Article:
Rohani, A. orcid.org/0000-0003-0996-9937 and Jabbour, M. orcid.org/0000-0002-7078-5726 (2024) Carbon media legitimacy in UK companies: actions or words? Journal of Applied Accounting Research, 25 (2). pp. 298-324. ISSN 0967-5426

https://doi.org/10.1108/jaar-08-2022-0200

---

emerald PUBLISHING

Journal of Applied Accounting Re

Carbon media Legitimacy in UK Companies: Actions or Words?

Journal:	*Journal of Applied Accounting Research*
Manuscript ID	JAAR-08-2022-0200.R2
Manuscript Type:	Research Paper
Keywords:	Carbon performance, Carbon disclosure, Carbon media legitimacy, Legitimacy theory

Carbon media Legitimacy in UK Companies: Actions or Words?

Abstract

Purpose- This study investigates whether carbon media legitimacy is influenced by carbon performance and/or carbon disclosure using a direct measure of carbon media legitimacy in UK context.

Design/methodology/approach- To test our hypotheses, we employ Tobit regression analysis of 95 UK companies listed in FTSE350. We use balanced panel data (475 observations in total) to reduces the noise introduced by unit heterogeneity.

Findings- We find that while corporate carbon performance is not reflected in carbon media legitimacy, carbon media legitimacy is positively and significantly affected by voluntary carbon disclosure (irrespective of its quality). Thus, voluntary carbon disclosure is shown to be an effective tool in legitimising corporate activities.

Research Implications- The results show a certain degree of naivety on the part of the media in assessing corporate carbon behaviour, since it values carbon disclosure (irrespective of its quality) more than carbon performance. Such media behaviour may hinder future improvement in carbon performance of firms.

Practical Implications- Our results indicate that the existing UK carbon disclosure policy does not address the heart of climate change and global warming. Thus, tougher regulations should be considered by policy-makers in relation to voluntary carbon disclosure in the UK.

Originality/value- To the best of our knowledge, this is the first study to examine whether carbon media legitimacy is associated with both carbon performance and carbon disclosure using a direct measure of carbon media legitimacy, and to use the UK context when addressing this association. It also examines the effectiveness of quality of carbon disclosure as legitimation tool.

Keywords: Carbon performance, carbon disclosure, carbon media legitimacy, legitimacy theory.

Paper Type: Research paper

1. Introduction

Stakeholder pressure on firms has persistently increased to manage/monitor and disclose their carbon emissions. In response to such pressures, companies are attempting to reduce their emissions, develop different strategies, and voluntarily disclose carbon information (Li et al., 2018). However, firms' attempts and strategies vary significantly (Li et al., 2018). In this regard, assessing their carbon footprint-related activities and strategies does not seem as an easy task for stakeholders because of various information asymmetries. Thus, reporting on corporations' strategies and activities and their impact on carbon emissions is vital for the decisions of stakeholders (Hahn and Lulfs, 2014; Liao et al., 2015). This led to calls in the literature for further research on carbon disclosure and performance (see, Borghei, 2021; He et al., 2020).

This paper investigates whether carbon performance (i.e. level of carbon emissions) and disclosure are reflected in firms' carbon (media[1]) legitimacy. A limited number of existing studies considered the impact of environmental disclosure (not carbon specific) on environmental legitimacy using a direct measure of legitimacy (Clarkson et al., 2010; Aerts and Cormier, 2009). For example, Aerts and Cormier (2009) investigated the impact of environmental disclosure and press release as legitimation tools and whether negative media legitimacy is a driver of environmental press release and/or environmental disclosure. Clarkson et al. (2010) examined the environmental disclosure effect on the cost of equity capital and firm value, and on the public perception of a company's environmental performance. Dai et al., (2018) investigated whether companies' perceived legitimacy increase as the quality of CSR disclosures increases, and whether legitimacy improvements lead to better financial performance. In this regard, legitimacy is viewed to mediate the relationship between CSR

[1] We view carbon legitimacy to be grounded in the public media role in constructing social perception (Aerts and Cormier, 2009). According to Aerts and Cormier (2009, p.3) 'as institutional intermediaries specializing in disseminating information about organizations or in evaluating their outputs, public media play an important role in legitimation processes'.

disclosure quality and firms' future financial performance. Nevertheless, little attempts were made to examine the extent to which carbon performance and disclosure are reflected in the firm's carbon legitimacy from the media and public views (see, Rohani, et al. 2021), and hence whether words have stronger impact on carbon media legitimacy than actions. Existing literature stresses environmental legitimacy as a significant informal driver for carbon disclosure (Hrasky, 2011; Luo et al., 2012). Nevertheless, existing studies addressing this association (Li et al., 2018) rarely considered the potential (reverse) association between carbon disclosure and/or performance and carbon legitimacy or explored both the quality and quantity of corporate carbon disclosure. A recent study by Rohani, et al. (2021) investigated the influence of carbon performance and disclosure on corporate economic performance and whether carbon legitimacy mediates such relationships, and looked at the relationship between carbon disclosure and performance and carbon legitimacy as part of the path analysis conducted. In our study, we extend Rohani, et al.'s (2021) study by bringing quality of carbon disclosure to more attention; utilising additional theoretical perspectives including stakeholder and institutional theories to provide a better understanding of the direct effects of carbon performance and carbon disclosure on carbon media legitimacy, and employing different analysis method (i.e. Tobit regression) with several additional control variables to enhance accuracy of results. This relationship merits further attention and particular focus because if words are louder than actions, companies may use voluntary disclosure to protect/enhance their corporate legitimacy, without making sincere efforts to reduce the emissions level (Luo and Tang, 2014). Thus, a voluntary disclosure may hinder future improvements in corporate underlying carbon performance (Cho et al., 2012).

In this study, we build on a complementarity between three theories, i.e. legitimacy theory, stakeholder theory and institutional theory. To elaborate, legitimacy theory assumes that companies may be motivated to employ voluntary disclosures as a legitimation strategy to gain,

maintain and/or repair corporate legitimacy (Dai et al. 2018). Firms could be perceived as legitimate not only because of their environmental-related actions/developments but also because of how society perceives those actions/developments (Deegan, 2002). Stakeholder theory proposes that organisations' managers should work in the best interest of stakeholders, who should have a continuous involvement in the decision-making process (Brammer and Milligton 2003). The interactions between firm managers and influential stakeholders can influence the level of environmental disclosure (see, e.g. Giacomini et al., 2021; Huang and Kung, 2010). Stakeholders' influence depicts the interest and impact of groups/individuals (see, Henriques and Sadorsky 1999). Institutional theory also provides an analytical lens to understand the association between organisational carbon practices and social influence (media legitimacy here). As companies face uncertainty, they may tend to adopt mimetic behaviours and thus follow standard responses to uncertain conditions (Lapsley and Pallot, 2000). Thus, they make organisational changes and adopt similar structures/strategies as a way to gain legitimacy (Siti-Nabiha and Scapens, 2005). In this regard, corporations could emulate disclosure practices adopted by other corporations to gain social acceptance/legitimacy.

The uncertainty surrounding carbon reduction activities and emissions measurements may encourage firms to use different mechanisms, such as voluntary carbon disclosure, to respond to the ever-increasing environmental concerns and maybe to protect/enhance their corporate legitimacy (Luo and Tang, 2014). Legitimacy refers to the social entities' endorsement of companies, such as media (Dai et al., 2018). Such disclosure may not necessarily coincide with genuine actions to improve the underlying carbon performance (Luo and Tang, 2014), and can construct a new and different image of an organisation (Hopwood, 2009). Thus, it is crucial to understand whether carbon disclosure and performance are reflected in carbon media legitimacy, and hence focus on a specific stakeholder (not the whole society).

This study utilises a sample of FTSE350 companies, reporting their emissions to the CDP on constant basis between 2009 and 2014. 2009 marks the era when climate change issues began to attract significant attention, and managers' awareness of the urgency to tackle climate change was raised through the introduction of incentive schemes such as European Union ETS, encouraging the implementation of emissions management practices (Hörisch, 2013). This study benefits from the UK's leading position in tackling climate change matters, and its early and regular development of climate change related schemes/acts (Abdel-Maksoud and Jabbour et al., 2021) such as the 2008 Climate Change Act and the 2020 HM Treasury interim report recommending the TCFD-aligned climate disclosures[2]. In spite of all the efforts, UK organisations and governmental policies do not seem to be effective in addressing climate change core concerns (Luo and Tang, 2014). There are significant variations in the extent of carbon management strategies usage among UK sectors, which is also generally low (Renukappa et al., 2013). FTSE350 UK companies are major polluters, which consequently demonstrated efforts to enhance their carbon disclosure and performance. One example is them taking part in the CDP annual questionnaire. Nevertheless, a genuine decrease in emission levels is yet to be attained (Luo and Tang, 2014).

Our study has three key contributions to the literature. First, it builds on legitimacy theory, stakeholder theory and institutional theory and contributes to the empirical research on carbon disclosure and performance. It is one of the first studies to examine whether carbon media legitimacy is associated with both carbon performance and carbon disclosure using a direct measure of carbon media legitimacy. Since legitimacy is not directly observable, researchers mostly examine relationships between observable firm's performance attributes (such as

[2] Task Force on Climate-related Financial Disclosures (TCFD) report (2017) sets recommendations for "disclosing clear, comparable and consistent information about the risks and opportunities presented by climate change. Their widespread adoption will ensure that the effects of climate change become routinely considered in business and investment decisions. Adoption of these recommendations will also help companies better demonstrate responsibility and foresight in their consideration of climate issues." (TCFD report, 2017, p.i)

carbon performance and carbon disclosure) or third-party actions, such as lawsuit for environmental issues, and measures of environmental reporting to deduce legitimation effects and processes (Aerts and Cormier, 2009). In this study we use direct measure of carbon media legitimacy, using the role of media in constructing social perception, to investigate the impacts of carbon performance and carbon disclosure on carbon media legitimacy. Second, our study brings quality of carbon disclosure to more attention and measures both quality and quantity of carbon disclosure, and hence adds to the limited number of studies on the association between environmental disclosure and environmental legitimacy by examining not only the relationship between carbon disclosure and carbon media legitimacy but also the effectiveness of carbon disclosure quality as legitimation tool. Third, there is a scant literature addressing climate change using UK companies (see, Giannarakis et al., 2017; Haque, 2017; Renukappa et al., 2013). To our knowledge, our study is one of the first studies to examine the relationship between carbon disclosure as well as carbon performance and carbon media legitimacy in the UK context.

The remainder of this paper is organised as follows. The next section presents the theoretical background based on legitimacy theory and hypotheses development. Section 3 explains the research design of this study. The research findings are presented in section 4, followed by the discussion and conclusion in section 5.

2. Theoretical Background and Hypotheses Development

2.1. Legitimacy theory: carbon disclosure, performance and legitimacy

Legitimacy theory has been widely used in the environmental disclosure and performance literature. It was adopted in previous studies on carbon disclosure, performance and legitimacy. Hrasky (2011) investigated whether Australian firms have adjusted their footprint-related disclosure responses. The author found an increase in footprint-related disclosure rates, and a

notable signalling of disclosure. It was also found that substantive action is pursued by carbon-intensive sectors, while symbolic disclosure is largely pursued by less intensive sectors. Bae Choi et al. (2013) reported on the extent of voluntary carbon emission disclosures by Australian companies from 2006 to 2008, and investigated the variables explaining the extent of carbon disclosures. They found a significant increase in the carbon disclosure score, and more comprehensive disclosures are made by larger firms with high visibility. Hassan and Kouhy (2014) in their study of the Nigerian oil and gas companies showed a significant negative relationship between carbon disclosure substance and performance.

Liu et al. (2016) investigated the mediation role of carbon disclosure in the relationship between carbon performance and financial performance, and found that carbon emission is positively associated with carbon disclosure level, which has a positive relationship with financial performance. Giannarakis et al. (2017) looked at whether carbon performance is reflected by climate change disclosure in UK firms, and found a positive relationship between carbon performance and climate change disclosure. Jaggi et al. (2018) examined the factors motivating voluntary carbon disclosure of Italian listed companies. Their findings supported the premise of legitimacy theory that firms disclose carbon information to inform society that they seriously consider their climate change responsibility.

Recently, Li et al. (2018) examined the impact of environmental legitimacy on carbon disclosure, and mediating role of green innovation in Chinese companies. The authors found a significant relationship between environmental legitimacy and corporate carbon disclosure, and green process innovation mediates the relationship. A more recent paper by Rohani, et al. (2021), using path analysis, examined the influence of carbon performance and disclosure on corporate economic performance and whether carbon legitimacy mediates such relationships, and thus looked at the relationship between carbon disclosure and performance and carbon legitimacy as part of the path analysis conducted. The authors found that improvements in

emissions are not financed by companies' shareholders, and carbon legitimacy improves companies' economic performance. They also found that carbon disclosure indirectly improves economic performance via carbon legitimacy, and that carbon performance is not reflected in carbon legitimacy, while carbon disclosure as a legitimising tool strongly enhances carbon legitimacy. Our study extends prior research and particularly Rohani et al.'s (2021) study by bringing quality of carbon disclosure to more attention and utilising additional theoretical perspectives; stakeholder and institutional theories to provide an understanding of the direct effects of carbon performance and carbon disclosure on carbon media legitimacy. We also employ different analysis method (i.e. Tobit regression) with several additional control variables to enhance accuracy of results.

2.2. Carbon media legitimacy

Organisations continually attempt to meet public expectations and to be perceived as operating within the norms and values of their respective societies. As climate change and global warming have increasingly become key political and societal issues, voluntary carbon disclosure is expected to increase as a way to gain and/or maintain corporate legitimacy (Qian and Schaltegger, 2017). Public media can play a key role in such legitimation process. Firms' environmental disclosures can play a key role in gaining positive media coverage (Dai et al., 2018). Carbon legitimacy, in our study, is argued to be shaped through the social perceptions constructed by the media. Media legitimacy is crucial because of the intermediary role played by the media in disseminating information about or assessing companies' outputs (Fombrun, 1996). In this regard, media tone can confer (if positive) or withhold (if negative) legitimacy on firms (Dai et al., 2018). There is an alignment between the media's content and public opinion about social and environmental matters (Deephouse and Carter 2005). Thus, unethical environmental behaviour covered by the media can raise public resentment towards a specific

firm (Tang et al., 2012). Journalists cover such stories as a way to serve their audience and progress in their careers (Dai et al., 2018).

Media assessment can represent the sole constant proxy for legitimacy collective perceptions (Aerts and Cormier, 2009). The institutional role/ structural position of public media creates a perception that it can offer more accurate evaluations of and has more accessibility to companies' information, which increases its followers (Fanelli and Misangyi, 2006). Various public opinions may vary in relation to environmental management (positive or negative). However, media lens is argued to filter these opinions to some common impression (Aerts and Cormier, 2009). In this regard, companies aim at maintaining/developing a positive media coverage through disclosing environmental information, which is monitored by the media (Dai et al., 2018). A limited number of studies considered the environmental disclosure impact on environmental legitimacy using a direct measure of legitimacy (Clarkson et al., 2010; Aerts and Cormier, 2009). Nevertheless, limited attempts were made to examine the extent to which carbon performance and disclosure are reflected in the firm's carbon legitimacy from the media and public views.

In the pursuit of legitimation, companies may employ voluntary environmental disclosure to enhance environmental legitimacy without related changes in operations (Hopwood, 2009). Thus, voluntary environmental disclosure, by conveying a favourable picture of a company, might reduce the effects of poor(er) environmental performance (Freedman and Patten, 2004). This may demotivate companies to enhance their underlying carbon performance. In this regard, environmental disclosure and performance have been increasingly researched (e.g. Cormier and Gordon, 2001; Deegan et al., 2002; Bansal and Clelland, 2004). However, prior research is scarce on studies addressing the direct effects of carbon disclosure and carbon performance on carbon media legitimacy. Furthermore, a key shortcoming of the existing

literature is the rare use of a direct measure for legitimacy (see, Aerts and Cormier, 2009), particularly in the carbon disclosure context.

2.3. Carbon media legitimacy and carbon performance

More recently, stakeholders have showed a high interest in firms' environmental performance. For example, the Accounts Modernisation Directive requested Public Limited and large private companies to report to investors on the effect of environmental issues on their profitability (defra, 2006). This growing stakeholders' influence is expected to enhance the environmental awareness among firms and hence pressure them to enhance their carbon performance as a way to satisfy key stakeholders.

Managers tend to implement managerial changes, and communicate them, to satisfy influential stakeholders (Deegan, 2002; Ullman, 1985). Companies' environmental performance can be of particular community concern as a result of media reporting (see, Islam and Deegan 2010). Such influence of media coverage can be particularly significant when negative and unobtrusive events takes place (Islam and Deegan 2010, Elijido-Ten 2011). Media reports influence can thus prompt companies to improve their environmental/carbon and economic performance to ensure that their operations do not convey environmental risk (Al-Tuwaijri et al. 2004), and hence to support firm's position reported to its stakeholders.

Firms subject to stakeholders' influence are said to exhibit better environmental performance (see, Al-Tuwaijri et al. 2004), which is compliant with both stakeholder theory and legitimacy theory. Villiers and Van Staden (2011, pp. 404-505) argue that: '…environmental legislation, such as the various Clean Air Acts, the Energy Policy Act of 2005 and the American Recovery and Reinvestment Act of 2009, have increased both the penalties for bad environmental behaviour and the incentives for good performance. As a result, environmental performance is increasingly an important issue for investors, potential investors

and other stakeholders (Van der Laan Smith et al., 2005, Villiers and Van Staden, 2010).'Our study extends prior literature by examining whether carbon media legitimacy is actually associated with organisational carbon performance. By doing this, we shift the focus towards whether a specific influential stakeholder (media here) instead of the whole society reflects firms' actions and words.

Also, in a normative sense, carbon media legitimacy should be based on corporate underlying carbon performance. According to Deephouse and Carter (2005), legitimacy reflects the consistency of organisational performance with social norms and values. Bansal and Clelland (2004, p.94) defined environmental legitimacy 'as the generalised perception or assumption that a firm's corporate environmental performance is desirable, proper, or appropriate.' Qian and Schaltegger (2017) also asserted that, from a legitimacy perspective, a company's activities should be congruent with the norms and values of the society in which it operates. Anecdotal evidence such as the BP oil spill in 2010 and the cheating emission tests by German car giant Volkswagen (VW) in 2015 indicated the association between poor environmental performance and possible damage to the corporate legitimacy. Hence, it is expected that companies with a better carbon performance enjoy a more positive carbon media legitimacy.

Thus, following the above discussion, the following hypothesis is developed:

H1: There is a positive association between carbon media legitimacy and carbon performance.

2.4. Carbon media legitimacy and carbon disclosure

Cormier and Magnan (2015) critically argued that environmental legitimacy may or may not correspond to corporate underlying performance because it can be based on perceptions of corporate environmental performance (not actual). Ashforth and Gibbs (1990) argued that since legitimacy is mostly based on perceptions, it could be controllable by companies. For

companies to be perceived as legitimate, not only the actual operations but also the society's collective perception of those operations plays an important role (Deegan, 2002). Hence, companies may use voluntary environmental disclosure to manage those perceptions by demonstrating congruence between their organisational practices and the norms and values of their respective societies (Lindblom, 1994). Organisations tend to increase the extent of environmental disclosure as a way of responding to community concerns (Brown and Deegan 1998, Deegan et al. 2002, Islam and Deegan 2010), and to use carbon disclosure strategically to manage the legitimacy threat (Liu et al., 2016).

As companies face uncertainty, they may tend to adopt mimetic behaviours and thus follow standard responses to uncertain conditions (Lapsley and Pallot, 2000). A number of studies showed the existence of mimetic behaviour with regards to organisational structures, processes, strategies or choices of technology (e.g. Benders et al., 2005, Massini et al., 2002, 2005; Haveman, 1993). Thus, such mimetic behaviour can be relevant to the adoption of particular carbon disclosure practices. Modelling business practices on those of other companies in the organisational field can reflect the companies' pursuit of legitimacy or improved performance (see DiMaggio and Powell, 1983). In this regard, it is possible that companies emulate disclosure practices adopted by other companies not for the sake of high carbon efficiency but only to gain social acceptance/legitimacy.

Prior studies addressing companies' carbon disclosure have mainly focused on the carbon information disclosure available via different channels (Harmes 2011; Kolk et al., 2008); the factors influencing carbon disclosure (Stanny and Ely, 2008; Freedman and Jaggi, 2005); carbon disclosure environmental and economic consequences (Luo and Tang, 2014; Hrasky, 2011); and legitimacy or media effect on carbon disclosure (Li et al., 2018; Guenther et al., 2015; Dawkins and Fraas, 2011). However, a limited number of studies addressed the relationship between carbon disclosure and legitimacy, in which legitimacy was mainly treated

as an antecedent to carbon disclosure. The effect of environmental disclosure in annual reports as an environmental legitimisation tool was examined by Aerts and Cormier (2009) using Janis–Fadner coefficient as a direct measure of environmental media legitimacy. A positive relationship between environmental legitimacy and the extent and quality of economic-based segments of environmental disclosures in annual reports was found. Voluntary environmental disclosure measured by an index consistent with the GRI framework was also found to have a positive relationship with the environmental legitimacy measured by Janis–Fadner coefficient (Clarkson et al., 2010). Furthermore, the probability of gaining an environmental award was shown to be affected by environmental reporting on the relevant activities undertaken, which can significantly influence legitimacy (Hassan and Ibrahim, 2012).

By examining the reporting practices of carbon emissions and their related policies from 2006 to 2008, Bae Choi et al. (2013) found that Australian companies employ voluntary carbon disclosure as a legitimation tool. Jaggi et al.'s (2018) findings also support the premise of legitimacy theory that firms disclose carbon information to inform society that they seriously consider their climate change responsibility. Our paper extends the existing environmental reporting literature by focusing on carbon media legitimacy as a consequence of carbon disclosure (not antecedent), as well as using a direct measure for carbon media legitimacy.

Hence, following the above discussion, it is expected that more extensive corporate carbon disclosure will lead to better carbon media legitimacy. Thus, the following hypothesis is developed:

H2: There is a positive association between carbon media legitimacy and quantity of carbon disclosure.

Hasseldine et al., (2005) concluded that quality of environmental disclosure rather than mere quantity has stronger impact on firm's environmental reputation. Their results are in line with

Toms (2002) findings suggesting that qualitative disclosure strongly enhances firm's reputation. Aerts and Cormier (2009) found that perceived environmental legitimacy is positively linked to the extent and quality of economic-based sections of environmental disclosures in annual reports. Rupley et al. (2012) asserted that in changing perceptions, companies disclose higher quality of voluntary environmental information. Odriozola and Baraibar-Diez (2017) found that the quality of sustainability reporting enhances credibility of firms and influences the perceptions of stakeholders which in turn improves corporate reputation. Pérez-Cornejo et al. (2020) found that CSR reporting quality increases the effect of environmental and social performance on firm's reputation and legitimacy. They argued that CSR reporting quality strengthen the impact of CSR performance on firm's reputation through a twofold effect." first CSR reporting quality reduces managerial discretion and increases comparability along time favouring consistency of companies' social actions that, in turn, reinforces and improves CSP (corporate social performance) credibility; second, CSR reporting also increases CSP visibility beyond the stakeholders involved in a single CSR action". (Pérez-Cornejo et al., 2020. p. 1259)

Hence, following the above discussion, it is expected that higher quality of corporate carbon disclosure will lead to better carbon media legitimacy. Thus, the following hypothesis is developed:

H3: There is a positive association between carbon media legitimacy and quality of carbon disclosure.

3. Research Design

3.1. Sample

The prominence of FTSE350 companies' climate-related issues (Liao et al., 2015) led us to choose them as our primary sample represent our primary sample. The final sample consisted

of 95 companies based on their consistent participation in the CDP questionnaire between 2009 and 2014, and a total of 475 company-years observations. The year 2009 has been selected as the starting point because the challenge of climate change was brought to sharp attention during 2009 at the United Nations Climate Change Conference in Copenhagen, Denmark. 2009 also witnessed an increased managers' awareness of the urgency to tackle climate change as a result of the introduction of incentive schemes such as European Union ETS, encouraging the implementation of emissions management practices (Hörisch, 2013).

The sample 'age' of a particular paper is hard to be specified as 'old' considering the length of time needed for executing and then presenting the research to relevant audiences (e.g. conferences). Thus, a perception of the paper as not being updated, despite the availability of public data, could be generated. However, the use of an old data set in a paper is considered appropriate if it the phenomenon researched continuous to be of interest (Stolowy, 2017). Considering the voluntary nature of most carbon-related UK[3] disclosure in the, our study's main argument continuous to exist and there is limited knowledge on the role carbon disclosure can play in constructing a new and different image of corporate activities, and hence prevent future enhancements in companies' emissions. Therefore, our data age should not raise concerns, and the conclusions drawn from the data remain suitable.

3.2. Empirical Models

We use Tobit regression to estimate the effect of carbon performance and carbon disclosure on carbon media legitimacy. We also use lagged independent variables since carbon information disclosed in annual and/or sustainability reports, and carbon emissions provided by CDP are available at the end of the year. Hence, the effects of carbon disclosure and carbon performance

[3] Companies are required by Companies Act Regulations 2013 to only disclose quantitative information on the annual emissions quantity generated from their business activities (Article 465). When measuring carbon disclosure, we further incorporate the qualitative information (e.g. strategies and actions) reported in the sustainability and/or annual reports, which continuous to be voluntary.

are not reflected in carbon media legitimacy in the same year. Therefore, the measures for carbon performance and carbon disclosure at t-1 and for carbon media legitimacy at t have been used. Likewise, we control for the influence of firm size, carbon-intensive vs. non-intensive sectors, economic performance, leverage, board size, board independence, and research and development (R&D) expense. Balanced panel data is used to test the study's hypotheses because it helps observing a particular unit in each period of time, allowing a reduction in the noise associated with unit heterogeneity.

To test hypotheses above, the following model is constructed:

$$Carbon\ meida\ legitimacy_{it} = \alpha_o + \alpha_1 carbon\ performance_{i(t-1)} + \alpha_2\ carbon\ disclosure_{i(t-1)} + \alpha_3 firm\ size_{i(t-1)} + \alpha_4\ Economic\ Performance_{i(t-1)} + \alpha_5\ board\ independence_{i(t-1)} + \alpha_6\ boardsize_{i(t-1)} + \alpha_7\ leverage_{i(t-1)} + \alpha_8 R\&D\ expense_{i(t-1)} + \alpha_9 carbon\ intensive\ industries_i + \alpha_{10}\ Industryeffect_i + \alpha_{11} Yeareffect_t + \varepsilon_{it}.$$

3.3. Variables Definition and Measurement

3.3.1. Dependent variable

Carbon media Legitimacy:

Carbon media legitimacy is measured using content analysis, where carbon and climate change-related concerns represented in Newspaper articles were analysed. It is suggested that the most eminent source for assessing companies' legitimacy is public media data (Li et al., 2018). Existing literature supports the alignment between the media's content and public opinion in connection with agenda-setting and framing paradigms (Deephouse and Carter, 2005; Ader, 1995). The legitimation process is generally influenced by the information disseminated and evaluations reported by the public media of particular companies (Cormier and Magnan, 2015). Perceptions of the public can be significantly impacted by newspapers' content, which can influence the process of social construction (Palmgreen et al., 2001). Considering the availability of ample print media archives covering extended time periods,

they can provide relevant and robust techniques for operationalising/studying legitimation (Baum and Powell, 1995)

Media coverage of corporate carbon and climate change matters was analysed through searching and classifying related newspapers' articles on Lexis Nexis[4]. Each newspapers' article was coded based on its impact on the firm's carbon legitimacy, i.e. negative, positive, or neutral. A total number of 1424 articles, released over the period 2010-2014, were retrieved based on a search of a company name and specific search words including: "carbon", "co2", "greenhouse gas emissions", "air pollution", "climate change", and "global warming". Out of which, 965 newspaper articles covered carbon-intensive industries and conveyed different news (good news[5]: 664; bad news: 246; and neutral news: 55), and 459 newspaper articles covered carbon non-intensive industries and conveyed different news (good news: 335; bad news: conveyed 89; neutral news: 35 conveyed).

Annual carbon media legitimacy measures are calculated using the Janis–Fadner coefficient of imbalance (see Aerts and Cormier 2009; Clarkson, Li, Richardson, and Vasvari 2008; Li et al. 2018). It ranges from -1.0 to +1.0, where 1.0 shows the most favourable article, and -1.0 shows the least favourable article (Li et al. 2018). The Janis–Fadner coefficient formula is shown below.

$$\text{Janis-Fadner coefficient}=\begin{cases}\frac{f^2-fu}{t^2} & if\ f>u\\ 0 & if\ f=u\\ \frac{fu-u^2}{t^2} & if\ u>f\end{cases}$$

[4] LexisNexis provides full-text documents from over 15,000 credible resources, such as national as well as local newspapers.
[5] If the newspapers' articles convey environmental commitment such as a reduction of greenhouse gas emission, they are classified as good news.

Where f 'is the number of favourable articles in a given year', u 'is number of unfavourable articles in a given year' and t is the total of f and u (Aerts and Cormier 2009, 8).

In the case of companies not having carbon related newspaper articles, the coefficient is set to 0 (Clarkson et al., 2008). In this regard, we interpret the media silence as a neutral perception of companies' carbon legitimacy.

3.3.2. Independent Variables

Carbon performance:

For the aim of this study carbon performance is measured as actual carbon emission, i.e. the log of total direct (Scope 1) and indirect (scope 2) carbon emission obtained from CDP over the period from 2009 to 2013. The total CO2 emissions are used as an overall indicator of carbon performance because both Scope 1 and Scope 2 are considered a necessary part of corporate carbon responsibility and management (Qian and Schaltegger, 2017)[6]. Since carbon emission reflects a firm's pollution level, these scores are inverted by multiplying them by a negative one to allow consistency with proposed hypotheses. Thus, the higher scores indicate better carbon performance.

Quantity of carbon disclosure:

Carbon disclosure quantity is measured based on a manual review of stand-alone sustainability reports over the period from 2009 to 2013. Stand-alone sustainability reports are channels for voluntary carbon disclosure, and hence are employed in this study. When these reports are not issued, we use voluntary CSR sections of the annual reports.

[6] According to GHG protocol, companies are required to disclose direct and indirect emissions categorised into three scopes: Scope1 includes all direct emissions from the sources owned or controlled by organisations, Scope 2 covers indirect emissions from consumption of purchased heat, electricity and/or steam, and finally scope 3 contains all other indirect emissions including transportation, waste disposal, outsources activities and so forth. Scope 3 has been excluded since different companies report different areas.

Quantity of carbon disclosure is measured using density ratio as it eliminates needless information. GRI guidelines (G3.1) suggest that companies should report the information that is necessary for stakeholders, but have to avoid any excessiveness. From a managerial perspective, the inclusion of varied social and environmental details in a lengthy report can enhance the availability of relevant information, but can also hinder the users' ability to easily identify such information (Cho and Roberts, 2010). Therefore, the following formula is used, similar to Michelon et al. (2015):

$$\text{Density of carbon related information} = \frac{\text{Number of carbon related sentences in the report}}{\text{Total number of sentences in the report} *}$$

* The report represents either the stand-alone sustainability report, or the voluntary CSR section of the annual report.

The density ratio ranges between 0 and 1. Values close to 1 indicate less dilution of the relevant information analysed (Michelon et al., 2015). The reliability of sentences is higher compared to pages and words because they deal with 'the problems of allocations of portions of pages and remove the need to account for, or standardise, the number of words and are a more natural unit of written English to count than words' (Hasseldine et al., 2005, p.236).

Quality of carbon disclosure:

Since density ratio merely measures the quantity of carbon disclosure, we repeat our Tobit regression using quality of carbon disclosure. Similar to carbon disclosure quantity, quality of carbon disclosure is measured based on a manual review of stand-alone sustainability reports over the period from 2009 to 2013. In the absence of such reports, we use voluntary CSR sections of the annual reports.

Quality of carbon disclosure is captured by employing content analysis based on Hrasky (2011) symbolic and behavioural disclosure scale[7]. Variations in the disclosure nature were captured using six categories. The first three categories capture symbolic disclosures. These include first, normative statements related to concern or intentions about the relevant issues but not specific action. Second, statements containing aspirational objectives or targets, but not related to specific actions. Third, statements reporting on any external awards or recognition that the company has received related to carbon footprints, climate change and/or global warming. The aggregation of these three categories is used to obtain the total number of symbolic disclosures made in each year by each company (Hrasky, 2011).

The remaining three categories capture behavioural disclosures. The first category relates to internal corporate initiatives to improve the corporate carbon footprint, while the second relates to involvement in external initiatives to reduce carbon footprint. The third comprises statements indicating actions taken to help others to lighten their carbon footprints. In total, statements in these three categories reflect the total number of behavioural sentences made in each year by each company. To measure quality of carbon disclosure, we use the ratio of the total number of behavioural sentences over the total number of symbolic sentences (Appendix A shows the different categories).

3.3.3. Control Variables

In order to control the impact of carbon performance and carbon disclosure on carbon media legitimacy, firm size, carbon-intensive industries, economic performance, board size, board

[7] According to Hrasky (2011, p.183), "a set of coding categories was derived inductively from the analysis to capture differences in the nature of the disclosures. After trial coding of the sustainability reports of four companies, it emerged that the categories identified and exemplified were sufficient to capture and distinguish the dimensions of disclosure necessary for the analytical requirements of this study."

independence, leverage, and R&D expense have been selected as control variables. Control variables' data have been collected from the Bloomberg database[8].

Firm size:

Firm size is found to be an antecedent of legitimacy (Aerts and Cormier, 2009). The size of a company is associated with its public visibility and enlarge public scrutiny (Baum and Oliver, 1991; Deephouse and Carter, 2005). Also, there is a higher likelihood that larger firms disclose extensive environmental information (Qiu et al., 2016). Log of total asset is used to measure firm size.

Carbon intensive industries:

Firms in the environmentally sensitive industries generally undergo greater environmental scrutiny and exposure (Aerts and Cormier, 2009; Patten, 2002; Hackston and Milne, 1996), and disclose more environmental information to gain and/or maintain legitimacy (Qiu et al., 2016). Based on the CDP classification, carbon-intensive industries include energy, industrial, material, and utilities. We employ a dummy variable where 1 indicates that a company is in carbon-intensive industry and 0 otherwise. 40 of the 95 companies in our sample come from carbon-intensive industries.

[8] Please note that due to the type of measurement used in this study (lag), we do not control for regulations. This is because the adoption of the Companies Act Regulations 2013 mandates the disclosure of GHG emissions from 2014 onwards, which has taken place after our observation period in relation to carbon performance and disclosure (measured from 2009-2013) (other variables are not affected by this regulations). In relation to emissions reporting, Companies Act Regulations 2013 requires companies to state in their reports the 'annual quantity of emissions in tons of carbon dioxide equivalent from activities for which that company is responsible' (Article 465) (i.e. mainly numerical information). This explains the change in sustainability reports to contain more numerical content following the adoption of Companies Act Regulations 2013 (Hummel and Roetzel 2019). It is also worth noting that the Companies Act Regulations 2013 is similar to the previous Companies Act 1985 Regulations 2005 in relation to that, companies' annual reports should include 'an understanding of the development, performance or position of the business of the company, [...] information relating to environmental matters and employee matters'. As such, 'the changes between the prior regulation and the SR [the Companies Act Regulations 2013] Regulations particularly relate to the additional disclosure on GHG emissions and the gender break' (Hummel and Roetzel 2019, 211).

Economic performance:

Corporate financial resources could influence both environmental performance and environmental disclosure. Previous empirical studies reported that financial performance is positively associated with environmental performance (Wahba, 2008) as well as environmental disclosure (Liu and Anbumozhi, 2009). This positive link indicates that a good management of sustainability could lead to shareholders' and other stakeholders' interests being mutually satisfied (Qian and Schaltegger, 2017). Economic performance is measured as a natural logarithm of 1 plus ROA.

Board size:

Fuente et al. (2017) highlighted board size as a determinant of the board's proper functioning and found a positive link between board size and the transmission of CSR information. Goodstein et al. (1994) also argued that an increase in board size facilitates the board involvement with social and environmental related issues. We argue that more involvement with social and environmental issues may attract media and increase number of positive newspapers' articles about firm resulting in better firm's media legitimacy. Board size is measured by the number of directors.

Board independence:

Prado-Lorenzo et al. (2009) found that CSR disclosure relates to external (independent) directors. Firms with a higher proportion of independent directors are found to be more socially and environmentally responsible (Webb, 2004; Wang and Coffey, 1992). A positive link was also found between a presence of independent directors in the board of directors and sustainability transparency. It is argued that independent directors consider stakeholders' interests more than other directors' do, which results in higher engagement with sustainability (Fuente et al., 2017). Similar to board size, such higher engagement with sustainability may

positively attract media attention resulting in more positive media legitimacy. Board independence is measured as a percentage of independent directors to total directors.

Leverage:

Ferguson et al. (2002) argued that companies tend to disclose carbon emission information when experiencing high financial leverage, mainly on debt increase as a result of reductions in carbon emissions. Leverage is measured as net debt divided by equity.

R&D expense:

Several studies (McWilliams and Siegel, 2000; Elsayed and Paton, 2005; Tang et al., 2012) indicated that there is a high correlation between expenditures in R&D and CSR. It is argued that firms with higher expenditures in R&D invest more heavily in CSR-related activities (McWilliams and Siegel, 2000). Since R&D is a factor reflecting a firm's management innovation, Clarkson et al. (2011) argued that an innovative management team is more likely to pursue proactive investment strategies, including environmental investment strategies. These proactive environmental strategies can increase media attraction resulting in (more) positive media legitimacy.

Finally, we included industry and year fixed effects in our model, because they mitigate the problem of industry and year specific unobserved heterogeneity that is correlated with the independent variables.

4. Results

4.1. Descriptive Statistics and Correlation Analysis

Table 1 illustrates the mean scores of carbon media legitimacy, carbon disclosure and carbon performance for different industries. Table 1 shows that consumer staple has the highest carbon media legitimacy meaning that on average it has the highest number of favourable newspapers'

articles among other industries, while material has the lowest ones. Among all industries, energy, materials, and utilities are the highest polluting ones, and utilities disclose more carbon information than others do.

Insert Table 1 about here

Table 2 shows the descriptive statistics related to the sample firms' dependent, independent and control variables. The mean of carbon media legitimacy for our sample (0.34) represents a positive attitude from the media towards the companies' carbon actions. This table also shows variance inflation factor (VIF) to address multicollinearity. Multicollinearity occurs when independent variables in a regression model are correlated. It is viewed as more of disadvantage because it practically inflates unnecessarily the standard errors of coefficients in regression (Akinwande et al., 2015). To address multicollinearity, we use variance inflation factor (VIF). VIF assesses how much the variance of an estimated regression coefficient increases when predictors are correlated. According to Everitt and Skrondal (2010) and Akinwande et al. (2015), independent variables must be allowed in regression model if VIF is below 5. All VIFs presented in table 2 are below 5 meaning that there is no multicollinearity issue in our model.

Insert Table 2 about here

Correlations between our research variables are depicted in Table 3. There is a positive/negative correlation between carbon disclosure (0.1496)/carbon performance (-0.0683) and carbon media legitimacy. There is also a negative correlation between carbon performance and carbon disclosure, which is in line with existing literature on environmental disclosure and environmental performance (e.g. Cho et al., 2012; Clarkson et al., 2011; Patten, 2002). This result also corresponds to the legitimacy theory proposition that higher level of

environmental disclosure is sought by companies experiencing bad environmental performance.

Insert Table 3 about here

4.2. Hypotheses Testing

Following Deephouse and Carter (2005), since the dependent variable (i.e. carbon media legitimacy) is a censored variable, it is estimated using censored regression (i.e. Tobit). Table 4 presents Tobit estimates using quantity of carbon disclosure. Model 1 reports the baseline model where control variables are regressed on dependent variable. The coefficient for firm size is significant and negative (β = -0.2229, $p < 0.01$). This might be because bigger firms are under a higher level of public scrutiny, and hence they may experience a higher number of unfavourable newspapers' articles. Model 2 reports the estimates for carbon performance and control variables. The coefficient for carbon performance is negative and non-significant at any conventional significance level. This is not consistent with hypothesis 1. This means that carbon media legitimacy is not influenced by underlying carbon performance, which is contrary to normative expectations.

Model 3 reports estimates for carbon disclosure and control variables. Carbon disclosure shows significantly positive (β = 1.1236, $p < 0.01$) coefficient with carbon media legitimacy which is in line with Hypothesis 2. This supports the premise of legitimacy theory that firms disclose voluntary information to gain and/or maintain legitimacy. Model 4 includes all variables of this study. Similar to Model 3, Model 4 reports a positive and significant correlation between carbon disclosure and carbon media legitimacy (β = 1.1130, $p < 0.01$) which supports the second hypothesis.

Insert Table 4 about here

We replaced quantity of carbon disclosure with quality of carbon disclosure and reran censored regression. Table 5 presents Tobit estimates using quality of carbon disclosure. The results show a positive but not statistically significant relationship (β = .0433 and p = .11) between quality of carbon disclosure and carbon media legitimacy. Hence, our result is not in line with H3. The findings indicate that quality of carbon disclosure does not improve carbon media legitimacy and given the positive and significant relationship between quantity of carbon disclosure and carbon media legitimacy, the results imply that a higher volume of carbon disclosures (irrespective of its quality) enhances firm's carbon media legitimacy.

Insert Table 5 about here

4.3. Reliability test of content analysis

4.3.1. Reliability test for Carbon media Legitimacy

The manual coding of the newspapers used in this study is subject to personal judgement, which necessitates a test for internal consistency. Therefore, a random sample of 100 newspapers were sent to an external colleague for consistency checks. Using Cronbach's alpha, the variances between the coders indicated a significant inter-coder reliability (alpha for: good news = 0.891; bad news = 0.915, neutral news = 0.852) (Weber, 1990).

4.3.2. Reliability test for quality of carbon disclosure

Since we use content analysis to measure the quality of carbon disclosure, we need to demonstrate the reliability of our data. As aforementioned, quality of carbon disclosure is measured by using content analysis based on Hrasky (2011) symbolic and behavioural disclosure scale. To test internal consistency of symbolic and behavioural statements, we employ Cronbach's alpha. According to De Swert (2012), ten percent of the complete dataset is often considered as an acceptable subsample size to test inter-coder reliability. Hence, out of 475 company-years observations, 50 company-years observations have been selected

randomly and second author repeat coding process using Hrasky (2011) symbolic and behavioural disclosure scale. Using Cronbach's alpha, the inter-coders met internal consistency for symbolic disclosure ($\alpha = 0.95$) and behavioural disclosure ($\alpha = 0.93$).

4.4. Robustness check

4.4.1. Address Endogeneity: Generalized Method of Moment (GMM)

In section 4.3, we have estimated the regression model using the Tobit regression method without considering the potential endogeneity problem. In this section, we address this issue by estimating the model using generalised method of moments (GMM) approach. This analysis indicates whether the results reported in the section 4.3 are sensitive to alternative model estimations, and whether the previous results are subject to endogeneity bias. GMM approach mitigates model estimation bias with regards to unobserved heterogeneity, simultaneity and dynamic endogeneity (Ullah et al., 2018; Bhattacharyya and Rahman, 2020).

Following Wintoki et al. (2012) and Addessi et al. (2017), we apply two-step dynamic GMM estimator to our panel data to control for two-way causality that may exist between carbon media legitimacy and carbon performance as well as carbon media legitimacy and carbon disclosure. Firms with low carbon media legitimacy in one year may improve their carbon performance and/or disclose more carbon information to gain better legitimacy in the following year. Table 6 presents the two-step system GMM results. Consistent with the main results presented in Table 4, there is a positive and significant relationship between carbon disclosure and carbon media legitimacy, and no significant relationship was found between carbon performance and carbon media legitimacy. The results for control variables improved significantly compared with main results since majority of control variables are significantly correlated with carbon media legitimacy.

Insert Table 6 about here

4.4.2. Sub-sample test

To test the robustness of our results, we use a subsample test. Following Qian and Schaltegger (2017), we limit our sample to carbon-intensive industries and rerun the Tobit model. The results that are presented in Table 7 qualitatively support our main findings in Table 4.

Insert Table 7 about here

5. Discussion and Conclusion

This study investigated the effect of carbon performance and disclosure on firms' carbon media legitimacy. Thus, it contributes to the current empirical research on environmental legitimacy via investigating the direct legitimation effects of carbon performance and carbon disclosure. It also assessed the effect of carbon disclosure quantity and quality on carbon media legitimacy. This allowed reaching conclusions on whether companies could use voluntary carbon disclosure as a mechanism to enhance their legitimacy (see, e.g. Hopwood, 2009). Our results show that while carbon performance is not reflected in carbon media legitimacy, carbon disclosure (irrespective of its quality) positively and significantly enhances firm's carbon media legitimacy. This shows that companies can enhance their legitimacy by channelling their carbon disclosure more toward symbolic information. This is interesting and highlights a key concern that requires further attention.

The results of this study are consistent with the legitimacy theory assumption that voluntary carbon disclosure can be an effective legitimising tool. From the legitimacy perspective, companies are considered as adaptive bodies that respond to social and political pressures relating to environmental challenges, such as climate change (Qian and Schaltegger, 2017). Carbon disclosure is thus posited as a legitimising tool that may be hindering improved future corporate carbon performance. Such results support Cho and Patten's (2013) argument that

voluntary environmental disclosure reduces incentives for companies to improve environmental performance.

Our results provide evidence that companies increase the extent of environmental disclosure as a way of managing the media coverage influence (Brown and Deegan 1998, Islam and Deegan 2010), which can be particularly significant when negative and unobtrusive events takes place (Islam and Deegan 2010, Elijido-Ten 2011). Thus, they try to satisfy influential stakeholders (media here) via communicating more carbon information. In this regard, the results of this study are inconsistent with the argument that media reports (i.e. specified stakeholder) influence can prompt companies to improve their environmental performance (Al-Tuwaijri et al. 2004). This raises questions about the increasing importance of environmental performance for specific stakeholders (Villiers and Van Staden, 2011). The results thus show a certain degree of naivety on the part of the media in evaluating corporate carbon behaviour, since it values firms' carbon disclosure more than the underlying carbon performance. Such media behaviour may hinder future improvement in firms' carbon performance. Thus, the media should carefully consider firms' underlying carbon performance when evaluating their carbon behaviour.

Our results also show that modelling business practices on those of other companies reflects the companies' pursuit of legitimacy and not improved performance. As such, companies can mimic other companies' disclosure practices not with the intention to achieve high carbon efficiency but to gain social legitimacy. Thus, our results are consistent with institutional theory, which suggest that firms' tendency to conform does not necessarily make them more effective.

Prior evidence shows that firms issuing high-quality CSR reports are perceived as having greater legitimacy (Dai et al., 2018). In the carbon context, the results of our study suggest that the higher level of carbon disclosure regardless of its quality can lead to better carbon media

legitimacy. This means that companies may improve their legitimacy by channelling their carbon disclosure more toward the discussion of policies and unverified targets (i.e. symbolic disclosures) rather than providing meaningful information. Similar to Chauvey et al.'s (2015) findings, it appears that fewer companies incline to provide negative performance information in their reports. Such findings are contrary to the desires of the proponents of improved corporate carbon performance and carbon disclosure, and consistent with symbolic management theory (Pfeffer and Salancik, 1978) and related impression management perspectives (Merkl-Davies and Brennan, 2007). Impression management theory argues that firms use environmental disclosure to manage impressions in order to mask actual environmental performance (Cho et al., 2014) and present more favourable image of environmental activities (Cho et al., 2010).

The findings also support Hopwood's (2009) concern that voluntary environmental disclosures can "thicken the corporate veil". He argued that while increased level of voluntary disclosure can have a constructive outcome, there is a risk that such disclosures, in the pursuit of legitimation, aim at creating a positive impression of corporate activities without changing the real actions.

Our results also have practical implications. They indicate that the existing carbon disclosure policy in the UK does not address the heart of climate change and global warming because companies can enhance their legitimacy by disclosing voluntary carbon disclosure (irrespective of its quality). Protecting the environment is highly important and carbon disclosure ought to be about transparent accountability, not "greenwashing". In this regard, regulatory bodies need to consider expanding the scope of compulsory carbon disclosure to include qualitative details about organisational carbon-related processes, strategies and activities and their influence on carbon performance. Hence, tougher regulations need to be considered by policy-makers in relation to voluntary carbon disclosure. One way to achieve that is to develop a common

framework for carbon reporting by regulatory bodies and hence promote the standardisation of voluntary carbon disclosure to allow the users of carbon information (e.g. media) to improve their interpretations of such information and hence their associated decisions. Likewise, since independent audit is a mechanism that helps to improve the credibility, accuracy, reliability, interpretability, and comprehensiveness of reports (O'Dwyer and Owen, 2005), carbon disclosure should be assured by external verification (Chen et al., 2016). Thus, compulsory carbon assurance policies should be put in place as this continues to be voluntary. This can create incentives for improving carbon performance. Consideration should also be given to the level of assurance required by companies, particularly in the light of new evidence showing that higher level of assurance can be used as a tool to access detailed information about stakeholders' needs and concerns, which can prompt companies to enhance their carbon performance (see, Rohani et al., 2022). Furthermore, companies should consider creating a frequent dialogue with the media alongside other stakeholders, which can support the development of enhanced carbon related behaviour.

This study is subject to some limitations. First, we focused on UK companies (FTSE350), which limits the ability to generalise to other contexts. Future research can consider developed or developing countries to examine how different countries with different cultures and social and political situations react to carbon-related issues. Second, carbon disclosure was measured based on a review of hard copy reporting (i.e. sustainability report or CSR section in annual report) and not web-based disclosure because of the issue of specifying the exact timing of the web-based disclosure. However, it is shown that hard-copy environmental reporting and web-based disclosures are very consistent (Cormier and Magnan, 2004). Third, the measure of carbon media legitimacy may raise questions since it depends on the classification of newspaper articles to different categories, which is subject to individuals' discretion. To address this concern, we used Cronbach's alpha to demonstrate the reliability of carbon media

legitimacy. In addition, some may argue that this proxy merely captures media perceptions of corporate activities, not other stakeholders' perceptions. However, public media information and evaluations are argued to be more widely distributed compared to the average stakeholders' views, and thus they can influence stakeholders' perceptions of organisations (Fanelli and Misangyi, 2006). Future studies can conduct survey to capture firm's carbon legitimacy or use social media legitimacy and compare their results with our findings. Finally, similar to approaches adopting content analysis, the data collection process of the quality of carbon disclosure is inherently subjective. Nevertheless, following the set of coding categories developed by Hrasky (2011) to capture the differences in the nature of carbon disclosures helped us in enhancing the data collection process. It is suggested that selecting disclosure categories from well-grounded relevant literature and establishing/using reliable coding instrument with well-specified decision categories and decision rules can enhance the reliability in data recording and analysis (Guthrie et al., 2004, p.289). We also used Cronbach's alpha to demonstrate the reliability of quality of carbon disclosure.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

References:

Abdel-Maksoud, A., Jabbour, M., & Abdel-Kader, M. (2021). Stakeholder pressure, eco-control systems, and firms' performance: empirical evidence from UK manufacturers. *Accounting Forum*, 45(1), 30-57.

Addessi, W., Pulina, M., & Sallusti, F., 2017. Impact of changes in consumer preferences on sectoral labour reallocation: evidence from the Italian economy. *Oxford Bulletin of Economics and Statistics*, 79(3), pp.348-365.

Ader, C.R. (1995). A longitudinal study of agenda setting for the issue of environmental pollution. *Journalism & Mass Communication Quarterly*, 72(2), 300-311.

Aerts, W., & Cormier, D. (2009). Media legitimacy and corporate environmental communication. *Accounting, Organization, and Society,* 34(1), 1-27.

Akinwande, M.O., Dikko, H.G. & Samson, A. (2015). Variance inflation factor: as a condition for the inclusion of suppressor variable (s) in regression analysis. *Open Journal of Statistics*, *5*(07), 754.

Al-Tuwaijri, S., Christensen, T., & Hughes II, K. (2004). The relations among environmental disclosure, environmental performance, and economic performance: a simultaneous equations approach. *Accounting, Organizations and Society*, 29, 447-471.

Ashforth, B. E., & Gibbs, B. W. (1990). The double-edge of organizational legitimation. *Organization Science*, 1(2), 177-194.

Bae Choi, B., Lee, D. & Psaros, J. (2013). An analysis of Australian company carbon emission disclosures. *Pacific Accounting Review*, 25(1), 58-79.

Bansal, P., & Clelland, I. (2004). Talking trash: Legitimacy, impression management, and unsystematic risk in the context of the natural environment. *Academy of Management Journal*, 47(1), 93-103.

Baum, J.A.C., & Oliver, C. (1991). Institutional linkages and organizational mortality. *Administrative Science Quarterly*, 36, 187-218.

Baum, J.A.C., & Powell, W.W. (1995). Cultivating an Institutional Ecology of Organizations: Comment on Hannan, Carroll, Dundon, and Torres. *American Sociological Review*, 60, 529-538.

Benders, J., Batenburg, R., & van der Blonk, H. (2005), "Sticking to standards: technical and other isomorphic pressures in deploying ERP-systems", *Information and Management*, 43(2), 194-203.

Bhattacharyya, A. and Rahman, M.L. (2020). Mandatory CSR expenditure and stock return. *Meditari Accountancy Research*, 28(6), 951-975.

Borghei, Z. (2021). Carbon Disclosure: A Systematic Literature Review. *Accounting and Finance*. 61(4), 5255-5280.

Brammer, S., & Millington, A. (2003). The effect of stakeholder preferences, organizational structure and industry type on corporate community involvement. *Journal of Business Ethics*, 45(3), 213-226.

Brown, N. & Deegan, C. (1998) The public disclosure of environmental performance information-a dual test of media agenda setting theory and legitimacy theory, *Accounting and Business Research*, 29(1), 21-41.

Chauvey, J.N., Giordano-Spring, S., Cho, C.H. & Patten, D.M. (2015). The normativity and legitimacy of CSR disclosure: Evidence from France. *Journal of Business Ethics*, *130*(4), 789-803.

Chen, L., Srinidhi, B., Tsang, A., & Yu, W. (2016). Audited Financial Reporting and Voluntary Disclosure of Corporate Social Responsibility (CSR) Reports. *Journal of Management Accounting Research*. 28(2), 53-76.

Cho, C.H., Guidry, R.P., Hageman, A.M., & Patten, D.M. (2012). Do actions speak louder than words? An empirical investigation of corporate environmental reputation. *Accounting, Organization, and Society*, 37, 14-25.

Cho, C.H., & Patten, D.M. (2007). The role of environmental disclosures as tools of legitimacy: A research note. *Accounting, Organization, and Society,* 32, 639-647.

Cho, C.H. & Patten, D.M. (2013). Green accounting: Reflections from a CSR and environmental disclosure perspective. *Critical Perspectives on Accounting*, *24*(6), 443-447.

Cho, C.H., Patten, D.M. & Roberts, R.W. (2014). Environmental disclosures and impression management. In *Communication and language analysis in the corporate world,* 217-231. Hershey, PA: IGI Global.

Cho, C.H., & Roberts, R.W. (2010). Environmental reporting on the internet by America's Toxic 100: Legitimacy and self-presentation. *International Journal of Accounting and Information Systems,* 11(1), 1-16.

Cho, C.H., Roberts, R.W. & Patten, D.M. (2010). The language of US corporate environmental disclosure. *Accounting, Organizations and Society*, *35*(4), 431-443.

Clarkson, P., Fang, X., Li, Y. & Richardson, G.D. (2010). The relevance of environmental disclosures for investors and other stakeholder groups: are such disclosures incrementally informative?. Available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1687475 (accessed 16 June 2018).

Clarkson, P.M., Li, Y., Richardson, G.D., & Vasvari, F.P. (2008). Revisiting the relation between environmental performance and environmental disclosure: An empirical analysis. *Accounting, Organization, and Society,* 33(4-5), 303-327.

Clarkson, P.M., Li, Y., Richardson, G.D. & Vasvari, F.P. (2011). Does it really pay to be green? Determinants and consequences of proactive environmental strategies. *Journal of Accounting and Public Policy*, 30(2), 122-144.

Cormier, D. & Magnan, M. (2004). The impact of the web on information and communication modes: the case of corporate environmental disclosure. *International Journal of Technology Management*, 27(4), 393-416.

Cormier, D., & Magnan, M. (2015). The economic relevance of environmental disclosure and its impact on corporate legitimacy: An empirical investigation. *Business Strategy and the Environment,* 24(6), 431-450.

Dai, N.T., Du, F., Young, S.M., & Tang, G. (2018). Seeking Legitimacy through CSR Reporting: Evidence from China. *Journal of Management Accounting Research*. 30(1), 1-29.

Dawkins C. and Fraas J. (2011). Coming Clean: The Impact of Environmental Performance and Visibility on Corporate Climate Change Disclosure. *Journal of Business Ethics*, 100, 303-322.

Deegan, C. (2002). Introduction: The legitimising effect of social and environmental disclosures – a theoretical foundation. *Accounting, Auditing & Accountability Journal*, 15(3), 282-311.

Deegan, C., Rankin, M., & Tobin, J. (2002). An examination of the corporate social and environmental disclosures of BHP from 1983-1997: A test of legitimacy theory. *Accounting, Auditing & Accountability Journal*, 15(3), 312-343.

Deephouse, D. L., & Carter, S. M. (2005). An examination of differences between organizational legitimacy and organizational reputation. *Journal of Management Studies*, 42(2), 329-360.

Department of Environment, Food and Rural Affairs (Defra). (2006). Environmental key performance indicators, reporting guidelines for UK business. London: Queen's Printer and Controller. www.defra.gov.uk

De Swert, K. (2012). Calculating inter-coder reliability in media content analysis using Krippendorff's Alpha. *Center for Politics and Communication*, *15*.

DiMaggio, P. & Powell, W. (1983). The Iron cage revisited: institutional isomorphism and collective rationality in organizational fields, *American Sociological Review*, 48(2), 147-160.

Elijido-Ten, E. (2011). Media coverage and voluntary environmental disclosures: A developing country exploratory experiment. *Accounting Forum*, 35(3), 139-157.

Elsayed, K. & Paton, D. (2005). The impact of environmental performance on firm performance: static and dynamic panel data evidence. *Structural change and economic dynamics*, 16(3), 395-412.

Everitt, B. S. & Skrondal, A. (2010). *The Cambridge Dictionary of Statistics,* Cambridge University Press.

Fanelli, A., & Misangyi, V. F. (2006). Bringing out charisma: CEO charisma and external stakeholders. *Academy of Management Review*, 31(4), 1049–1061.

Ferguson, M.J., Lam, K.C. & Lee, G.M. (2002). Voluntary disclosure by state-owned enterprises listed on the stock exchange of Hong Kong. *Journal of International Financial Management & Accounting*, 13(2), 125-152.

Fombrun, C. (1996). Reputation: Realizing value from the corporate image. Boston, MA: Harvard Business School Press.

Freedman, M., & Jaggi, B. (2005). Global warming, commitment to the Kyoto protocol, and accounting disclosures by the largest global public firms from polluting industries. *The International Journal of Accounting*, 40(3), 215-232.

Freedman, M. & Patten, D.M. (2004). Evidence on the pernicious effect of financial report environmental disclosure. *Accounting Forum*, 28(1), 27-41.

Fuente, J.A., García-Sanchez, I.M. & Lozano, M.B. (2017). The role of the board of directors in the adoption of GRI guidelines for the disclosure of CSR information. *Journal of Cleaner Production*, 141,737-750.

Giacomini, D., Rocca, L., Zola, P., & Mazzoleni, M. (2021). Local Governments' environmental disclosure via social networks: Organizational legitimacy and stakeholders' interactions, *Journal of cleaner production*, 317, 128290.

Giannarakis, G., Zafeiriou, E., & Sariannidis, N. (2017). The impact of carbon performance on climate change disclosure. *Business Strategy and the Environment*, *26*(8), 1078-1094.

Goodstein, J., Gautam, K. & Boeker, W. (1994). The effects of board size and diversity on strategic change. *Strategic management journal*, 15(3), 241-250.

Guenther, E., Guenther, T., Schiemann, F. & Weber, G. (2015). Stakeholder Relevance for Reporting: Explanatory Factors of Carbon Disclosure. *Business and Society*, 55, 1-37.

Guthrie, J., Petty, R., K. Yongvanich, K., & Ricceri, F. (2004). Using Content Analysis as a Research Method to Inquire into Intellectual Capital Reporting. *Journal of Intellectual Capital*, 5(2), 282-293.

Hackston, D., & Milne, M. J. (1996). Some determinants of social and environmental disclosures in New Zealand companies. *Accounting, Auditing and Accountability Journal,* 25, 77-108.

Hahn, R. & Lülfs, R. (2014). Legitimizing negative aspects in GRI-oriented sustainability reporting: A qualitative analysis of corporate disclosure strategies. *Journal of Business Ethics*, 123(3), 401-420.

Haque, F. (2017). The Effects of Board Characteristics and Sustainable Compensation Policy on Carbon Performance of UK Firms. *The British Accounting Review*, 49(3), 347-64.

Harmes, A. (2011). The limits of carbon disclosure: Theorizing the business case for investor environmentalism. *Global Environmental Politics*, 11(2), 98-119.

Hassan, A. & Ibrahim, E. (2012). Corporate environmental information disclosure: factors influencing companies' success in attaining environmental awards. *Corporate Social Responsibility and Environmental Management,* 19(1), 32-46.

Hassan, A., & Kouhy, R. (2014). Time-series cross-sectional environmental performance and disclosure relationship: specific evidence from a less developed country. *International Journal of Accounting and Economics Studies*, 2(2), 60-73.

Hasseldine, J., Salama, A.I., & Toms, J.S. (2005). Quantity versus quality: the impact of environmental disclosures on the reputations of UK Plcs. *The British Accounting Review,* 37(2), 231-248.

Haveman, H.A. (1993). Follow the leader: mimetic isomorphism and entry into new markets, *Administrative Science Quarterly*, 38(4), 593-627.

He, R., Luo, L., Shamsuddin, A., & Tang, Q. (2020). Corporate Carbon Accounting: A Literature Review of Carbon Accounting Research from the Kyoto Protocol to the Paris Agreement. *Accounting and Finance*, 62(1), 261-298.

Henriques, I., & Sadorsky, P. (1999). The relationship between environmental commitment and managerial perceptions of stakeholder importance. *Academy of Management Journal*, 42(1), 87-99.

HM Treasury (2020). Interim Report of the UK's Joint Government-Regulator TCFD Taskforce (2020). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/933782/FINAL_TCFD_REPORT.pdf (accessed 5 October 2021).

Hopwood, A.G. (2009). Accounting and the environment. *Accounting, Organization, and Society*, 34(3-4), 433-439.

Hörisch, J. (2013). Combating climate change through organisational innovation: an empirical analysis of internal emission trading schemes. *Corporate Governance*, 13(5), 569-582.

Hrasky, S. (2011). Carbon footprints and legitimation strategies: symbolism or action? *Accounting, Auditing and Accountability Journal,* 25(1), 174-198.

Huang, C-L., & Kung, F-H. (2010). Drivers of Environmental Disclosure and Stakeholder Expectation: Evidence from Taiwan, *Journal of business ethics*, 96(3), 435-451.

Islam, M. & Deegan, C. (2010). Media pressures and corporate disclosure of social responsibility performance information: A study of two global clothing and sports retail companies, *Accounting and Business Research*, 40(2), 131-148.

Jaggi, B., Allini, A., Macchioni, R. & Zagaria, C. (2018). The factors motivating voluntary disclosure of carbon information: Evidence based on Italian listed companies. *Organization & Environment*, 31(2), 178-202.

Kolk, A., Levy, D., & Pinkse, J. (2008). Corporate responses in an emerging climate regime: The institutionalization and commensuration of carbon disclosure. *European Accounting Review*, 17(4), 719-745.

Lapsley, I. & Pallot, J. (2000). Accounting, management and organisational change: a comparative study of local government, *Management Accounting Research*, 11(2), 213-229.

Li, D., Huang, M., Ren, S., Chen, X., & Ning, L. (2018). Environmental legitimacy, green innovation, and corporate carbon disclosure: Evidence from CDP China 100. *Journal of Business Ethics*, 150(4), 1089-1104.

Liao, L., Luo, L. & Tang, Q. (2015). Gender diversity, board independence, environmental committee and greenhouse gas disclosure. *The British Accounting Review*, *47*(4), 409-424.

Lindblom, C. K. (1994). The implications of organizational legitimacy for corporate social performance and disclosure. *In Paper presented at the critical perspectives on accounting conference, New York, NY.*

Liu, X. & Anbumozhi, V. (2009). Determinant factors of corporate environmental information disclosure: an empirical study of Chinese listed companies. *Journal of Cleaner Production*, 17(6), 593-600.

Liu, Y.S., Zhou, X., Yang, J.H., & Hoepner, A.G.F. (2016). Corporate Carbon Emission and Financial Performance: Does Carbon Disclosure Mediate the Relationship in the UK? Discussion Paper, Number: ICM-2016-03. ICMA Centre, Henley Business School, University of Reading.

Luo, L., & Tang, Q. (2014). Does voluntary carbon disclosure reflect underlying carbon performance? *Journal of Contemporary Accounting & Economics,* 10(3), 191-205.

Luo, L., Lan, Y.C., & Tang, Q. (2012). Corporate incentives to disclose carbon information: evidence from the CDP global 500 report. *Journal of International Financial Management and Accounting*, 23(2), 93-120.

Massini, S., Lewin, A.Y., & Greve, H.R. (2005). Innovators and imitators: organizational reference groups and adoption of organizational routines, *Research Policy*, 34(10), 1550-1569.

Massini, S., Lewin, A.Y., Numagami, T., & Pettigrew, A.M. (2002), "The evolution of organisational routines among large Western and Japanese firms", *Research Policy*, 31(8/9), 1333-1348.

McWilliams, A. & Siegel, D. (2000). Corporate social responsibility and financial performance: correlation or misspecification? *Strategic Management Journal*, 21(5), 603-609.

Merkl-Davies, D.M. & Brennan, N.M. (2007). Discretionary disclosure strategies in corporate narratives: incremental information or impression management? *Journal of Accounting Literature*, 26, 116-194.

Michelon, G., Pilonato, S. & Ricceri, F. (2015). CSR reporting practices and the quality of disclosure: An empirical analysis. *Critical Perspectives on Accounting*, 33, 59-78.

Odriozola, M.D. and Baraibar-Diez, E. (2017). Is corporate reputation associated with quality of CSR reporting? Evidence from Spain. *Corporate social responsibility and environmental management*, *24*(2), 121-132.

O'Dwyer, B., & Owen, D. L. (2005). Assurance statement practice in environmental, social and sustainability reporting: a critical evaluation. *The British Accounting Review*, 37(2), 205-229.

Palmgreen, P., Donohew, L., Lorch, E.P., Hoyle, R.H., & Stephenson, M.T. (2001). Television campaigns and adolescent marijuana use: tests of sensation seeking targeting. *American Journal of Public Health,* 91, 292-296.

Patten, D.M. (2002). The relation between environmental performance and environmental disclosure: a research note. *Accounting, Organization, and Society,* 27(8), 763-773.

Pfeffer, J., & Salancik, G. R. (1978). The external control of organizations. New York: Harper and Row.

Pérez-Cornejo, C., de Quevedo-Puente, E. and Delgado-García, J.B. (2020). Reporting as a booster of the corporate social performance effect on corporate reputation. *Corporate Social Responsibility and Environmental Management*, *27*(3), 1252-1263.

Prado-Lorenzo, J.M., Gallego-Alvarez, I. & Garcia-Sanchez, I.M. (2009). Stakeholder engagement and corporate social responsibility reporting: the ownership structure effect. *Corporate Social Responsibility and Environmental Management*, 16(2), 94-107.

Qian, W. & Schaltegger, S. (2017). Revisiting carbon disclosure and performance: Legitimacy and management views. *The British Accounting Review*, *49*(4), 365-379.

Qiu, Y., Shaukat, A. & Tharyan, R. (2016). Environmental and social disclosures: Link with corporate financial performance. *The British Accounting Review*, *48*(1), 102-116.

Renukappa, S., Akintoye, A., Egbu, C., & Goulding, J. (2013). Carbon Emission Reduction Strategies in the UK Industrial Sectors: An Empirical Study. *International Journal of Climate Change Strategies and Management,* 5(3), 304-23.

Rohani, A., Jabbour, M., & Abdel-Kader, M. (2021). Carbon performance, carbon disclosure, and economic performance: the mediating role of carbon (media) legitimacy in the UK. *International Journal of Accounting and Economics Studies*, 9(1). 8-20.

Rohani, A., Jabbour, M., & Aliyu, S. (2022). Corporate incentives for obtaining higher level of carbon assurance: seeking legitimacy or improving performance?. *Journal of applied accounting research* [Preprint].

Rupley, K.H., Brown, D. and Marshall, R.S. (2012). Governance, media and the quality of environmental disclosure. *Journal of Accounting and Public Policy*, *31*(6), 610-640.

Siti-Nabiha, A.K. & Scapens, R.W. (2005). Stability and change: an institutionalist study of management accounting change", *Accounting Auditing and Accountability Journal*, 18(1), 44-73.

Stanny, E., & Ely, K. (2008). Corporate environmental disclosures about the effects of climate change. *Corporate Social Responsibility and Environmental Management*, 15(6), 338-348.

Stolowy, H. (2017). Letter from the Editor: Why Are Papers Desk Rejected at European Accounting Review?, European Accounting Review, 26(3), 411-418.

Tang, Z., Hull, C.E. & Rothenberg, S. (2012). How corporate social responsibility engagement strategy moderates the CSR–financial performance relationship. *Journal of Management Studies*, 49(7), 1274-1303.

Task Force on Climate-related Financial Disclosures' (TCFD) report (2017). Available at: https://assets.bbhub.io/company/sites/60/2020/10/FINAL-2017-TCFD-Report-11052018.pdf (accessed 5 October 2021).

Toms, J.S. (2002). Firm resources, quality signals and the determinants of corporate environmental reputation: some UK evidence. *The British accounting review*, *34*(3), 257-282.

Ullah, S., Akhtar, P. & Zaefarian, G. (2018). Dealing with endogeneity bias: The generalized method of moments (GMM) for panel data. *Industrial Marketing Management*, 71, 69-78.

Ullmann, A. A. (1985). Data in search of a theory: A critical examination of the relationships among social performance, social disclosure, and economic performance of U.S. firms. *Academy of Management Review*, 10(3), 540-557.

Van der Laan Smith, J., Adhikari, A., & Tondkar, R. H. (2005). Exploring differences in social disclosure internationally: A stakeholder perspective, *Journal of Accounting & Public Policy*, 24(2), 123-151.

Villiers, C. de. & van Staden, C. (2011). Where firms choose to disclose voluntary environmental information. *Journal of Accounting and Public Policy*, 30(6), 504-525.

Wahba, H. (2008). Does the market value corporate environmental responsibility? An empirical examination. *Corporate Social Responsibility and Environmental Management*, 15(2), 89-99.

Wang, J. & Coffey, B.S. (1992). Board composition and corporate philanthropy. *Journal of business Ethics*, 11(10), 771-778.

Webb, E. (2004). An examination of socially responsible firms' board structure. *Journal of Management and Governance*, 8(3), 255-277.

Weber, R.P. (1990). *Basic Content Analysis*. 2 edition. Thousand Oaks: Sage Publications Ltd.

Wintoki, M.B., Linck, J.S. & Netter, J.M. (2012). Endogeneity and the dynamics of internal corporate governance. *Journal of financial economics*, 105(3), 581-606.

Appendix A. The disclosure categories

Symbolic Disclosure	Description	Exemplifying disclosure

Normative statement	Statements espousing commitment to and recognition of the importance of carbon footprints, global warming and climate change but not indicative of specific action or outcome	We believe it is important for Australia to establish a long-term greenhouse gas emissions reduction goal and to map a path to achieve it. Climate change and resource scarcity are issues that require us to evolve our business model to meet our responsibilities.
Aspirational target	Articulation of targets or objectives to be achieved in the future without associated action	Our ultimate goal is to have no carbon emissions released to the atmosphere. We have set targets for paper use, recycling facilities and greenhouse gas emissions.
Awards/recognition	Statements indicating external recognition of positive efforts pertinent to carbon footprints, global warming and climate change	We were included in the 2004 Climate Leadership Index comprising the 50 "best in-class" responses.
Behavioral Disclosure	**Description**	**Exemplifying disclosure**
Internal activities	Statements about specific internal corporate actions taken relevant to carbon footprints, global warming and climate change	Where possible we install electricity generators that use the waste gas as fuel, electricity produced in this way actually reduces greenhouse gas emissions. The $A30 million plant that we opened in September will generate approximately six megawatts of electricity per hour and reduce greenhouse gas emission by 250,000 tons of carbon dioxide equivalent per year.
External activities	Statements about involvement in activities relevant to carbon footprints, global warming and climate change that are initiatives developed with partners or projects external to the organization	Since becoming a member of the Greenhouse Challenge Program one division has completed a range of efficiency improvement projects resulting in reduced greenhouse gas emissions of more than one million tons per annum. To support efforts to research the impacts of climate change we have partnered with the EarthWatch Institute to offer an opportunity for our co-workers to join an international conservation research project.
Assisting others	Statements about actions taken to help others to reduce their carbon footprint	We have developed a range of products so customers have a choice about their contribution to greenhouse gas emissions reduction. All colleagues who are allocated a car space for non-company vehicles are required to offset their annual greenhouse gas emissions through a subscription to GreenFleet.

Source: Hrasky (2011, p. 184)

Table 1
Carbon legitimacy, carbon disclosure, and carbon performance mean scores by industry

Sector	Firms	Carbon Legitimacy	Carbon Disclosure	Carbon Performance (million tonnes)
Consumer Discretionary	15	0.38	0.14	521,748
Consumer Staples	10	0.54	0.09	2,147,018
Energy	8	0.34	0.09	20,011,623
Financials	22	0.23	0.11	157,014
Health Care	4	0.4	0.1	661,743
Industrials	18	0.48	0.13	1,572,505
Information Technology	3	0.066	0.17	18,031
Materials	9	0.026	0.07	12,845,121
Telecommunication Services	1	0.2	0.12	2,281,278
Utilities	5	0.5	0.21	6,644,729
Total	95			

Table 2
Descriptive statistics of dependent, independent and control variables

Variable	Obs	Mean	Std. Dev.	Min	Max	VIF
Carbon Legitimacy	475	0.34	0.53	-1	1	-
Carbon Disclosure	475	0.12	0.10	0	0.51	1.04
Carbon Performance	475	-5.26	1.15	-8.07	-2.60	2.37
Firm Size	475	9.83	0.77	8.69	12.23	3.38
Carbon Intensive Industries	475	0.42	0.49	0	1	1.52
Economic Performance	475	1.80	0.86	-4.60	4.19	1.35
Board Size	475	10.30	2.58	6	21	1.81
Board Independence	475	61.10	12.60	11.76	93	1.39
Leverage	475	62.79	116.61	-168.14	590	1.03
R&D Expense	475	155.59	683.25	0	5523	1.17

Firm Size is log of total assets. Carbon Intensive Industries is dummy variable where one indicates that company is in carbon intensive industry and zero otherwise. Economic Performance is natural logarithm of 1 plus ROA.

Table 3
Correlations

		1	2	3	4	5	6	7	8	9	10
1	Carbon Legitimacy	1									
2	Carbon Disclosure	0.1496	1								
3	Carbon Performance	-0.0683	-0.0081	1							
4	Firm Size	-0.0396	-0.0664	-0.5589	1						
5	Carbon Intensive Industries	0.0431	0.0165	-0.3945	-0.1181	1					
6	Economic Performance	-0.0618	0.0581	-0.0328	-0.3471	0.1296	1				
7	Board Size	-0.0020	0.0509	-0.3635	0.6235	-0.1205	-0.1251	1			
8	Board Independence	-0.0173	-0.1095	-0.3394	0.4548	-0.0222	-0.0820	0.1319	1		
9	Leverage	0.0731	0.1814	-0.0956	-0.0252	0.0852	0.0145	-0.0199	0.0378	1	
10	R&D Expense	0.0921	0.0031	-0.1841	0.2328	-0.1076	0.1541	0.2129	0.2077	-0.0325	1

Firm Size is log of total assets. Carbon Intensive Industries is dummy variable where one indicates that company is in carbon intensive industry and zero otherwise. Economic Performance is natural logarithm of 1 plus ROA.

Table 4
Censored regression estimates of carbon legitimacy

	Model 1	Model 2	Model 3	Model 4
Carbon Disclosure			**1.1236*****	**1.1130*****
			(0.3898)	(0.3904)
Carbon Performance		-0.0421		-0.0285
		(0.0723)		(0.0719)
Firm Size	**-0.2229*****	**-0.2535***	**-0.2135*****	-0.2344
	(0.0823)	(0.0978)	(0.0818)	(0.0971)
Carbon Intensive Industries	0.2705	0.2165	0.1572	0.1216
	(0.3798)	(0.3906)	(0.3777)	(0.3880)
Economic Performance	**-0.1609*****	**-0.1634*****	**-0.1701*****	**-0.1717*****
	(0.0522)	(0.0523)	(0.0518)	(0.0520)
Board Size	0.0229	0.0220	0.0170	0.0165
	(0.0195)	(0.0196)	(0.0195)	(0.0195)
Board Independence	0.0041	0.0037	0.0044	0.0041
	(0.0036)	(0.0037)	(0.0036)	(0.0037)
Leverage	0.0001	0.0001	0.0001	0.0001
	(0.0001)	(0.0001)	(0.0001)	(0.0001)
R&D Expenses	**0.0002*****	**0.0002*****	**0.0002*****	**0.0002*****
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Industry effects	YES	YES	YES	YES
Year effects	YES	YES	YES	YES
Constant	1.0183**	0.9596*	0.9047*	0.8663*
	(0.5026)	(0.5121)	(0.4984)	(0.5074)
Number of observation	475	475	475	475
Pseudo R^2	0.057	0.057	0.065	0.065
Log likelihood	-465.97	-465.80	-461.76	-461.68

Note: Standard errors are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Firm Size is log of total assets. Carbon Intensive Industries is dummy variable where one indicates that company is in carbon intensive industry and zero otherwise. Economic Performance is natural logarithm of 1 plus ROA.

TABLE 5
Censored regression estimates of carbon legitimacy- Quality of carbon disclosure

	Model 1	Model 2	Model 3	Model 4
Quality of Carbon Disclosure			0.0446	0.0433
			(0.0273)	(0.0274)
Carbon Performance		-0.0555		-0.0471
		(0.0720)		(0.0718)
Firm Size	**-0.221*****	**-0.260*****	**-0.231*****	**-0.264*****
	(0.0838)	(0.0985)	(0.0837)	(0.0980)
Carbon Intensive Industries	0.332	0.260	0.379	0.317
	(0.385)	(0.395)	(0.385)	(0.396)
Economic Performance	**-0.158*****	**-0.161*****	**-0.159*****	**-0.162*****
	(0.0525)	(0.0526)	(0.0522)	(0.0523)
Board Size	0.0246	0.0233	0.0220	0.0210
	(0.0196)	(0.0197)	(0.0196)	(0.0197)
Board Independence	0.0045	0.0039	0.0036	0.0031
	(0.0036)	(0.0037)	(0.0037)	(0.0037)
Leverage	-0.0001	-0.0001	-0.0001	-0.0001
	(0.0003)	(0.0003)	(0.0003)	(0.0003)
R&D Expenses	**0.0002*****	**0.0002*****	**0.0002*****	**0.0002*****
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Industry effects	YES	YES	YES	YES
Year effects	YES	YES	YES	YES
Constant	0.960*	0.884*	0.975*	0.910*
	(0.505)	(0.514)	(0.503)	(0.512)
Number of observation	475	475	475	475
Pseudo R^2	0.057	0.057	0.059	0.060
Log likelihood	-467.48	-467.18	-466.15	-465.93

Note: Standard errors are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Firm Size is log of total assets. Carbon Intensive Industries is dummy variable where one indicates that company is in carbon intensive industry and zero otherwise. Economic Performance is natural logarithm of 1 plus ROA.

Table 6
Two-step system GMM estimates of carbon legitimacy

	System GMM	Std. err.
L. Carbon Legitimacy	**0.291*****	0.008
Carbon Disclosure	**0.462*****	0.058
Carbon Performance	0.005	0.010
Firm Size	**-0.134*****	0.020
Carbon Intensive Industries	**0.186*****	0.052
Economic Performance	**-0.101*****	0.006
Board Size	**0.0162*****	0.004
Board Independence	**0.00413*****	0.000
Leverage	**0.0002*****	0.000
R&D Expenses	**0.0001*****	0.000
Industry effects	YES	
Constant	0.348***	0.071
Number of observation	361	
AR(1) test p-value	0.003	
AR(2) test p-value	0.857	
Hansen J test p-value	0.481	

Note: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.Firm Size is log of total assets. Carbon Intensive Industries is dummy variable where one indicates that company is in carbon intensive industry and zero otherwise. Economic Performance is natural logarithm of 1 plus ROA.

Table 7
Censored regression estimates of carbon legitimacy- Carbon intensive industries

	Model 1	Model 2	Model 3
Carbon Disclosure		**1.515*****	**1.501*****
		(0.437)	**(0.440)**
Carbon Performance	-0.0486		-0.0192
	(0.0733)		(0.0715)
Firm Size	**-0.573*****	**-0.558*****	**-0.573*****
	(0.133)	**(0.117)**	**(0.129)**
Economic Performance	-0.0240	-0.0546	-0.0544
	(0.0623)	(0.0611)	(0.0611)
Board Size	**0.0514****	**0.0456***	**0.0451***
	(0.0255)	**(0.0248)**	**(0.0248)**
Board Independence	-0.0037	-0.0003	-0.0006
	(0.00424)	(0.00411)	(0.00422)
Leverage	-0.00002	-0.0001	-0.0001
	(0.000306)	(0.000299)	(0.000300)
R&D Expenses	**0.001*****	**0.0008*****	**0.0008*****
	(0.000235)	**(0.000231)**	**(0.000233)**
Industry effects	YES	YES	YES
Year effects	YES	YES	YES
Constant	2.124***	1.992***	1.947***
	(0.417)	(0.370)	(0.407)
Number of observation	200	200	200
Pseudo R^2	0.1561	0.1896	0.1898
Log likelihood	-141.14	-135.53	-135.50

Note: Standard errors are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
Firm Size is log of total assets. Carbon Intensive Industries is dummy variable where one indicates that company is in carbon intensive industry and zero otherwise. Economic Performance is natural logarithm of 1 plus ROA.