0.78
FSP	0.30 (0.18)	1.55
Leverage	0.08 (0.30)	0.25
ROA	-1.17 (0.62)	-1.88
Incentives	0.79 *** (0.15)	5.39
Key management	0.07 (0.12)	0.57
Paris Agreement	0.51 *** (0.09)	5.66
Industry	0.24 (0.16)	1.49
Future risk: 3 to 6 years	0.52 *** (0.16)	3.10
Future risk: > 6 years	0.49 *** (0.16)	3.03
Future risk: not provided	0.38 ** (0.18)	2.52
Constant	2.31	8.16
R ² within	0.31	
N	240	

In table 4: *** p<0.01, ** p<0.05, * p<0.1 for statistically significant variables. Standard errors are in parenthesis.

²³ The difference between the observed value and the predicted value is called the residual. Residuals are used to assess the adequacy of linear models (Cox & Snell, 1968). More specifically the graphs of residuals are examined for trends, symmetry of distributions, and changes of sign (Roger Newson et al., 2006). Additionally the normality, linearity and homoscedasticity assumptions were determined based on the analysis of residuals (Amran & Haniffa, 2011). No serious mis-specifications were noted.

The results from Table 4 show that the statistically significant variables related to the CDP score are Incentives, the Paris Agreement and Future risk. Discussion of each of these variables follows.

Incentives are statistically significant and positively correlated with the CDP score at the 1% significance level. Compared to companies in which no incentives are given the CDP score is expected to be 0.79 times higher for companies that do give incentives. This makes sense as Ihlen (2009) indicated that incentives can be effective in rewarding responsible corporations. Furthermore, being able to identify and understand managers' incentives is considered by Luo et al. (2012) to be a driving force to create a low-carbon economy. This claim indicates that incentives play a role incentivising behaviour around climate change. Practically there are various types of incentives that can be provided. Therefore, it is considered worthwhile to further assess this variable by considering whether the type of incentives influences the CDP score, which will follow in the next subsection.

In Table 4, the Paris Agreement variable is also statistically significant and positively correlated with the CDP score at the 1% significance level. This result aligns with the results seen in Figure 2 in the Method Chapter. Companies who completed the CDP questionnaire after the Paris Agreement are expected to have a CDP score, on average, 0.51 times higher than companies who completed the CDP questionnaire before the Paris Agreement. This result shows better environmental stewardship for companies post the signing of the Paris Agreement which aligns with the literature reviewed. Wolfgang et al. (2016) suggests that the years following the Paris Agreement would indicate whether the global community is willing to seriously tackle the challenges of climate change. Based on these results it appears that South African companies are considering the seriousness of the climate change issue post the signing of the Paris Agreement.

Future Risk has a statistically significant relationship with the CDP score. As a reminder, this variable assessed how long into the future management was considering climate change in its disclosure to the CDP, and the coefficients are assessed in relation to the reference Group i.e. where climate change risk is considered 1 to 3 years into the future.

Table 4 shows that companies with a 3 to 6 years future risk assessment or greater than 6 years future risk assessment are, on average, expected to have a CDP score of 0.52 and 0.49 more when compared to companies with a 1 to 3 years future risk assessment, holding all other variables in the model constant. This result suggests better environmental stewardship for companies with a longer-term view for their risk assessment. These findings are supported by Yow and Rubin (2017) who indicate that companies must adopt a longer term view for issues of sustainability, such as climate change, that are material to their business. Therefore, companies should consider the future risk of climate change with a longer-term view to determine how tangible their risk is.

None of the remaining variables in Table 4 show a statistically significant relationship with the CDP score. In particular, this result is contrary to the findings from the literature where the size of the company was positively correlated and statistically significant (Prado-Lorenzo et al., 2009), the FSP variable was correlated with whether firms disclose information requested by the CDP (Stanny & Ely, 2008), the Leverage variable was positively correlated with voluntary disclosure to the CDP (Elfeky, 2017; Jaggi et al., 2017) and being in a carbon-intensive industry was not positively associated with voluntary disclosure to the CDP (Stanny & Ely, 2008). However Jaggi et al. (2017) similarly found that the ROA did not have a positive relationship with the CDP score .

The study conducted by Prado-Lorenzo et al. (2009), which had a differing MtoB variable finding, was completed in 2009 using data from the Fortune 500 companies and includes data from countries that had both ratified and not ratified the Kyoto Protocol. It is hypothesised that the result of this current study differed to the study conducted by Prado-Lorenzo et al. (2009) because the sample was from a single country (South Africa) which had ratified both the Kyoto Protocol and the Paris Agreement.

Stanny & Ely (2008) conducted a study in the United States (US) which had the differing FSP variable finding. FSP is a measure of the total foreign sales, divided by total turnover of a company for the year. Not all the South African companies in this current study's sample had any foreign sales i.e. an FSP of 0 (n=19). Stanny & Ely (2008) possibly had differing results since their sample had more of the companies with foreign sales. The

Industry variable finding compared to the study conducted by Stanny & Ely (2008) was also different. In this current study's sample, most of the companies were in the financial services industry (n=40). The US has many more listed companies than South Africa and could perhaps have had more diverse industry representation in the sample that resulted in the different findings between the studies.

There were two papers with differing leverage results. The study conducted by Elfeky (2017) was based solely on Egyptian companies and the study conducted by Jaggi et al. (2017) was based on solely Italian companies. The percentage of debt to gross national product (GDP) for Egypt is almost double that of South Africa, and in Italy it is almost triple that of South Africa (Country Economy, 2018; Grey, 2017). It is suggested that perhaps the differing levels of debt between these countries resulted in the differing findings.

The final variable that did not have a statistically significant relationship with the CDP score is the key management variable. The key management variable was not incorporated into prior studies of the CDP score. It is therefore not possible to conclude on whether allocating a separate person to manage the risks and opportunities related to the environment and sustainability will result in an improved CDP score. Jacques et al. (1997) however stated that the degree of management's support for environmental activities can be used as an indicator of the quality of the climate change mitigation plan. Jacques et al. (1997) might have therefore coded the variable as 1 if there was CEO involvement and 0 for designated officer. This is a potential area for future research.

Next, the Incentives variable will be further assessed. Incentives provided have important implications for managerial behaviour (Deegan & Islam, 2012), thus understanding the role of incentives in motivating managers to focus on sustainability is topical (Deegan & Islam, 2012). Furthermore, given the statistical and economic significance of incentives on the CDP score in this study, it was considered necessary to further assess the relationship between the CDP score and the Incentives variable.

INCENTIVES

In Table 4, the Incentives variable was treated as a binary variable and indicated whether incentives were or were not given for the management of climate change issues. As part of the data collection phase the type of incentive recorded for each companies' climate change questionnaire to the CPD was so collected. Therefore for this additional test, the Incentive variable is recoded as follows: where no incentive is provided the variable has a value of 0 (n=52), where management's incentive is monetary the variable has a value of 1 (n=128), and where management's incentive is based on both a monetary reward and recognition, the Incentives variable has a value of 2 (n= 62). Thus, the variable is no longer a binary variable but a categorical variable. The formula for the random effect panel data model is shown in Equation 2.

$$\begin{aligned} CDP\ Score = & \beta_1 Size + \beta_2 FSP + \beta_3 Leverage + \beta_4 ROA + \beta_{5-6} Incentives \\ & + \beta_7 Key\ management + \beta_8 Paris\ Agreement + \beta_9 Industry \\ & + \beta_{10-12} Future\ risks + u_{it} + \varepsilon_{it} \end{aligned}$$

Equation 2

In Equation 2 β_{1-12} indicates the coefficient for each of the independent variables (Cameron & Trivedi, 2009), u_{it} refers to the between-entity error term and ε_{it} is the within-entity error (Torres-reyna, 2007). Providing no incentive is the reference Group for the incentive variable²⁴. The output for this test is presented in Table 5.

²⁴ No incentives provided is selected as the reference Group. As an example, the regression output will only present coefficients and standard errors for the remaining options i.e. where a monetary reward is given as an incentive (β_5 *Incentives*) or where both a monetary reward and recognition are used as an incentive (β_6 *Incentives*).

Table 5: Predictors of CDP Score for all companies (Categorical Incentive variable)

	Coefficients	z
Size	0.01 (0.02)	0.79
FSP	0.30 (0.19)	1.55
Leverage	0.07 (0.32)	0.23
ROA	-1.15 (0.62)	-1.84
Incentive: Monetary	0.79*** (0.15)	5.25
Incentive: Monetary & Recognition	0.80 *** (0.16)	5.04
Key management	0.07 (0.12)	0.57
Paris Agreement	0.51*** (0.09)	5.61
Industry	0.24 (0.16)	1.50
Future risk: 3 to 6 years	0.52 *** (0.17)	3.08
Future risk: > 6 years	0.50 *** (0.16)	3.06
Future risk: not provided	0.38** (0.15)	2.51
Constant	2.31	8.19
R ²	0.30	
N	240	

In table 5: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$ for statistically significant variables. Standard errors are in parenthesis.

Table 5 shows that both monetary incentives and monetary and recognition incentives are positively statistically significant at the 1% significance level. This could be because both include monetary incentives. None of the companies in this sample had only recognition incentives. Companies providing either type of incentive, providing monetary incentives alone or both monetary incentive and recognition, are expected to have, on average, a CDP score of 0.79 or 0.80 more when compared to companies that do not provide incentives, holding all other variables in the model constant. These findings enhance those seen in Table 4. Given no notable difference in either the economic or statistical significance of the two types of incentives, the results suggest that it is not the

type of incentive given that assists in driving better environmental stewardship, but rather the practice of providing incentives in the first instance.

The results of this study suggest, as indicated by Hartman, Perego and Young (2013), monetary incentives make management more eager to promote environmental risk-reducing activities. Furthermore, non-monetary incentives such as recognition are most cost-effective and workers exert more effort when the meaning of work is higher (Kosfeld, Neckermann & Yang, 2014). Therefore, companies should consider the structure of incentives for managing climate change issues, as the practice of providing incentives is important. However, contrary to the results of this study, it should be noted that the literature which indicates that monetary incentives are the primary means of motivating employees and drive their performance and behaviour (Kosfeld et al., 2014).

There is no difference in the statistical significance or direction of the remaining coefficients in Table 5, when compared to the results in Table 4, therefore, the results of Table 5 merely provide further insight into the Incentive variable.

The purpose of this study was to determine which factors, either company specific or individual company responses within the CDP questionnaire, are associated with the CDP climate change score. The results of Table 4 and 5 indicated that Incentives, the Paris Agreement and Future Risk factors are associated with the CDP climate change score, thereby answering the research question put forward.

CONCLUSION AND RECOMMENDATIONS

The purpose of this study was to determine which factors, either company specific or individual company responses within the CDP questionnaire, influence a high CDP climate change score for South African companies. A random effect panel data model regression was run using winsorised data and provided results showing that Incentives, the Paris Agreement and Future Risk were all statistically significant in influencing the CDP score.

To start, the finding that the Paris Agreement variable is positively statistically significant suggests that South African companies are considering the seriousness of addressing the climate change issue post the signing of the Paris Agreement. The results align with the literature which questioned whether an analysis of the years following the Paris Agreement would show whether the global community is willing to tackle the challenges of climate change (Wolfgang et al., 2016).

The Future Risk variable which was positively statistically significant indicates that there is likely to be better environmental stewardship the longer into the future that management consider climate change. These findings are supported by Yow and Rubin (2017) who indicated that companies must adopt a longer term view for climate change issues that materially affect their business.

Lastly, where companies provide incentives for the management of climate change issues these companies are more likely to have a higher CDP score. This result is consistent irrespective of the type of incentive given. Therefore, companies should consider the structure of incentives for managing climate change issues. Hartman et al. (2013) indicated that monetary incentives make management more eager to promote environmental risk-reducing activities. While non-monetary incentives such as recognition are most cost-effective and workers exert more effort when the meaning of work is higher (Kosfeld, Neckermann & Yang, 2014). Figure 5 indicates how each of the variables from this study link to disclosure theories and which variables were statistically significant.

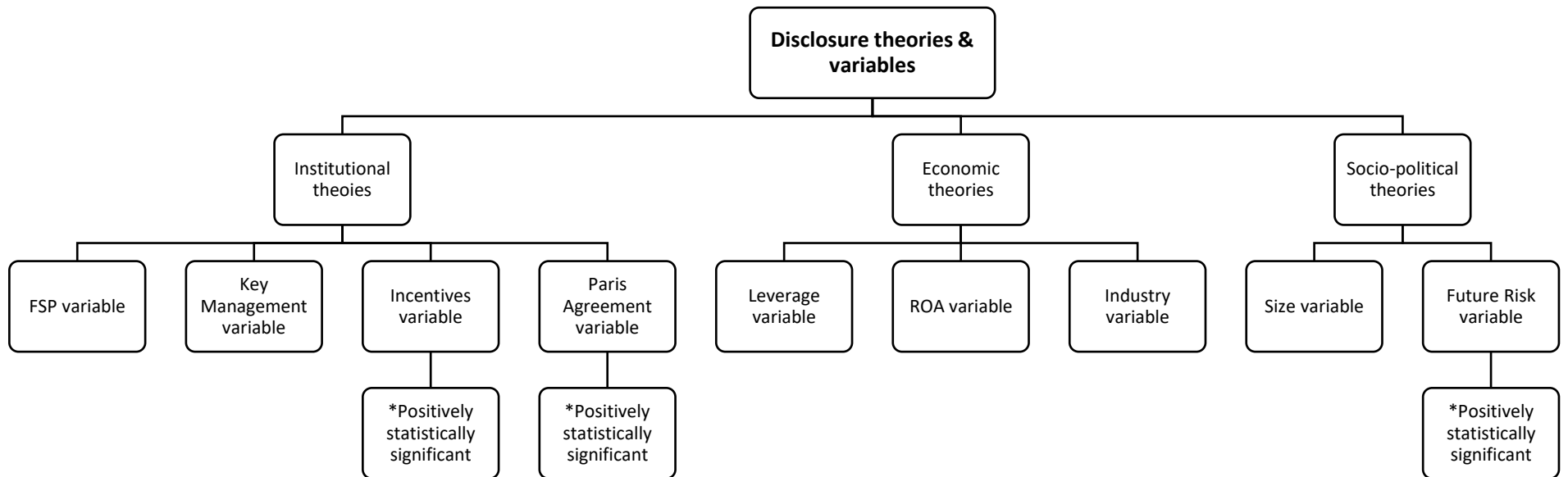


Figure 5: Disclosure theories and variables ²⁵

²⁵ For some of the variables included in this figure there is an overlap with the three theories. However, the researcher has included the most relevant theory, although there is some overlap.

This study's findings add to the literature on disclosure theories. If institutional investors, in terms of Institutional theories, call for incentives to motivate for climate change management, companies are more likely to introduce these incentive schemes and make the appropriate disclosures, particularly to the CDP (Deegan & Islam, 2012). This finding indicates that institutional investors should request that incentives be implemented because this will result in the company obtaining a higher CDP score. Furthermore, in terms of Institutional theories, if regulations stipulated in the Paris Agreement are implemented, this process might be a driving force for corporate climate change disclosure (Cormier et al., 2005). Consequently, institutional investors may want to motivate for this disclosure post the signing of the Paris Agreement to become mandatory to an organisation such as the CDP.

In terms of Socio-political theories, managers are far more willing to disclose their future climate change risk activities than their carbon emissions levels to manage stakeholders' perceptions of the company (Najah & Cotter, 2012). This study's findings indicate that managers should be made aware that the further into the future they consider climate change risk management the better because this action will result in the company obtaining an improved CDP score, whilst simultaneously managing stakeholders' perceptions of the company.

Recommendations based on these results are appropriate for companies and policy makers of the JSE Top 100 companies. Many of the companies were excluded due to incomplete information or non- response to the CDP. The first recommendation is that all companies, particularly South African companies in the JSE Top 100, consider responding to the CDP. Secondly for those companies responding to the CDP if a company wants to improve its CDP score it should ensure that it is incentivising its staff to manage climate change.

The South African DEA (2017) stated that it will evaluate the private sector's transition to a lower carbon economy based on companies' participation and activities disclosed in their responses to the CDP. Thus, policymakers in South Africa could draw attention to the findings that a company's CDP score improves if future risk is considered further into

the future and encourage companies to align their goals with the Paris Agreement's objectives. Furthermore, this process could assist the policymakers in trying to get their policies implemented sooner.

AREAS FOR FUTURE RESEARCH

This research project analysed 242 responses due to its focus only on South African companies that responded to the CDP. Future research could repeat this study and increase the sample size by including responses from different countries that have ratified the Paris Agreement in order to present a global study. This enlarged scope will help researchers in part to understand the differences that exist between countries such as that seen with the Leverage variable in Egypt and Italy and determine if the findings of this study are consistent with the global norm.

This study's scope was related to the outcome of the CDP score which measures only how well a company discloses information about climate change. This study does not claim to assess what drives good responses to climate change, to assess disclosures made to the CDP on climate change. Future research could be conducted to assess what drives good responses to climate change, focussing on the management of climate change and not just the disclosure of climate change management. Climate change management could be considered the final product, while the disclosure output is the interim product.

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APPENDIX A

Key for Table 6	
✓	Included in sample
x	Excluded from sample

Table 6: South African companies' responses to the CDP questionnaire

Rank		Full Name	Industry	CDP 2017	CDP 2016	CDP 2015	CDP 2014	CDP 2013
1	ABINBEV	Anheuser-Busch Inbev SA NV	Consumer goods	x	x	x	x	x
2	BATS	British am. Tobacco PLC	Consumer goods	✓	✓	✓	✓	✓
3	NASPERSN	Naspers Ltd	Consumer services	x	x	x	x	x
4	GLENCORE	Glencore Xstrata PLC	Basic materials	✓	✓	✓	x	x
5	RICHEMONT	Compagnie Fin Richemont	Consumer goods	x	x	x	x	x
6	BILLITON	Bhp Billiton PLC	Basic materials	✓	✓	✓	✓	✓
7	FIRSTRAND	Firststrand Ltd	Financials	x	x	x	x	x
8	ANGLO	Anglo American PLC	Basic materials	✓	✓	✓	✓	✓
9	STANBANK	Standard Bank Group Ltd	Financials	x	x	x	x	x
10	VODACOM	Vodacom Group Ltd	Telecommunications	✓	✓	✓	✓	✓
11	SASOL	Sasol Ltd	Basic materials	✓	✓	✓	✓	✓
12	MTN	MTN Group Ltd	Telecommunications	✓	✓	✓	✓	✓
13	OLDMUTUAL	Old Mutual PLC	Financials	✓	✓	✓	✓	✓
14	SANLAM	Sanlam Ltd	Financials	x	x	✓	✓	✓
15	B-AFRICA	Barclays Africa Group Ltd	Financials	x	x	x	x	x
16	SOUTH32	South32 Ltd	Basic materials	✓	✓	x	x	x
17	SHOPRIT	Shoprite Holdings Ltd	Consumer services	x	x	x	x	x
18	NEDCOR	Nedbank Group Ltd	Financials	x	x	x	x	x
19	REMGRO	Remgro Ltd	Industrial	✓	✓	✓	✓	✓
20	RMBH	RMB Holdings Ltd	Industrial	x	x	x	x	x
21	ASPEN	Aspen Pharmacare Holdings	Health care	✓	✓	✓	✓	✓
22	DISCOVERY	Discovery Holdings Ltd	Financials	✓	✓	✓	✓	✓
23	KUMBAIO	Kumba Iron Ore Ltd	Basic materials	✓	✓	✓	✓	✓
24	MONDIPLCP	Mondi PLC	Basic materials	✓	✓	✓	✓	✓

25	ANGLOPLAT	Anglo American Platinum Corporation Ltd	Basic materials	✓	✓	✓	x	✓
26	CAPITEC	Capitec	Financials	x	x	x	x	x
27	BIDCORP	Bid Corporation Ltd	Consumer services	x	x	x	x	x
28	GROWPNT	Growthpoint Properties Ltd	Financials	x	x	x	x	x
29	TIGBRANDS	Tiger Brands Ltd	Consumer goods	✓	✓	✓	x	✓
30	BIDVEST	The Bidvest Group Ltd	Industrials	x	x	✓	✓	✓
31	MRPRICE	Mr Price Group Ltd	Consumer services	x	x	x	x	x
32	SHRETAIL	Steinhoff African rt Ltd	Consumer services	x	x	x	x	x
33	MEDCLIN	Mediclinic Int PLC	Health care	x	✓	✓	✓	✓
34	NEPIROCK	Nepi Rockcastle PLC	Financials	x	x	x	x	x
35	WOOLIES	Woolworths Holdings Ltd	Consumer services	✓	✓	✓	✓	✓
36	INVPLC	Investec PLC	Financials	x	x	x	x	x
37	RMIH	Rand Merch Ins Holdings Ltd	Financials	x	x	x	x	x
38	REDEFINE	Redefine Properties Ltd	Financials	✓	✓	✓	✓	✓
39	HAMMERSON	Hammerson PLC	Financials	✓	✓	✓	x	✓
40	EXXARO	Exxaro Resources Ltd	Basic materials	x	x	x	x	x
41	TFG	The Foschini Group Ltd	Consumer services	✓	✓	x	x	x
42	IMPERIAL	Imperial Holdings Ltd	Industrials	✓	✓	✓	x	x
43	PSG	PSG Group Ltd	Financials	x	x	x	x	x
44	ASSORE	Assore Ltd	Basic materials	x	x	x	x	x
45	INTUPROP	Intuprop	Financials	✓	✓	✓	✓	✓
46	TRUWTHS	Truworhs International Ltd	Consumer services	✓	✓	✓	✓	✓
47	ANGGOLD	Anglogold Ashanti Ltd	Basic materials	✓	✓	✓	x	✓
48	REINET	Reinet investments SCA	Financials	x	x	x	x	x
49	CLICKS	Clicks Group Ltd	Consumer services	✓	✓	✓	✓	✓
50	SAPPI	Sappi Ltd	Basic materials	✓	✓	✓	✓	✓
51	A-V-I	AVI Ltd	Consumer goods	x	x	x	x	x
52	SPAR	The Spar Group Ltd	Consumer services	✓	✓	✓	x	✓
53	LIFEHC	Life Healthcare Group Holdings Ltd	Health care	✓	✓	✓	✓	✓

54	LIB-HOLD	Liberty Holdings Ltd	Financials	✓	✓	✓	x	✓
55	BARWORLD	Barloworld Ltd	Industrial	✓	✓	✓	✓	✓
56	NETCARE	Netcare Ltd	Health care	✓	✓	✓	✓	✓
57	GFIELDS	Gold fields Ltd	Basic materials	✓	✓	✓	x	✓
58	CAPCO	Capital & Counties Prop PLC	Financials	✓	✓	✓	✓	x
59	MONDILTDP	Mondi Ltd	Basic materials	x	x	x	x	x
60	MASSMART	Massmart Holdings Ltd	Consumer services	✓	✓	✓	✓	✓
61	PICKNPAY	Pick 'n Pay Stores Ltd	Consumer services	✓	✓	✓	✓	✓
62	MMIHOLDINGS	MMI Holdings Ltd	Financials	✓	✓	✓	✓	✓
63	SANTAM	Santam Ltd	Financials	x	✓	✓	✓	✓
64	INVLTD	Investec Ltd	Financials	x	x	x	x	x
65	PNR-FOODS	Pioneer Foods Group Ltd	Consumer goods	x	x	✓	✓	x
66	DISTELL	Distell	Consumer goods	✓	✓	✓	x	x
67	RESILIENT	Resilient Property Income Fund	Financials	x	x	x	x	x
68	Dis-Chem	Dis-chem Pharmacies Ltd	Consumer services	x	x	x	x	x
69	TSOGO-SUN	Tsogo Sun Holdings Ltd	Consumer services	x	x	x	x	x
70	CML	Coronation Fund Managers Ltd	Financials	x	x	x	x	x
71	TELKOM	Telkom SA Ltd	Telecommunications	✓	✓	✓	✓	✓
72	ARM	African Rainbow Minerals	Basic materials	✓	✓	✓	✓	✓
73	HYPROP	Hyprop Investments Ltd	Financials	✓	✓	✓	x	x
74	STEINHOFF	Steinhoff Int Holdings N.V.	Consumer goods	x	✓	✓	✓	✓
75	SIBANYE	Sibanye Gold Ltd	Basic materials	✓	✓	✓	x	x
76	KAP	KAP industrial Holdings	Industrials	x	x	✓	x	✓
77	BRAIT	Brait SE	Financials	x	x	x	x	x
78	IMPLATS	Impala Platinum Holdings Ltd	Basic materials	✓	✓	✓	x	✓
79	NORTHAM	Northam Platinum Ltd	Basic materials	✓	✓	✓	✓	✓
80	ITLTILE	Italtile Ltd	Consumer services	x	x	x	x	x
81	FORTRESSA	Fortress income fund Ltd	Financials	x	x	x	x	x
82	JSE	JSE Ltd	Financials	✓	✓	✓	x	x
83	FORTRESSB	Fortress Reit Ltd	Financials	x	x	x	x	x

84	VUKILE	Vukile Property Fund Ltd	Financials	x	x	x	x	x
85	GLOBETRD	Globe Trade Centre SA.	Financials	x	x	x	x	x
86	RCL	RCL foods Ltd	Consumer goods	✓	✓	✓	x	x
87	NEWGOLD	New Gold Issuer Ltd	Financials	x	x	x	x	x
88	MAS	Mas Rei	Financials	x	x	x	x	x
89	CURRO	Curro Holdings Ltd	Consumer services	x	x	x	x	x
90	TONGAAT	Tongaat Hulett Ltd	Consumer goods	✓	✓	✓	✓	✓
91	SUPRGROUP	Super Group Ltd	Industrials	x	x	x	x	x
92	HCI	Hosken Consolidated Investments Ltd	Financials	✓	✓	✓	x	✓
93	REUNERT	Reunert Ltd	Industrials	✓	✓	✓	✓	✓
94	ATT	Attacq Ltd	Financials	x	x	x	x	x
95	ACUCAP	Acucap Properties Ltd	Financials	x	x	x	x	x
96	AECI	AECI Ltd	Basic materials	✓	✓	✓	✓	✓
97	GROUP	Greenbay Properties Ltd	Financials	x	x	x	x	x
98	PPC	PPC Ltd	Industrials	✓	✓	✓	✓	✓
99	IPF	Investec Property Fund	Financials	x	x	x	x	x
100	EPP	Echo Polska Prop NV	Financials	x	x	x	x	x

Companies incl.	242	50	53	55	38	46
Companies excl.	258	50	47	45	62	54
	500	100	100	100	100	100

APPENDIX B

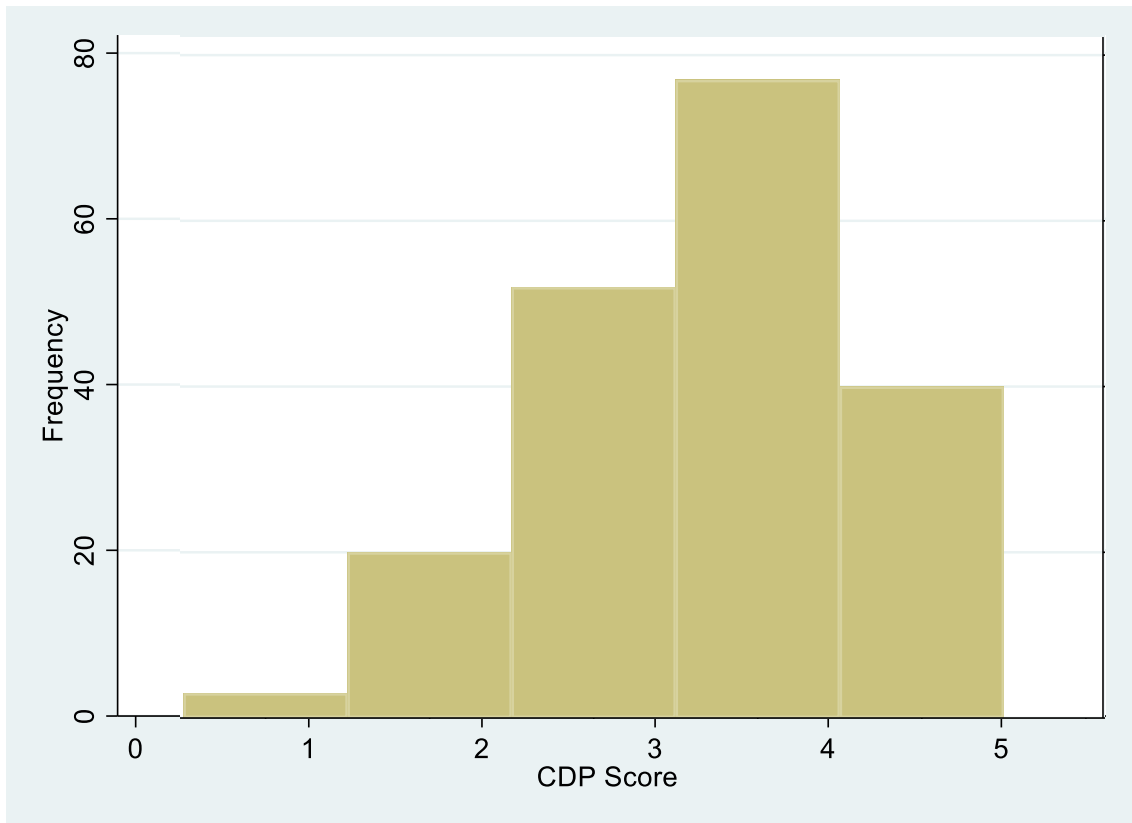


Figure 6: Histogram of the CDP Score 2013 to 2015

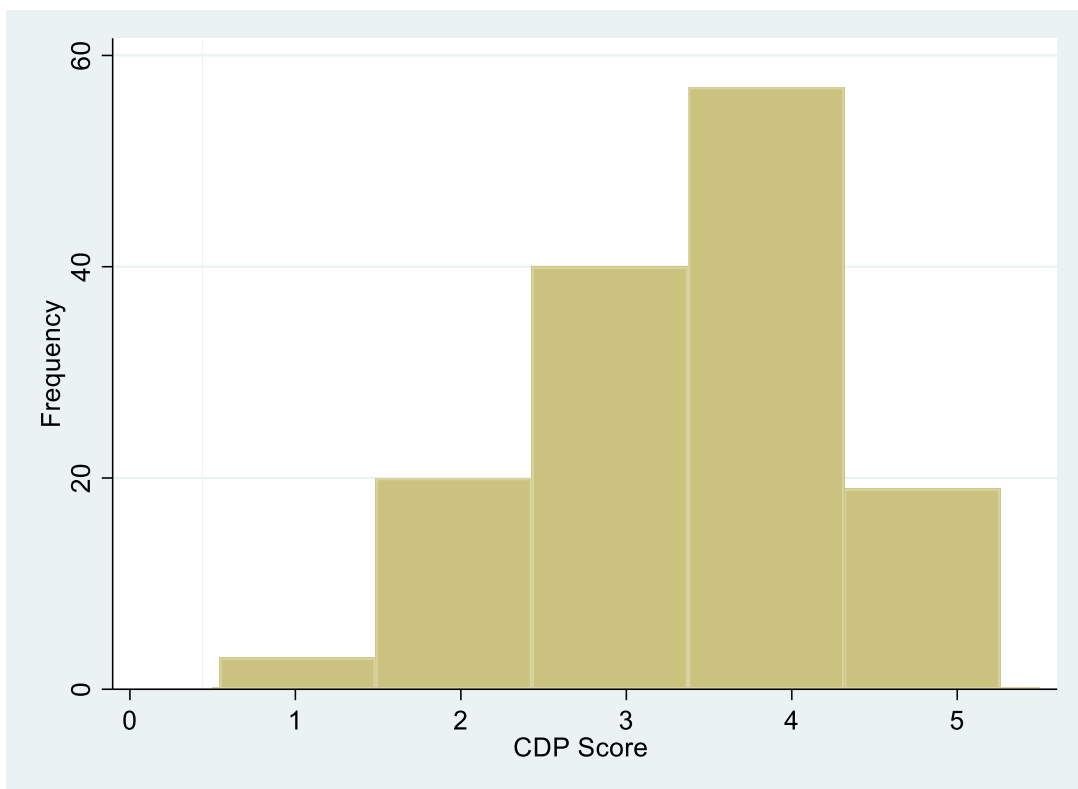


Figure 7: Histogram of the CDP Score 2016 to 2017

APPENDIX C

The data was inspected for outliers, which were noted for two of the continuous variables, namely Size and ROA. Because of these outliers, it is necessary to consider whether the testing of the data should be performed excluding these outliers, using winsorised data, or if it is appropriate to keep the outliers in the original dataset (Aguinis, Gottfredson & Joo, 2013).

Firstly, outliers were determined not to be error outliers (Aguinis et al., 2013). Secondly, outliers were checked to determine if the model fit would change after being removed (Aguinis et al., 2013). Therefore, to determine the best fit for the model, each of the tests were run three times, namely: (1) using the data in its original format (n = 242), (2) using winsorised data (n = 240), and (3) using the original data but excluding outliers (n = 229). The best model fit upon examination of the residuals plotted against the model fit was for the winsorised data. Table 7 below indicates the winsorised variables, with only changes to the Size, Leverage and ROA variables.

Table 7: Summary statistics for the continuous and binary independent variables after winsorising.

Variable name						
<i>Continuous variables:</i>	N	Mean	Std.Dev	Min	Max	Changed?
Size	240	17.48	1.36	15.23	22.64	✓
Foreign sales percentage (FSP)	242	37%	0.35	0%	100%	✗
Leverage	240	0.54	0.21	0.14	0.94	✓
Return on assets (ROA)	242	8%	0.09	-17%	35%	✓
<i>Binary variables:</i>	N	Freq (%)				
Incentives	242	190 (79)				✗
Key management	242	82 (34)				✗
Industry	242	97 (40)				✗
Paris Agreement	242	103 (43)				✗