Carbon practice, carbon reputation and corporate economic performance: An empirical investigation of FTSE350 carbon sensitive industries

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**Abstract**

In this study, we investigate whether corporate economic performance is influenced by carbon performance and carbon disclosure. We further examine the extent to which corporate carbon performance is reflected in its carbon reputation and whether carbon disclosure mediates the negative impacts of carbon performance on carbon reputation. Based on pooled cross sectional time series design of 40 UK firms over the period from 2009 to 2013 from carbon sensitive industries (total 200 observations), we found that quantity of carbon disclosure is positively related to corporate carbon reputation, and carbon reputation as an intangible asset can improve economic performance of the firm. In addition, bootstrapping method indicates that the effect of quantity of carbon disclosure on economic performance is fully mediated by carbon reputation. No relationship was found between carbon performance and both quality and quantity of carbon disclosure and quality of carbon disclosure does not enhance corporate carbon reputation. Finally, we could not evidence it pays to be green, i.e. improving the company’s carbon performance does not necessarily lead to better economic performance. Overall, our findings are consistent with legitimacy theory that voluntary carbon disclosure appears to be an effective tool for reputation risk management, and carbon reputation is a valuable resource increasing the economic performance of the firms which is in line with resource based theory.

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**Introduction**

As companies struggle to compete in the global economy, they ought to do so within societal constraints by considering ever-increasing environmental accountability. Several cases have indicated the association between poor corporate environmental performance and abrupt reduction in corporate share price. Both British Petroleum (BP) oil spill in the Gulf of Mexico in 2010 and Toyota for its massive recall in 2009 and 2010 can be deemed as such examples. In addition, their reputation was damaged by removal from such socially responsible investment indices as DJSI and FTSE4Good.

Among current environmental issues, carbon footprints, climate change, and global warming can be considered as the most urgent concerns facing society and key issues of corporate responsibility. Social and political concerns about the carbon footprint related issues have been heightened over the last decade by number of factors including carbon tax and carbon offset schemes, growth in emissions trading, voluntary initiatives such as Carbon Disclosure Project and so forth (Hrasky, 2011). Hence, it is not surprising that different mechanisms such as voluntary carbon disclosure are employed by companies in order to respond to such ever-increasing concerns for the aim of protecting and/or enhancing corporate reputation and may consequently improve firm’s economic performance.

This study aims to investigate the extent to which corporate carbon reputation is influenced by carbon performance and both quality and quantity of carbon disclosure and whether such reputation serves a mediator role between these constructs and corporate economic performance. For the first time this study incorporates these four constructs into a single inclusive model.

Our study integrates three streams of sustainability research. First, few studies have examined the relationship between carbon performance and carbon disclosure. We extend these studies by examining not only the relationship between carbon performance and carbon disclosure (i.e. quantity of disclosure), but also the relationship between carbon performance and what is being disclosed (i.e. quality of disclosure[[2]](#footnote-2)). Second, for the first time this research investigates the impact of quantity and quality of carbon disclosure on the firm’s carbon reputation, and finally the current study adds to limited number of studies by investigating the relationship between carbon reputation and economic performance and the potential direct and indirect (through carbon reputation) relationship that carbon performance and related disclosure may have on economic performance.

**Background and hypothesis development**

According to legitimacy theory, companies are motivated to employ voluntary disclosures to implement different legitimation strategies in order to gain, maintain and/or repair corporate legitimacy. In recent years, the implementation of different legitimation strategies within social and environmental disclosure has been more focused on building and maintaining corporate reputation (Deegan and Unerman, 2011). The use of the term reputation makes clearer the financial consequence and importance of legitimacy. Managers are aware of the significance of company’s reputation as a source of considerable value in generating future profit, and any damage to reputation can therefore affect companies’ future financial performance. Consistent with resource based theory, reputation is a valuable intangible asset not only because of their potential for creating value, but also because of their intangible nature making it difficult to replicate by rivals (Roberts and Dowling, 2002).

However employing different legitimation strategies suggest that if the aim of voluntary disclosures is to respond to legitimacy concerns, these strategies may vary across firms. In other words, corporate actions toward legitimacy and maintaining social contract can be both symbolic and behavioural (substantive) (Deegan and Unerman, 2011; Hrasky, 2011). Ashforth and Gibbs (1990) argues that the use of behavioural (substantive) management techniques of legitimation involve material, real change in corporate goals, process, and structures consistent with social norms and values. In contrast to behavioural (substantive) management techniques, symbolic management techniques of legitimation are employed to indicate corporate image in a manner to appear consistent with public norms and expectations without changing in actual operating policies of the company.

It seems that this symbolic management technique toward legitimacy underpinning Hopwood’s (2009) concerns that although environmental disclosure can increase corporate accountability by enhancing transparency of corporate environmental activities and their consequences (behavioural approach), such disclosure can construct new and different image of organization. In this case less is known about corporate real actions despite an apparent openness of reporting, and companies are subjects to less scrutiny in future.

Hence, the major concern we address in this study is whether corporate carbon disclosure mediates the negative impact of real carbon performance on carbon reputation. In this case, such disclosure by enhancing social legitimacy and consequently firm’s reputation (a factor that may improve firm’s economic performance) may actually hinder a future improvements in corporate carbon performance. This study explores this issue by investigating the interrelationship between firm’s carbon performance, carbon disclosure, carbon reputation and economic performance in a single inclusive model.

***Carbon performance and carbon disclosure***

Prior studies (Al-Tuwaijri et al., 2004; Cho et al., 2012; Cho and Patten, 2007; Clarkson et al., 2008; Clarkson et al., 2011; Hughes et al., 2001a; Patten, 2002) on relationship between environmental performance and environmental disclosure have failed to present a consistent and significant relationship. These studies have approached this association from two competing theoretical perspectives namely called voluntary disclosure theory and legitimacy theory. However, concerns related to methods and measures bring findings into question (Patten, 2002).

Voluntary disclosure theory mainly applied by financial disclosure studies asserts that firms with better environmental performance have incentives to disclose their objective environmental performance indicators which are difficult to be imitated by poor performers. Thus, this theory predicts positive association between environmental performance and quantity of environmental disclosure. In contrast, social-political theories such as legitimacy theory argues that companies employ social and environmental reporting as a tool of impression management to reduce social and political pressures. In other words, legitimacy theory proposes that companies are willing to use such disclosure as a legitimation tool to reduce the negative potential impacts of real performance information for the aim of mitigating social and political pressures (Cho and Patten, 2007) and protecting corporate reputation (Bebbington et al., 2008; Cho et al., 2012). Hence, this theory predicts negative association between environmental performance and level of environmental disclosure.

As aforementioned, corporate disclosure strategies toward legitimacy can be both symbolic and/or behavioural (substantive). However, according to legitimacy theory, since firms with poor environmental performance may face threatened legitimacy, they are motivated to make more self-serving disclosures. Hence, their disclosure tend to be more soft in nature (i.e. symbolic) as they seek to manipulate perceptions regarding their performance instead of revealing the meaningful information (i.e. behavioural) (Clarkson et al., 2011).

Following previous studies (Cho et al., 2012; Cho and Patten, 2007; Clarkson et al., 2011; Hughes et al., 2001a; Patten, 2002) suggesting negative relationship between environmental performance and quantity of environmental disclosure which is consistent with legitimacy theory, and in line with Clarkson et al. (2008, 2011) proposing that legitimacy theory can be also useful to predict the relationship between environmental performance and what is being disclosed (i.e. nature of disclosure), the following hypotheses are developed:

**H1:** Ceteris paribus, quantity of carbon disclosure is negatively associated with carbon performance.

**H2:** Ceteris paribus, quality of carbon disclosure (i.e. ratio of behavioural disclosure to symbolic disclosure) is negatively associated with carbon performance.

***Carbon performance, carbon disclosure, and corporate carbon reputation***

Fombrun (1996, p.10) defined corporate reputation as:

… a collective representation of a firm's past actions and results that describes the firm's ability to deliver valued outcomes to multiple stakeholders. It gauges a firm's relative standing both internally with employees and externally with its stakeholders, in both its competitive and institutional environments.

In other words, he argues that reputation can be defined and measured based on overall estimation and assessment in which a firm is held by its constituents. In a normative sense, reputation should be based on corporate real performance. Several studies (Brammer and Pavelin, 2006; Brown and Perry, 1994; Brown et al., 2010) have documented that actual financial performance and company’s general reputation are aligned. Also anecdotal evidence such as BP oil spill in 2010 has indicated the association between poor corporate environmental performance and damage to corporate reputation. Thus, it is expected that companies with better performance enjoy more positive environmental reputation. Accordingly, based on the above discussion, the following hypothesis is developed:

**H3**: Ceteris paribus, carbon reputation is positively associated with environmental performance.

However, Brady (2005) states that reputation is based on the individuals’ perceptions of the firm. Since there is a potential to manipulate these perceptions, corporate reputation may not always be based on real actions. Bebbington et al. (2008, p.339) argue that “reputations are viewed as having some basis in organizations’ actions (providing a quality good/service, for example) as well as being constructed by others via their perception of those activities”. Cho et al. (2012) assert that within CSR context, voluntary CSR disclosure can serve as a tool to shape and filter individuals’ images and perceptions of perceived performance. This is in line with Bebbington et al. (2008) suggestion considering CSR disclosure as a mechanism for perception creation and as a tool for reputation risk management. Unerman (2008) also takes the view that CSR reporting is a potentially powerful tool employed by firms to influence individuals’ perceptions.

Literature on linkages between CSR reporting and reputation is scarce. One reason can be due to the difficulty in measuring corporate reputation. Toms (2002) integrates resource based theory and quality signaling theory to test the impact of quality of CSR disclosure on corporate environmental reputation using reputation rankings for the community and environmental responsibility aspect of BMAC (Britain’s Most Admired Companies) survey. He finds strong support for the association between CSR reporting and environmental reputation. Hasseldine et al. (2005) complement and extend the work of Toms to investigate the effect of both quality and quantity of disclosure on corporate environmental reputation determined by BMAC. They conclude that quality of disclosure has a stronger effect on environmental reputation creation. Based on a sample of 92 US firms from environmental sensitive industries and using Newsweek magazine’s reputation scores, Cho et al. (2012) also provide positive association between CSR disclosure and environmental reputation of firms. Hence, based on the above discussion, the following hypotheses are developed:

**H4**: Ceteris paribus, carbon reputation is positively associated with quantity of carbon disclosure.

**H5:** Ceteris paribus, carbon reputation is positively associated with quality of carbon disclosure.

***Carbon reputation and economic performance***

Managers normally devote substantial part of their efforts and resources to create, maintain, and improve the reputation of the firm (Deephouse, 2000). Consistent with resource based theory, corporate reputation possesses the characteristics of intangible assets which may provide firms with competitive advantage resulting in greater profitability (Hall, 1992). To illustrate the value of reputation, for instance, when acquirer buys a company with good reputation or image, acquirer not only does pay for tangible assets in place, but also pays for reputation in the form of goodwill. Also in situation where customers are not able to know about the quality of goods before purchasing, strong reputation can serve as a signal about the quality of goods (Shapiro, 1983).

Several studies (Deephouse, 2000; Kim, 2001; Kim et al, 2007;Roberts and Dowling, 2002; Shamsie, 2003; Vergin and Qoronfleh, 1998) have found positive relationship between corporate reputation and financial performance. With a good corporate reputation, companies not only do appear as a stronger rival, but can also experience greater financial performance (Shamsie, 2003). Good reputation can also improve corporate economic performance by allowing firms to charge higher prices, attract more customers and/or investors, enhance access to capital markets, reduce firm risk, and so forth (Herremans et al., 1993). Accordingly, based on the above discussion, the following hypothesis is developed:

**H6:** Ceteris paribus,Economic performance is positively associated with carbon reputation.

***Carbon performance and economic performance***

Financial consequences of corporate social responsibility have remained the unresolved question in environmental accounting discipline. Managers commonly assume that engaging with social and environmental practices incur significant costs beyond profit maximization. If the maximization of profit and social and environmental activities coincide, there would be no controversy over pursuing social and environmental issues. Prior examinations (Al-Tuwaijri et al., 2004; Bowman and Haire, 1975; Bragdon and Marlin, 1972; Chen and Metcalf, 1980; Clarkson et al., 2011; Cordeiro and Sarkis, 1997; Elsayed and Paton, 2004; Freedman and Jaggi, 1992; Jacobs et al., 2010; Lopez-Gamero et al., 2009; Nishitani et al., 2011; Rockness et al., 1986; Spicer, 1978) on relationship between environmental performance and economic performance have produced mixed results. Several researchers (Aragon-Correa and Sharma, 2003; Gonzalez\_Benito and Gonzalez-Benito, 2005; Lankoski, 2008) have referred to lack of solid theoretical framework as the main reason of such divergence. Different and questionable environmental performance and economic performance measurements, relatively low power of measurement error, small sample size, and failure to control for industry type as well as corporate size can be considered as such theoretical shortcomings (Al-Tuwaijri et al., 2004).

Proponents of win-win scenario (Hart, 1995; Porter and Van der Linde, 1995 a,b; Karagozoglu and Lindell, 2000) believe that improving environmental performance can be in the interest of both society and firm, and assert that firms through environmental improvement can enjoy more productivity and profitability, and meanwhile protect environmental resources. They argue that strict environmental regulations may lead to more innovation, efficiency, and competition. Cairncross (1994) suggestes that it would be beneficial for some firms to make environmental regulations stricter in order to help to defend firm from international competition or enhance competitive advantages. Thus, win-win scenario proposes positive relationship between environmental performance and economic performance.

On the other hand, opponents of this scenario (Palmer et al., 1995; Walley and Whitehead, 1994) believe that win-win scenario are likely to be limited in reality and argue that given the costs of environmental initiatives, firms encounter a trade-off (at least in the short-term) between environmental performance and financial performance. Thus, this perspective suggests negative association between these constructs. Another approach proposes neutral relationship between environmental and financial performance. McWilliams and Siegel (2001) argue that firms which do not invest in social and environmental responsibility have lower cost and lower price for their products, whereas those firms concentrating on social and environmental characteristics to their products incur higher cost, but their customer are willing to pay higher prices.

Since the largest number of studies have found a positive relationship between environmental performance and economic performance (Nishitani et al., 2011), the following hypothesis is developed:

**H7**: Ceteris paribus, economic performance is positively associated with carbon performance.

***Carbon disclosure and economic performance***

Unlike the studies exploring the relationship between environmental performance and financial performance, studies investigating relationship between social and environmental disclosure and financial performance are scarce. Absence of data sets related to social and environmental disclosure can be deemed as one of the main reasons of such scarcity (Murray et al., 2006).

Previous results (Anderson and Frankle, 1980; Jaggi and Freedman, 1992; Murray et al., 2006) which are predominantly from the US studies have been mixed and inconclusive. Anderson and Frankle (1980) assess the impact of the social disclosure on financial market. They compare the returns to portfolios included the securities of those firms disclosing social information and those not disclosing such information. Their results indicate that market values social disclosure positively. Jaggi and Freedman (1992) also find out that environmental disclosure in heavily polluting companies have information content and hence conclude positive association between environmental disclosure and economic performance. Finally, Murrary et al. (2006) explore the relationship between social and environmental disclosure and share price returns of UK top 100 companies. They find no direct relationship between these variables. Accordingly, given the absence of robust empirical support for predicting the relationship between both quality and quantity of carbon disclosure and firm’s economic performance, the following hypotheses are developed:

**H8:** Ceteris paribus, economic performance is not associated with quantity of carbon disclosure.

**H9:** Ceteris paribus, economic performance is not associated with quality of carbon disclosure.

**Research Methods**

Consistent with previous studies (Aerts and Cormier, 2009; Kim et al., 2007), in which they sequenced research design variables, a time sequence design has been used for this study to enhance the interpretability of causal relationships with variables. Thus, the measures for carbon performance and carbon disclosures at the t-1 time point, and for carbon reputation and economic performance at t0 have been used.

Figure 1 depicts the relationships among the variables of this study:

**Figure 1. Theoretical model**

**H1, H2**

**H4, H5**

**H6**

**H3**

**H8, H9**

**H7**

 T-1 T0

***Sample***

The sample of this study is drawn from those FTSE350 companies reported to Carbon Disclosure Project (CDP) over the period from 2009 to 2013. Although Britain can be considered as one of the leading countries in tackling climate change and global warming, it is thought that the heart of issue has not been addressed by the UK companies and government policies (Luo and Tang, 2014). According to Luo and Tang (2014), even though companies listed on FTSE350 as the biggest polluters in the UK are showing their commitment toward carbon transparency and carbon reduction by for instance participating in CDP survey every year, they are still far from achieving real reduction in their carbon emissions.

Following previous studies (Cho et al., 2012; Cho and Patten, 2007; Clarkson et al., 2011, 2008) emphasizing on the role of industry in environmental practice of organizations and consistent with Brammer and Pavelin (2006, p. 438) argument that ‘‘industry environments are correlated with significant pressure from institutional, and other, stakeholders’’, the impacts of carbon performance and carbon disclosure on reputation can be vary across industry sectors. Thus, we focus only on those industries with higher carbon exposure, i.e. energy, industrial, material, and utilities.

Although initial sample of the current study contains all companies related to carbon sensitive industries, 40 companies have been chosen since only these companies have reported consistently over the period from 2009 to 2013. Therefore, final sample has 200 company-years. We choose the year 2009 as the starting point since the challenge of climate change was brought into sharp attention during 2009 at United Nations Climate Change Conference in Copenhagen, Denmark. During the summer 2009, many NGOs and politicians were busy preparing for this conference in Copenhagen, and hence climate change and global warming risks gained public visibility during that year (Rahman et al., 2014). Meanwhile the year 2013 is selected since it presents the most recent available data.

Because there has been no change in carbon disclosure regulation over this period, we employ pooled cross sectional time series design as it has advantage over both cross sectional and time series design. This design allows us to increase our sample size and capture a larger portion of variability in the data in order to have more robust parameter estimates (Podestà, 2002).

**Definition of variables**

***Carbon performance***

For the aim of this study carbon emission intensity (emissions relative to economic output) is used as the ratio of total direct (Scope 1) and indirect (scope 2)[[3]](#footnote-3) emissions obtained from CDP[[4]](#footnote-4) to total sales (Clarkson et al., 2008; Luo and Tang, 2014; Patten, 2002). This ratio is more comparable across different reporting periods and between firms since it considers the variation in the output of services and products (Hoffmann and Busch, 2008). Furthermore, according to Patten (2002), such adjustment for company size is made because larger firms would be expected to have higher environmental impacts than smaller firms.

Carbon performance scores for the sample companies range from 1.1 to 42852 with a mean of 889.58 where hider scores denote worse performance.

***Carbon disclosure***

We measure both quantity and quality of carbon disclosure based on a hand-review of stand-alone sustainability reports. Due to adopting legitimacy theory which is related to managers’ incentives of voluntary disclosure, stand-alone sustainability reports as a voluntary disclosure channels are employed. In the absence of such reports, we use voluntary CSR sections of the annual reports.

In order to measure the quantity of carbon disclosure, we rely on density ratio obtained from Michelon et al. (2014). Under G3.1 of GRI guidelines, reports ought to provide the level of information required by stakeholders but avoid unnecessary and excessive information. Beretta and Bozzolan (2004, p.272) argue that writing styles determine the effectiveness of narrative reporting and the relevance of disclosed information is influenced by “how much it is diluted into the mass of other pieces of information disclosed”. Cho and Roberts (2010) take a view that from managerial point of view, diluting social and environmental information in a long document such as stand-alone sustainability report may serve to provide relevant information but in a way that is hard for the user to find the relevant information and it may divert attention. Hence, following Michelon et al. (2014), density of carbon-related information is captured as the ratio between the number of carbon-related sentences over total number of sentences in the stand-alone sustainability report or voluntary CSR section of annual report. Sentences are more reliable than pages and words since they overcome “the problems of allocations of portions of pages remove the need to account for, or standardize, the number of words and are a more natural unit of written English to count then words” (Hasseldine et al., 2005, p.236).

Quality of carbon disclosure is captured by employing content analysis based on Hrasky (2011) symbolic and behavioral disclosure scale. She used six categories to capture differences in the nature of disclosure, i.e. symbolic or behavioural. The first three categories capture symbolic disclosures. The first category is normative statements related to concern or intentions about the relevant issues but not specific action. The second category records statements containing aspirational objectives or targets, but again without specific actions. The third disclosure category is for statements reporting on any external awards or recognition that the company has received related to carbon footprints, climate change 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.

There are also three categories to 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 is 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 (Appendix I shows different categories). Thus, quality of carbon disclosure is calculated as the ratio between the number of behavioural sentences over the number of symbolic sentences. Quantity and quality disclosure scores range from zero to .46 and .11 to 10.6 with a mean of .12 and 1.74 respectively.

***Carbon reputation***

We rely on content analysis of newspaper articles for corporate carbon issues to measure carbon reputation. According to Palmgreen et al. (2001), newspapers have a strong effect on public’s perceptions. Baum and Powell (1995) argue that content analysis of press media is useful in studying legitimation and consequently reputation process as detailed archives of press media exist for many years and industries, and these archives offer powerful techniques for operationalizing legitimation and hence reputation.

In total, 965 articles have been extracted using a company’s name and the following keywords: “carbon”, “co2”, “greenhouse gas emissions”, “air pollution”, “climate change”, and “global warming” over the period from 2009 to 2013. Out of these 965 articles, 664 articles have provided good news, 246 have provided bad news and 55 articles have provided neutral news. Each article has been coded based on its impact on the firm’s carbon footprint or climate change legitimacy, whether it comes from national or local newspapers, and whether the whole article or just part of it has reported on company’s carbon-related issues (which they have been named focused and unfocused articles by the authors).

Unlike previous studies adopted weighting method using three cardinal scales (i.e. favourable (+1), neutral (0), and unfavourable (-1)), this study adopts nine scales to weight articles as follows:

* Favorable national and focused articles: +4
* Favorable national and unfocused articles: +2
* Favorable local and focused articles: +2
* Favorable local and unfocused articles: +1
* Neutral articles: 0
* Unfavorable local and unfocused articles: -1
* Unfavorable local and focused articles: -2
* Unfavorable national and unfocused articles: -2
* Unfavorable national and focused articles: -4

Consistent with previous studies (Aerts and Cormier, 2009; Cho et al., 2012; Clarkson et al., 2008; Deephouse, 2000), Janis-Fadner coefficient is used to measure corporate carbon reputation. Given the adoption of new weighting system, Janis-Fadner coefficient ranges from -16 to +16. Reputation scores are between -9 to 6.25 with a mean of .73.

The formula is as follows:

Janis-Fadner coefficient=$\left\{\begin{array}{c}\frac{f^{2}-fu}{total^{2}} if f>u\\0 if f=u\\\frac{fu-u^{2}}{total^{2}} if u>f\end{array}\right.$

***Economic performance***

Prior environmental studies have employed both accounting and market-based measures as a proxy of economic performance. According to Al-Tuwaijri et al. (2004, p.455) “one limitation in using various economic performance metrics is that they tend to focus narrowly on one aspect of a firm’s economic performance”. For instance, Net income can be a representative of firm’s profitability without considering firm size. Such limitation can be addressed by employing such measures as ROA where different companies from different industries have different industry-driven levels of fixed assets and different assets’ ages.

Therefore, following Al-Tuwaijri et al. (2004) and in line with the adoption of resource based theory predicting that good reputation can increase corporate annual return by achieving competitive advantages over other competitors, annual share return can be the best candidate for representing economic performance for this study. Annual share returns is calculated as natural logarithm of share price at the end of year divide by the price at the beginning of the year[[5]](#footnote-5). According to Al-Tuwaijri et al., (2004, p.456):

Annual stock returns represent a more objective and comprehensive measure of economic performance. The latter is due to the proposition that stock price should impound information about the firm’s future prospects from a vast array of both financial and non-financial measure, such as net income, ROA, operational data, etc.

Annual share return for sample companies are between -.89 and .60 with a mean of .021.

***Control variable***

Several researches (Al-Tuwaijri et al., 2004; Kim et al., 2007; Roberts and Dowling, 2002a) have indicated that current economic performance might be influenced by previous one. In other words, those firms with better economic performance may enjoy better performance for the next year as well. Therefore, we control for potential impacts of previous economic performance on current one.

**Results**

Our study hypothesized relations are interconnected (see Fig. 1). Hence, path analysis is employed to test the hypotheses so that the direct and indirect relations between all variables of interest can be tested. Since all of the variables within this study are observed variables which are directly measured, an overall structural model but not a measurement model is estimated[[6]](#footnote-6).

Fig. 2 presents the results of the path model employing quantity of carbon disclosure and Fig. 3 shows the results using quality of carbon disclosure. Following Hair et al. (2009) several indices are used to determine whether the path models have acceptable fit. First, the Chi- squares in both models are non-significant indicating that the path model is strong fit for the sample (Schumacker and Lomax, 2010). Second, the root-mean-square error of approximation (RMSEA) of both models are .057 and .058 respectively which is well under the recommended threshold of .08 (Hair et al., 2009). Third, according to Hair et al. (2009) higher values of goodness of fit (GFI) measure indicates a better model fit. The values from both models are .994 and .993 respectively showing a strong fit. Finally, the comparative fit index (CFI) of .976 and .905 exceeds the recommended threshold of .90 (Schumacker and Lomax, 2010). Hence, all indices demonstrate that the models have acceptable fit.

.19\*\*\*

.08

.17\*\*

**Figure 2. Path analysis of hypothesized relations using quantity of carbon disclosure.**

.00

.42\*\*\*

-.01

-.09

**Model Fit Statistics**

Chi-Square, 3.276, (df=2), p .0.19

RMSEA, .057

Goodness of Fit Index (GFI), .994

Comparative Fit Index (CFI), .976

**Probability Level**

\*\*\*, p<.01

\*\*, p<.05

\*, p<.10

.19\*\*\*

-.02

.21\*\*\*

**Figure 3. Path analysis of hypothesized relations using quality of carbon disclosure.**

 .01

-.03

-.01

-.09

**Model Fit Statistics**

Chi-Square, 3.343, (df=2), p .0.19

RMSEA, .058

Goodness of Fit Index (GFI), .993

Comparative Fit Index (CFI), .905

**Probability Level**

\*\*\*, p<.01

\*\*, p<.05

\*, p<.10

***Test of H1 and H2***

The first two hypotheses investigate whether carbon performance is associated with quantity and quality of carbon disclosure respectively. As shown in Fig. 2 and Fig. 3, the paths from carbon performance to both quantity and quality of carbon disclosure are not statistically significant. Thus, H1 and H2 are not supported. However, these non-significant relationships suggest that firms disclose carbon information to gain legitimacy among stakeholders, irrespective of their real performance.

***Test of H3, H4, and H5***

The second set of hypotheses is related to determinants of corporate carbon reputation. They investigate whether corporate carbon performance and both quality and quantity of carbon disclosure are associated with carbon reputation. As indicated in Fig. 2 and Fig.3, the paths from carbon performance to carbon reputation in both models are not significant documenting that real carbon performance is not reflected in firm’s carbon reputation. H3 is therefore not supported.

In contrast, the path from quantity of carbon disclosure to carbon reputation is positive and strongly statistically significant (p<.01), indicating more carbon disclosure improves corporate carbon reputation. Hence, H4 is supported. However, as shown in Fig.3, there is no significant relationship between quality of such disclosure and carbon reputation which is not supporting H5. These findings indicate that volume of such disclosures can enhance firm’s carbon reputation irrespective of its quality.

***Test of H6***

As indicated in both figures, the paths from carbon reputation to economic performance are positive and statistically significant (at significance level of 5 and 1 percent respectively). These findings which are consistent with resource based theory suggest that firms with better carbon reputation can enjoy better economic performance and carbon reputation is presently driver of share prices. Therefore, H6 is supported

***Test of H7***

No significant association is found between carbon performance and corporate economic performance. Unlike carbon reputation, this non-significant association shows that firm’s carbon emissions are not presently drivers of share prices and better carbon performers are not rewarded in the market. Hence, H7 is not supported.

***Test of H8 and H9***

Finally, the last set of hypotheses investigates the association between both quality and quantity of carbon disclosure and firm’s economic performance. As shown in Fig. 2 and Fog. 3, the paths from both quantity and quality of carbon disclosures to economic performance are not statistically significant documenting that the financial market is not yet responsive to the firm ‘s carbon disclosures, or maybe the information provided is not sufficient enough to send a clear signal to the market. H8 and H9 are therefore supported.

***Mediation tests***

In order to test any mediating effect in our models, we perform bootstrapping method by AMOS 22. Bootstrapping involves repeatedly randomly sampling observations with replacement from the data set to compute the desired statistic in each resample. Over hundreds of bootstrap resamples provide an approximation of the sampling distribution of the statistic of interest. Our results indicate strongly statistically significant indirect relation between quantity of carbon disclosure and economic performance (p<.01). Further investigation shows that carbon reputation fully mediated the relationships between quantity of such disclosures and economic performance.

***Additional control variable***

Following Cho et al.,(2012), Cho and Patten (2007), Clarkson et al., (2011), Patten (1991), Toms (2002) suggesting that corporate environmental disclosure and environmental reputation might be influenced by corporate size, we control for potential firm size effects using log of total assets. Log of total assets for sample companies range from 8.7 to 11.3 with a mean of 9.7. All indices show that the new models have acceptable fits. Although the paths from size to carbon reputation and carbon disclosure are statistically significant in both models (p<.01), previously reported path analysis findings do not change and hence the results in original analysis continue to hold.

**Conclusion**

Our primary goal of conducting this study was to investigate the direct and indirect (through carbon reputation) effects of carbon performance and both quality and quantity of carbon disclosure on firm’s economic performance. In addition, we intended to identify the extent to which real carbon performance is reflected in corporate carbon reputation and whether quantity and/or quality of carbon disclosure mediate the impact of poorer carbon performance on carbon reputation.

Our path models’ results show several interesting findings. Based on pooled cross sectional time series design of 40 UK firms from industries facing higher levels of carbon exposure over the period from 2009 to 2013, we find that real carbon performance is not related to both quality and quantity of carbon disclosure. We also find that carbon performance is not reflected in corporate carbon reputation and quantity of carbon disclosure (irrespective of its quality) can enhance firm’s carbon reputation. This suggests that companies use such disclosures to gain legitimacy irrespective of their real performance.

We also document a significant positive relation between carbon reputation and corporate economic performance. Thus, consistent with resource based theory, carbon reputation can be deemed as a valuable intangible asset increasing the economic performance of those firms with higher carbon exposure. Unlike some prior studies, we did not support that it pays to be green. In other words, we did not find a significant positive association between carbon performance and economic performance, and also, consistent with few prior studies, no relation was found between both quality and quantity of carbon disclosure and firm’s economic performance. These results suggest that financial market is not yet responsive to both corporate carbon emissions and carbon disclosure or disclosed information might be not sufficient to send clear message to the market. Finally and interestingly, bootstrapping method indicate a significant positive indirect relation between quantity of carbon disclosure and firm’s economic performance. Since we did not find a direct relation between these two constructs, further investigation showed that this association is fully mediated by carbon reputation.

An important implication of our findings is that voluntary carbon disclosure appears to be an effective reputation risk management tool. This can be in line with Bebbington et al. (2008) argument considering voluntary social and environmental disclosure as a mechanism for perception creation and tool for reputation risk management. Although firms’ managers may see our results as good news that by disclosing more carbon information (regardless of its quality and regardless of their real performance), they can enhance firms’ carbon reputation and consequently corporate economic performance, proponents of improved carbon performance may see this as negative news since there is no incentive for business managers to improve their real carbon performance.

No significant relation between carbon performance and carbon disclosure, carbon performance and carbon reputation as well as quality of carbon disclosure and carbon reputation indicate that ,consistent with Hopwood (2009) argument, it seems many companies tend to channel their carbon disclosure more toward symbolic disclosure than providing behavioural (meaningful) disclosures. Hopwood (2009) argues 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 (symbolism). This would seem to be contrary to the desire of society. Thus, our results can send a clear message to regulatory bodies that current policy for voluntary carbon disclosure is not sufficient enough to address the heart of climate change and global warming issues.

Like all studies, our study has some limitations. First, we focused only on relative large UK companies facing higher levels of carbon exposure and thus we cannot generalize our findings to other settings and context. Second, our carbon disclosure is based on hard copy, not web-based disclosure due to timing of web-based disclosures. Third, our measure of carbon reputation may raise questions since it depends on classification of newspapers’ articles to different categories which may differ between different individuals. In addition, this proxy merely captures media perception of corporate activities, not other stakeholders’ perceptions. Finally, due to lack of carbon performance database and in order to have consistent data, we relied only on CDP as one of the most reliable database related to corporate carbon emissions. However, we acknowledge that reported scope 1 and scope 2 emissions’ data may not consistent in terms of boundaries and protocols between all sample companies.

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**Appendix I. The disclosure categories**

|  |  |  |
| --- | --- | --- |
| Symbolic Disclosure | Description | Exemplifying disclosure |
| Normative statement | Statements espousingcommitment 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 orobjectives 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. |
| Behavioural 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 carbonfootprints, 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)

1. Corresponding Author [↑](#footnote-ref-1)
2. The ration of symbolic disclosure to behavioural disclosure [↑](#footnote-ref-2)
3. According to GHG protocol, companies are required to disclose direct and indirect emissions categorized into three scopes: Scope1 includes all direct emissions from the sources owned or controlled by organizations, 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 corporations report different areas. [↑](#footnote-ref-3)
4. Carbon Disclosure Project (CDP) is a non-profit organization based in the UK working with companies and shareholders to provide the greenhouse gas emissions of large companies using GHG protocol as the framework of reference (Dragomir, 2012) [↑](#footnote-ref-4)
5. Ri,t=ln(Pi,t/Pi,t-1) [↑](#footnote-ref-5)
6. We Utilized AMOS 22 to estimate paths. [↑](#footnote-ref-6)