Carbon Disclosure and Financial Performance: UK Environmental Policy

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Abstract

The outcome of carbon disclosure, the importance of which has grown remarkably in recent years to become a strategic decision-making issue for organisations in today's competitive environment, is a subject of lively debate but remains under-researched in the environmental accounting literature. This study is motivated by this research gap and the growing interest in assessing the financial consequences of corporate involvement in climate change beyond regulatory compliance, as evidenced by firms' voluntary participation in the Carbon Disclosure Project (CDP). Using the resource-based view (RBV) of the firm as a theoretical framework and linking it to carbon disclosure through CDP, we conceptualise and empirically investigate the impact of adopting proactive carbon management policies and communicating them to stakeholders, focusing on the financial performance of the top FTSE350 companies between 2007 and 2015. By developing a comprehensive financial performance index and controlling for several firm characteristics, we find strong evidence that voluntary carbon disclosure is positively associated with firm financial performance. The findings in this paper provide new insights and policy implications for managers, financial stakeholders, and regulators.

1 Introduction

A growing number of firms have made their global-warming strategies part of their core policies because they recognise that going green can save money through improved energy efficiency and waste management, among other factors. Under current regulatory reforms intended to address the growing environmental concerns of diverse stakeholders, climate change and energy transitions have become pressing financial and social issues (Cadez, Czerny, & Letmathe, 2019). Green finance has recently emerged as a standard aspect of many investment decisions (Ward, 2017).

The emergence of investors' interests in climate-related financial risks calls for a specific type of global data about those risks in order to support rational investment decisions (The Economist, 2017). One attempt to respond to these needs was the initiation of the Carbon Disclosure Project (CDP), an environmental impact charity that investigates participating companies' practices and risks related to global warming.[1] The objective of this paper is to investigate the relationship between voluntary carbon disclosure and firm financial performance (FP). Achieving this objective could demonstrate how the impacts of climate change on business operations – and responses to those impacts – can be simultaneously associated with both the environment and business.

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[1] The project began in the UK in 2000 but has grown to become the world's largest register of corporate emissions. Each year, it administers a questionnaire on climate change-related issues to public companies on behalf of its signatories (e.g. banks, investors, wealth advisors, pension funds). It then makes the results public in an annual report.

Our study is motivated by an interest in understanding corporate engagement in climate change practices beyond stringent requirements related to regulatory compliance, as evidenced by firms' voluntary participation in carbon disclosure through CDP. The resource-based view (RBV) is deemed appropriate for this study setting. The RBV emphasises that internally made decisions, based on a firm's ability to exploit the available productive resources, generate competitive advantage and thereby produce financial benefits. That is, there are possibly valuable and hard-to-duplicate resources that might provide strategic gains over competitors (Hasseldine, Salama, & Toms, 2005).

Our sample comprises 977 firm-year observations listed in the FTSE350 index from 2007 to 2015, a period characterised by high public awareness and extensive policy debate on climate change and greenhouse gas (GHG) emissions. FTSE350 companies are the largest companies by market capitalisation listed on the London Stock Exchange. Therefore, these companies represent a central projection for the UK's carbon profile and economic performance. We utilise the carbon disclosure score (CDS), reported by the CDP, and construct a comprehensive financial index that captures different types of a firm's performance. This financial index comprises both accounting and market indicators. The findings in this study suggest that voluntary carbon disclosure tends to significantly improve a firm's FP. This finding is consistent with a "win-win" perspective on being 'green and competitive' (Porter & Van der Linde, 1995). Furthermore, we extend our analyses and cluster the full sample into two sub-samples: firms reporting high FP and firms reporting low FP. The results show that firms that achieved high FP reported highly positive carbon disclosure compared to modest disclosure for firms with low FP.

This study contributes to the emerging research area of climate-related activism and the broader corporate transparency debate in three ways. First, the limited debate within the prior literature on the financial consequences of carbon disclosure indicates a lack of consensus on the direction of this relationship. Moreover, relatively little is known about this association within the European context in general and the UK context in particular. The UK represents an interesting setting for this type of research. While the European Union (EU) is marked as one of the world's top three GHG-emitting economies (after China and the United States), the UK, a member of the G7 (Group of Seven), represents one of the largest GHG emitters in the world (Central Intelligence Agency (CIA), 2018). The UK is also listed among the twenty countries with the highest carbon emissions carbon dioxide (Union of Concerned Scientists (UCS), 2018). The UK is currently leading and developing proactive mechanisms to mitigate the dangers of climate change. Second, we build on the RBV theory (Hart, 1995) to understand how the proactive integration of climate change mitigation into a firm's business policy could be associated with bottom-line performance through carbon disclosure to stakeholders. Third, we test our RBV-based conceptual model against empirical reality by constructing a comprehensive index that captures FP. To our knowledge, this study is the first to use a financial index to quantify the association between FP and carbon disclosure. We take a step ahead to highlight how firms' engagement in high (low) carbon disclosure can lead to high (low) financial performance.

The findings in this paper provide updated insights and policy implications for managers, investors, and regulators. Managers should work towards improving the quality of carbon-related information by ensuring the relevance, credibility, and reliability of such information. In this regard, the CDP report, as a disclosure mechanism, suits the mission of both stakeholders and managers because it offers comparable and standardised information that makes it difficult for poor performers to mimic high achievers (Luo & Tang, 2014). Our findings also guide regulators on how to promote and focus their efforts towards the implementation of sustainable carbon management practices in businesses.

The next section reviews the literature and develops a hypothesis to answer the research question. Section 3 presents sample data and models. Section 4 reviews the empirical results and additional analyses. Section 5 concludes the paper.

2 Literature Review and Hypothesis Development

2.1 Background

The association between social/environmental responsibility and FP has long been the focus of considerable research in many scholarly disciplines (Griffin & Mahon, 1997; Hang, Geyer-Klingeberg, & Rathgeber, 2019; Hassan & Romilly, 2018; Margolis & Walsh, 2003; Orlitzky, Schmidt, & Rynes, 2003; Pava & Krausz, 1996; Qiu, Shaukat, & Tharyan, 2016; Tang & Demeritt, 2018). Hahn, Reimsbach, and Schiemann (2015) review the research addressing the outputs and outcomes of carbon disclosure and conclude that a considerable number of studies emphasise the empirical determinants and, to a lesser extent, the effects (outcomes) of carbon disclosure, which has become a strategic decision-making issue for organisations within the current competitive scenarios (Kuo & Chen, 2013). Accordingly, “the effects of carbon disclosure represent a major gap that should be filled by future research” (Hahn et al., 2015, p. 97).

This view appears especially valid considering that the ongoing debate in the limited literature on the economic impact of reported GHG emissions or disclosed responses to climate change also shows no consensus, and related empirical research provides inconclusive findings.

Some studies find general support for a positive relationship (e.g., Fujii, Iwata, Kaneko, & Managi, 2013; Gallego-Álvarez, Segura, & Martínez-Ferrero, 2015; Hart & Ahuja, 1996). Busch and Hoffmann (2011) find that carbon emissions as an outcome-based measurement have a positive relationship with FP, but they observe a negative link when using carbon management as a process-based measurement. Eun-Hee and Lyon (2011) analyse the conditions under which share prices increase for the Financial Times Global 500 due to participation in the CDP and find no systematic evidence that CDP participation directly increased share prices.[2] However, they find that companies' CDP participation increased shareholder value when exogenous events caused the likelihood of climate change regulation to rise. Gallego-Álvarez, García-Sánchez, and Vieira (2014) find that the GHG emissions ratio has neither a positive nor negative influence on a company's FP. They conclude that "future research should consider the possibility of including a broader time period, and thus the behaviour of firms before, during and after the period of economic crisis could be analyzed" (p. 371). Matsumura, Prakash, and Vera-Munoz (2014) find that the capital markets penalise all firms for their carbon emissions but impose a further penalty for non-disclosure. Misani and Pogutz (2015) study carbon-intensive industries, for which reduction of GHG emissions is a highly material issue, and find that firms achieve the highest FP when their disclosed GHG emissions are neither low nor high, but intermediate. These authors suggest that future research should also examine industries with lower average levels of

[2] The Financial Times Global 500 provides an annual ranking of the world's largest firms according to their market capitalisation. It shows the changing performance of both individual companies and the sectors and countries they operate in.

emissions. Lewandowski (2017) finds that carbon emission mitigation has a linear and significantly positive relationship to return on sales but is negatively related to Tobin's *q*.

Wide dissemination of carbon information on Twitter has been found to be negatively associated with the cost of equity (Albarrak, Elnahass, & Salama, 2019). Lemma, Feedman, Mlilo, and Park (2019) found that in the case of South African listed companies, voluntary carbon disclosure is associated with lower overall cost of capital.

Empirical investigations of this relationship have used global or US-based samples and employed different measures of carbon disclosure (e.g., carbon intensity ratios, variation in carbon dioxide emissions) while covering many different time periods and not focusing on the relatively longer period after the global financial crisis.

Although accounting and market measures of performance have been widely used in previous literature, no consensus exists on the measurement of FP. Moreover, Hahn et al. (2015, p. 94) conclude that the extant literature does not "explicitly refer to an underlying theoretical framework and, rather, rely on prior empirical evidence to develop their hypotheses". With the growing interest in and opaqueness of the implications of carbon disclosure, it is necessary to develop a firm theoretical foundation highlighting the underlying cause-effect relationship between carbon disclosure and FP.

2.2 Carbon Management and Financial Performance: An RBV Conceptualisation

In a competitive business environment, the primary focus of a firm is to overcome intense competition and outperform other firms by creating competitive advantage (Kamasak, 2013), defined as superior FP (Winter, 1995). A firm has a competitive advantage "if it [can] create more economic value than the marginal (breakeven) competitor in its product market" (Peteraf &

Barney, 2003, p. 314). Indeed, any firm is a bundle of resources (Penrose, 1959; Wernerfelt, 1984), defined as “the subset of its productive assets which are economically inalienable” (Wernerfelt, 2016, p. 102). Each firm has a unique (heterogeneous) resource endowment (Lockett, O'Shea, & Wright, 2008). These resources can only be a source of sustained competitive advantage when they are valuable (Barney & Clark, 2007). More precisely, “bundles of strategically relevant resources” (Peteraf & Barney, 2003, p. 317) enable a firm to create viable business strategies and to develop a sustainable competitive advantage over its rivals (Collis, 1994; Kamasak, 2013).

The RBV of a firm, “an efficiency-based explanation of sustained superior firm performance” (Barney & Clark, 2007, p. V), is one of the leading theoretical paradigms used to explain performance variation among competing firms (Galbreath & Galvin, 2008) in relation to internal, idiosyncratic resources or firm-specific factors (Barney, 1991).

The RBV theoretical lens appears to have become the dominant theory in the debate on how environmental practices are associated with FP (e.g., Hart, 1995; Hart & Ahuja, 1996; Klassen & Whybark, 1999; Ramanathan, 2018). In our study setting, it offers a supportive framework with which to analyse such relationships for two reasons (Surroca, Tribó, & Waddock, 2010). First, it focuses on FP as the key outcome variable. Second, prior work adopting this view explicitly recognises the importance of the creation of intangible assets or resources, such as legitimacy and the broader reputational benefits of taking a proactive approach to the environment (Hasseldine et al., 2005). Such advantage-creating resources can be generated, maintained or enhanced through disclosure practices (Chalmers & Godfrey, 2004).

Legitimacy, “a view closely tied to the RBV of the firm” (Tilling & Tilt, 2010, p. 58), serves as a resource (Hearit, 1995) that organisations use through various disclosure-related strategies (Deegan, 2014) to construct their social conversations with stakeholders and enhance their reputations (Busch & Hoffmann, 2011). Miles and Covin (2000, p. 300) point out, "reputational advantage, as a function of credibility, reliability, responsibility and trustworthiness, is enhanced by superior environmental performance". After implementing more mitigating actions related to their ecological impact and GHG effect, organisations will be more motivated to voluntarily disclose high-quality information to stakeholders (Kuo & Chen, 2013).

Accordingly, in the underlying proposition of the RBV, the desired outcome is to manage carbon effectively. This implies an organisational capability that should be communicated to corporate audiences in an appropriate, consistent, open, and accessible format in order to have a positive impact on competitive advantage.

A proactive carbon policy tends to achieve maximum possible operational efficiency and reduce risks to humans and the environment (Fujii et al., 2013; Hart & Ahuja, 1996). Improved environmental risk management practices in turn alleviate societal pressure, mitigate the threat of government regulation, lower market risk (Orlitzky & Benjamin, 2001) and reduce the cost of capital for the firm (Dhaliwal, Li, Tsang, & Yang, 2011). Environmentally active firms are also expected to "enjoy several potential revenue-generating benefits: (a) reducing their exposure to potential carbon costs, (b) opening up new markets, (c) developing competencies that provide a competitive advantage, and (d) creating new revenue streams from excess credits" (Peloza, 2009, p. 1526).

2.3 The Decision to Disclose Carbon Information Voluntarily

In an area of financial reporting dominated by voluntarism, many options are available to managers deciding how to report the impact of organisational activities on the environment

(Delmas & Burbano, 2011). As Cairncross (1995, p. 203) puts it, “Companies are free to publish whatever they wish (or whatever they think they can get away with”. There is also a possibility that environmental responsibility can be used to greenwash and thus deliberately manage stakeholders’ perceptions by reporting biased/misleading positive information not matched by improved environmental impacts (Al-Tuwaijri, Christensen, & Hughes, 2004), rather than as an authentic means of limiting global climate change by measuring, managing, and reducing GHG emissions (Haney, Jones, & Pollitt, 2009). Greenwashing can adversely affect investor confidence, eroding the capital market for environmentally responsible investing (Delmas & Burbano, 2011), and could be negatively related to firm performance (Lyon & Montgomery, 2015).

If these concerns are valid, managers need to improve the transparency and accountability of their corporate carbon footprints and find innovative ways to cut emissions and associated waste (Haslam, Butlin, Andersson, Malamatenios, & Lehman, 2014). Failure to communicate information on carbon footprints to the market would result in the inability of investors to accurately estimate the risk associated with the investment. Carbon disclosure can then be regarded as a commitment to transparency, as efforts to address climate change risks and opportunities, and as a criterion for measuring an organisation’s reliability and legitimacy. Once proactive carbon management strategies are adopted, firms will voluntarily report information about their mitigation actions (Connelly, Certo, Ireland, & Reutzel, 2011), that is, their ‘discharge of accountability’ (Gray, Owen, & Adams, 1996, p. 39), through communication to stakeholders (Zeghal & Ahmed, 1990). High-quality voluntary carbon disclosure will then enable the organisation to develop a competitive carbon strategy (Schaltegger & Csutora, 2012), publicise stronger environmental records to stakeholders (Mahoney, Thorne, Cecil, & LaGore, 2013), distinguish themselves from poor performers to avoid the problem of adverse selection (Luo & Tang, 2014), and eventually increase their market values (Hummel & Schlick, 2016). Therefore, within the context of the RBV, accountability through carbon disclosure, reconciled with sustainability, can be viewed as a resource that provides sustained competitive advantage (Haslam et al., 2014).

Luo and Tang (2014, p. 196) suggest that carbon information is “a complex and multidimensional concept”. Managers must therefore appreciate the key elements of making disclosures about their GHG pollution emissions and their detailed plans to address global warming. These plans should include low-carbon initiatives, emissions reduction targets, energy/power consumption, and the determination of climate change risks and opportunities, resulting in a change in business operations, expenditures, and revenues. Ultimately, to be considered a valuable, unique resource, a credible carbon reporting system – one that helps a firm to improve its perceived legitimacy and gain reputational advantages – should first answer questions about what types of carbon information is relevant and should be reported and what items reflect a proactive carbon management policy.

Carbon disclosures conveying relevant information to stakeholders regarding advantage-creating resources would, therefore, imply integration of (a) climate change into business strategy, (b) an effective system of corporate governance – based on the values of transparency and accountability – that addresses climate change, and (c) external assurance/verification to enhance the credibility of firms’ disclosures (Clarkson, Li, Richardson, & Vasvari, 2008). If carbon disclosures provide accurate information about actual performance and are successfully transmitted to a broader range of stakeholders, who increasingly require meaningful and transparent disclosures on GHG emissions and the management of related risks and opportunities regarding global warming, the carbon disclosure–FP relationship, in which strategic organisational resources required for competitiveness are combined, and environmental technologies are implemented, should exist (Klassen & Whybark, 1999). The relationships described above are summarised in Figure 1, which leads directly to the following hypothesis:

H_1 Carbon disclosure has a significant and positive association with FP.

3 Research Design and Data

3.1 Sample

Our sample includes all firms continuously listed in the FTSE350 index between the years 2007-2015, a period characterised by high public awareness and extensive policy debate on GHG emissions. The final sample consists of 977 firm-year observations after dropping the financial institutions, as is common in this type of research because of their unique accounting practices and the different set of environmental and social regulations they follow, such as the '*Equator Principles*' (Qiu et al., 2016).[3] It is worth mentioning that the FTSE350 companies were first invited to engage in and voluntarily report their carbon disclosure through the CDP online questionnaire in 2006. We exclude the year 2006 from the analysis for two reasons: (1) the modest participation level in the CDP questionnaire in that year, and (2) to ensure the consistency of the companies' responses to the questionnaire items and analyses of the CDP data

[3] The *Equator Principles* is a risk management framework, adopted by financial institutions, for determining, assessing and managing environmental and social risk in projects. See http://www.equator-principles.com.

across time. The responses in 2006 were analysed and classified into four categories (qualitative): answered questionnaire (AQ), provided information (IN), declined to participate (DP), and no response (NR). In contrast, in the following years, the responses were classified based on the digital analysis (quantitative) and ranged from 0 to 100. There was an intention to extend the sample period beyond 2015; however, according to the 2016 CDP report, the methodology of measuring the CDS for that year was substantially amended. Therefore, we would have lost the consistency of our data. The report states, "It is important to note that the 2016 scoring approach is fundamentally different from 2015, and different information is requested, so 2015 and 2016 scores are not directly comparable" (CDP, 2016).

Table 1 summarises the distribution of the final sample by the Global Industry Classification Standard (GICS) classification at sector level, the same classification applied by the CDP.[4]

3.2 Measures

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[4] The GICS is a standardized classification system introduced by Morgan Stanley Capital International (MSCI) and Standard & Poor's (S&P) for use by the professional investment management community. The hierarchical system comprises 11 sectors, 24 industry groups, 69 industries and 158 sub-industries; each entity or equity is assigned coding at all four of these levels. A significant change was made to the GICS in 2016, one year after our research period, when the real estate industry group (excepting real estate investment trusts, REITs) was moved from the financial sector to a new real estate sector.

3.2.1 Financial Performance

The dependent variable in this study is firm financial performance (FP). Measurement of FP is a fundamental problem in the context of the prior literature, which hypothesizes that corporate social and environmental responsibility is a predictor of FP (Margolis & Walsh, 2001). Accordingly, we take a step forward to overcome this concern by developing a composite financial performance index (FPI) incorporating the most common measures employed by previous studies examining the associations between corporate social/environmental responsibility and FP (e.g., Albarrak et al., 2019; Busch & Hoffmann, 2011; Jo & Na, 2012; Koh, Qian, & Wang, 2014; Oikonomou, Brooks, & Pavelin, 2014; Qiu et al., 2016).

The FPI comprises ten financial variables that reflect accounting and market measures. These variables are classified according to their measure source, either accounting, market, or combined accounting and market-based measures. Accounting-based measures include return on assets (ROA), return on equity (ROE), asset turnover (AT), the debt-to-equity ratio (D/E) and interest coverage ratio (IC). Market-based measures include stock return volatility (RV), cost of equity (COE) and the price-earnings ratio (P/E). Altman Z-score (Z) and the market-to-book ratio (P/B) are categorised as combined measures. In constructing the FPI, we take the average industry value for each of these proxies at each time t and compare it with the firm i value of each proxy. We then create dummy variables for each of the ten variables. Each dummy variable gets a value of 1 if a firm's proxy has a score better than the industry average; 0 otherwise. Finally, we give a scale value for the FPI ranging from zero to ten, where a higher value reflects a better FP position. We use the scale value derived from the dummy variables to obtain the overall financial health level. We require the availability of all FPI proxies to have a value. We therefore remove any missing values among the FPI components. The data source is the Bloomberg database, and the definitions of variables are presented in Appendix 1.

Although the idea of constructing an index to capture variables in regression equations has recently been emphasised by scholars on financial flexibility (e.g., Doidge, Karolyi, Lins, Miller, & Stulz, 2009; Ferrando, Marchica, & Mura, 2017) and corporate governance (Mollah, Hassan, Al Farooque, & Mobarek, 2017), to our knowledge, no previous studies in the context of environmental accounting have implemented an FPI to assess the relationship between corporate social/environmental/carbon practices and FP.

Developing this index to simulate a firm's FP can be justified from three perspectives. First, it offers simultaneous assessments of a firm's performance using multiple indicators. Given a rich variety of available proxies of financial measures that can be used independently in analysis, existing studies measure firms' FP by employing individual measures of the same category, such as accounting-based measures (see, for example, Benston, 1985; Brealey, Myers, Allen, & Mohanty, 2012; Dhaliwal, Salamon, & Dan Smith, 1982; Fisher, 1984; Fisher & McGowan, 1983; Gonedes & Dopuch, 1979; Griner & Stark, 1991; Hagerman & Zmijewski, 1979; Harcourt, 1965; Hay & Morris, 1991; Rees, 1995; Salamon, 1985; Watts & Zimmerman, 1978; Wright, 1978). However, despite their similarities, each of the measures captures different aspects of a firm's FP. For example, return on assets (ROA), return on equity (ROE) and asset turnover (AT) reflect firms' profitability as well as their operational efficiency. Adding to these three measures, debt to equity (D/E) and interest cover (IC) provide the relative profitability of firms given their financial obligations. Furthermore, just as important as accounting measurements that reflect historical FP are market-based measures that provide the perceptions and reactions of the market regarding the firms' future financial prospects. Moreover, it might be argued that accounting proxies are likely to be subject to managerial opportunism (i.e., earnings management) and influenced by differences in accounting practices. Hence, additional consideration of market-based measures can provide a more robust examination of a firm's financial health. Overall, it can be seen that different financial measures do not stand on their own but complement each other for a more comprehensive analysis of a firm's financial achievements. Therefore, those measures should be used in an integrated manner by developing a composite measure that offers an overall assessment of the financial position/health of a firm that can be compared across several years.

Second, the FPI captures the relative FP of firms across industries rather than their absolute performance. It has been suggested that the study of firm performance should be extended to encompass other industry-specific characteristics (McGuire, Sundgren, & Schneeweis, 1988). As seen in previous studies, the comparison of absolute FP across firms can be misleading and biased. This property of the index is critical because it is more rational to compare firms with similar characteristics. Therefore, the index compares the individual financial aspects of each firm with the industry average benchmark.

Finally, regarding the selection of the index's components, this study thoroughly evaluates the ten most well-acknowledged and important financial measures that have been used both in the literature and in practice. Furthermore, there were criteria that these measuring elements should provide unique value added to the firm's FP from different perspectives and that duplication should be avoided. For example, as there is significant duplication between EPS and P/EPS ratios, and between Tobin's Q and P/EPS, EPS and Tobin's Q are excluded.

By computing the index, the correlations between measures are seen to be significant for approximately 90% of the measured pairs (the correlation results are not reported in this paper).

The associations between these ten measures justify the use of the FPI. In particular, many different aspects of firms' FP, good performance and poor performance can be inherent in all measures simultaneously. Consequently, it is useful to incorporate all aspects into one single measure for a complete picture of firms' financial health.

3.2.2 Carbon Disclosure

Koh et al. (2014) suggest that future research may endeavour to measure corporate social and environmental practices using a survey methodology. We use the Carbon Disclosure Score (CDS), collected from the CDP database, as a proxy for a firm's carbon disclosure. The CDS is obtained via a survey and is based on a company's responses to questions in the CDS Online Response System. The score ranges from 0 to 100, representing the quality level of a firm's responses to an annual questionnaire issued by the CDP, an independent, not-for-profit organisation. The CDP works with institutional shareholders and corporations to run the global environmental disclosure system for business and to disclose the GHG emissions of thousands of major companies worldwide (e.g., S&P500 and FTSE350). The CDP "is working to reduce the risks associated with transparency by facilitating dialogue and information-sharing between companies" (Wilhelm, 2013, p. 159). It therefore demonstrates a strategic competence that appeals to multiple stakeholders and builds broad legitimacy for carbon disclosure standards (Knox-Hayes & Levy, 2011).

The questionnaire assesses the information that companies disclose on CDS in terms of three broad topics: (1) climate change management: governance, strategy, targets and initiatives, and communications; (2) climate change-related risks and opportunities; and (3) climate change emissions methodology, emissions data, energy, emissions performance, and emissions trading.

Company responses to the CDP questionnaire, made publicly available on the CDP website, could have implications for investors' investment decisions (Eun-Hee & Lyon, 2011). According to Tang and Luo (2011, p. 26), "a firm's reputation could be adversely affected if the firm refuses to participate in CDP, or participated but disclosed poor carbon information".

The choice of the CDS measure of carbon disclosure is justified by the high number of organisations that voluntarily respond to the information request and by its popularity in previous studies. The CDP has highlighted the fact that its data were used in 70 peer-reviewed studies published between 2005 and 2015.

3.2.3 Controls

To control for the firm characteristics that may drive the examined relationship, we follow prior studies (Clarkson et al., 2008; Dhaliwal et al., 2011) and include in our analysis firm size (SIZE), measured by the natural log of total assets, financial leverage (LEV), measured by the ratio of total debt to total capital, and systematic risk measured by beta (BET) as control variables. Board size (BRS), measured by the natural log of the total number of directors, and the percentage of non-executive directors on the board (NED) are included to control for the role, effectiveness, and independence of the board (Dalton, Daily, Ellstrand, & Johnson, 1998). In line with prior studies, we also include the percentage of shares held by executive directors out of the total number of shares (MAN) and the total percentage of shares owned by substantial shareholders (5 percent or more) (SUB) to control for ownership structure effects (Jensen & Meckling, 1976). According to Stanny and Ely (2008), European companies with higher proportions of international trading face a higher expectation to disclose their carbon emissions. Therefore, we control for the effects of foreign market activities (FMA) based on the ratio of foreign assets to total assets. Furthermore, firms operate in markets with varying levels of competition (Kamasak, 2013). We therefore control for the effects of product market competition (COM), measured by the number of competitors in the same industry in a given year. Certain industries have high carbon emissions profiles and are therefore more heavily scrutinised by the public, media, and governmental regulations and legislation. Consequently, we include a dummy variable (IND) equal to one if a firm is part of a carbon-intensive industry and zero otherwise. Finally, we include yearly dummy variables to control for the possible influence of fluctuations in market trends that may affect firms' FP (Al-Awadhi & Dempsey, 2017).

3.2.4 Model Tested

To test $\mathbf{H_1}$, our main empirical model is set out below:

$$\mathrm{FPI}_{it} = \beta_0 + \beta_1\,\mathrm{CDS}_{it} + \beta_2\,\mathrm{SIZE}_{it} + \beta_3\,\mathrm{LEV}_{it} + \beta_4\,\mathrm{BET}_{it} + \beta_5\,\mathrm{BRS}_{it} + \beta_6\,\mathrm{NED}_{it} + \beta_7\,\mathrm{MAN}_{it} + \beta_8\,\mathrm{SUB}_{it} + \beta_9\,\mathrm{FMA}_{it} + \beta_{10}\,\mathrm{COM}_{it} + \beta_{11}\,\mathrm{IND}_{i} + \beta_{12}\,\mathrm{YEAR}_{t} + \varepsilon_{it} \quad (1)$$

where FPI is the financial performance index; CDS, Carbon Disclosure Score; SIZE, the natural log of total assets; LEV, the total debt to total capital ratio; BET, the systematic risk estimated by regressing the daily stock return on the daily market return over 12 months; BRS, the natural log of the number of board members; NED, the percentage of non-executive directors on the board; MAN, the percentage of shares held by executive directors to total number of shares; SUB, the total percentage of shares held by substantial shareholders (5 percent or more); FMA, the ratio of foreign assets to total assets; COM, the number of competitors in the same industry; IND, a dummy variable that takes the value of 1 for a carbon-intensive industry and 0 otherwise; and YEAR, dummy variables.[5]

4 Results and Analysis

4.1 Descriptive Statistics

Descriptive statistics are shown in Tables 2 and 3. In Table 2, the mean and distributional characteristics are reported for each variable. The response rate for our sample to the CDS information request is approximately 77% (752 out of 977). The mean value for CDS is 71.16, which is relatively high compared with prior studies that employed CDS as a dependent variable. Prado-Lorenzo and Garcia-Sanchez (2010), who examine the role of the board of directors in disseminating information related to GHG emissions, report 60% as the mean value for CDS based on the CDS 2007 annual survey. Additionally, Luo and Tang (2014), who investigate whether voluntary carbon disclosure reveals actual carbon performance, report 65% as the mean value for CDS based on the CDS 2010 annual survey. The differences in mean CDS values between our study and prior studies can be explained by the short period examined in those studies (only one year) and the time variation in the public pressure to disclose information related to climate change. The mean value for FPI is 4.9, with a minimum value of 0 and a maximum value of 10. The unreported average firm SIZE is £10.9 billion, which suggests that our sample comprises large firms. The mean and median values of SIZE, measured by the logarithm of total assets, are approximately 22, similar to the Clarkson et al. (2008) sample. The

[5] For the treatment of outliers, our data are winsorised at the 2.5th and 97.5th percentiles.

maximum value of SUB exceeds 100%. According to Asquith, Pathak, and Ritter (2005), this could occur when shares are owned by more than one party at the same time (the original lender plus the purchaser on the other side of the short sale).

Table 3 reports the Spearman (Pearson) correlations reported in the upper (lower) diagonal.[6] The correlation between CDS and other right-hand variables (e.g., SIZE) is consistent with prior literature. As Cormier and Magnan (1999) conclude, “irrespective of their information costs and financial condition attributes, large firms disclose more environmental information than small firms” (p. 444). Consistent with RBV expectations, the significant positive correlation between FPI and CDS provides some primary findings suggesting that carbon disclosure tends to be positively associated with FP.

4.2 Empirical Tests

4.2.1 Carbon Disclosure and Firm Performance

We employ alternative empirical assessments using several estimations to examine the association between carbon disclosure and FP. In addition to using ordinary least squares (OLS) regression procedures (Column 1), as reported in Table 4, we employ a TOBIT formulation for our second regression (Column 2) to account for the censored nature of the dependent variable (FPI) (Clarkson et al., 2008; Luo & Tang, 2014). We also re-estimate our model using the Random-Effects Generalised Least Squares (GLS-RE) (Column 3), based on Hausman test

[6] Unreported variance inflation factors (VIFs) are within levels of tolerance for multicollinearity.

results, to control for heteroscedasticity (Kennedy, 2003).[7] Finally, we use the instrumental variable two-stage least squares (IV-2SLS) estimator in column four (applying firm age and CDS Lag: 1 year) to examine the endogenous relation between carbon disclosure and FPI (Jo & Harjoto, 2011, 2012; Larcker & Rusticus, 2010). Endogeneity, arising from omitted variables, measurement error, interdependence between variables or correlated unobserved effects, is an issue we cannot ignore (e.g., Semykina & Wooldridge, 2010). Furthermore, it is often challenging to ascertain the existence of reverse causality between dependent and independent variables, i.e., whether CDS drives FPI or otherwise (Wintoki, Linck, & Netter, 2012). To address these endogeneity concerns, the study employed the IV-2SLS model, which requires the use of instrumental variables that are both exogenous and relevant. This requires the selection of an instrument for correlating with the endogenous variable (i.e., CDS) but not with the dependent variable (i.e., FPI) (Schreck, 2011). In line with Jo and Harjoto (2011, 2012), we select the Firm Age as a first instrumental variable. This selection is based on the assumption that mature firms are likely to be in a stronger position to participate in carbon disclosure projects but also that improved firm performance from such participation is not automatic (Jo & Harjoto, 2011, 2012). Consistent with prior studies (e.g., Schreck, 2011; Surroca et al., 2010), we use a one-year time lag of CDS as the second instrumental variable. Both instrumental relevance and exogeneity criteria are satisfied by using the lagged term of CDS. Prior-period CDS can be viewed as one of

[7] The Hausman test reports 0.460 and confirms the presence of no systematic differences between the fixed and random effects (Prob > 0.05).

a firm's criteria for judging its current carbon disclosure and its currently developing (declining) level.[8]

The results reported in Table 4 provide strong evidence for the positive association between carbon disclosure and FP. CDS has a highly significant and positive association with FPI, and this result is found consistently across all estimation methods. This result implies that firms that continuously engage in voluntary carbon disclosure of their carbon practices can attain high FP and achieve a long-term competitive advantage in the marketplace. This finding confirms our main hypothesis (**H_1**) and indicates that "it pays to be green" (Hart & Ahuja, 1996), which is generally supported by the RBV (Hart, 1995). Indeed, investing in a proactive carbon policy and voluntarily disclosing information that supports successful carbon management leads to developing company-specific competencies aligned with enhanced transparency and accountability and the creation of further market opportunities.

With regards to the control variables, SIZE reports a significant and negative association with FPI, contrary to our expectations. However, this finding is in line with prior research on the RBV (Gallego-Álvarez et al., 2015; Surroca et al., 2010), highlighting the importance of recognising the mediating effect of intangible assets in determining FP (e.g., Barney, 1991; Penrose, 1959; Teece, Pisano, & Shuen, 1997). We reflect on this argument within the theoretical framework proposed in Section 2.3 (Figure 1), suggesting the possible creation of a new intangible resource acquired through improved carbon management and subsequent

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[8] In order to confirm the absence of residual endogeneity, we run the Durbin Wu-Hausman test which reports a *P*-value of 0.483. The IV-2SLS estimation uses a reduced sample because instruments (lagged values) are only available for 651 observations.

voluntary disclosures. This resource takes the form of a reputational asset that offers a competitive advantage and hence improves FP. Because intangible assets are assumed to have a mediating effect on the association between environmental responsibility and FP, and the FP is negatively related to tangible assets (Surroca et al., 2010), the negative association between SIZE and FP seems to be driven by tangible rather than intangible assets. We also find that the coefficient on LEV is highly significant and negative. This finding may be attributable to the high cost of loans determined by debtors who interpreted the firms' need for debt as an indication of a liquidity issue in a manner that negatively affects the FP. Consistent with prior studies (e.g., Busch & Hoffmann, 2011), the coefficient on BET is highly significant and negative, suggesting that high-risk firms could encounter financial difficulties. Moreover, BRS reports a significant and positive association with FPI (Dalton et al., 1998). The coefficient on NED is positive and significant (except in GLS, where the coefficient is positive and insignificant). A high percentage of non-executive directors on the board is regarded as possibly having positive effects on firm FP (Cornett, Marcus, Saunders, & Tehranian, 2007). MAN has a negative and significant association with FP. This result is supported by Short and Keasey (1999), who suggest that at certain ownership levels, managers consider it beneficial to enjoy perquisites (e.g., bonuses), particularly at times of falling share prices. The association between SUB and FPI is negative and significant in OLS and IV-2SLS analyses. This result implies that institutional holders tend to be short-term investors who act as "brokers", holding or selling the shares according to their portfolio and reallocating requirements in a way that affects FP negatively, as opposed to institutional investors that own shares with a long-term policy (Elyasiani & Jia, 2010). COM is negatively and significantly associated with FP, which is interpreted as indicating that a rise in product substitutability leads to reduced revenues for any assumed number of firms. Moreover, IND reports a positive and significant association. Hart and Ahuja (1996) suggest that firms with intensive emissions can enhance their productivity and competence by reducing their industrial waste. This might lead to better employment of inputs, causing a reduction in raw materials and/or waste disposal expenses. FMA shows an insignificant relationship.

We further extend our analyses to cluster the full sample into two groups based on the mean value of FPI to examine whether there are structural differences in CDS across firms reporting high FPI and low FPI. Firms that were grouped as having a low FPI report no significant evidence for this association. In Table 5, the results confirm our main findings and show that firms with proactive carbon policies are more likely to have better firm FP. This finding suggests additional benefits to stakeholders and might enhance investors' confidence that these firms tend to achieve maximum possible operational efficiency and are more likely to have superior FP (Porter & Van der Linde, 1995).

4.2.2 Additional Analysis

We perform an additional test to further examine the effect of carbon disclosure across a different set of continuous measures (i.e., accounting, market, combined accounting and market-based measures) and to check the robustness of our main findings. We re-assess the associations between carbon disclosure and each of the individual proxies for our FPI, as shown in Table 6 Across four out of five accounting measures, the results report significant associations with carbon disclosure (i.e., ROA, ROE and AT in the expected direction and D/E in the inverse direction).[9] Among the three market measures, we only find a significant association between carbon disclosure and RV in the expected direction (i.e., negative). For the two combined measures, Z-score and P/B have a significant relationship in the expected direction (i.e., positive). Overall, the results indicate that carbon disclosure quality is less related to market-based measures than to other indicators.

Taken together, this finding suggests that accounting measures are more likely to be correlated with CDS than are market measures. This finding is in line with Orlitzky et al. (2003), who state that the relationship of CSR-FP is robust when employing accounting measures. Accounting measures reflect a firm's profitability as a determinant of operating efficiency and hence place more emphasis on internal resource utilisation strategies than market-based measures of performance. This interpretation is consistent with the RBV theory, which explains performance variations among competing firms (Galbreath & Galvin, 2008) based on each firm's ability to exploit its internal resources (Barney, 1991). Beliveau, Cottrill, and O'Neill (1994) show that the different financial responses to CSR are based on the measures employed, with the accounting measures capturing the historical aspect and the market measures capturing the future aspect. This argument confirms the need to use a constructed index that captures several financial dimensions, particularly when considering the debate about the proper measure of a firm's FP (e.g., Cochran & Wood, 1984). The use of market measures along with accounting measures compensates for any potential measurement deficiency (Balabanis, Phillips, & Lyall, 1998).

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[9] The expected direction for ROA, ROE and AT is positive, and the expected directions for D/E is negative.

Finally, because firm performance is determined by several considerations, most of them are unobservable and/or firm-specific. We control for this issue by re-estimating our main model using the Fixed-Effects Generalised Least Squares (GLS -FE). The results presented in the last column of Table 6 confirm the main findings that enhanced carbon disclosure is highly associated with better financial performance. Moreover, this result adds more justifications for the mechanism of FPI and confirms the validity of considering the industry average as a standard for comparing the firms' performance.

5 Conclusion

Motivated by the growing public concern about climate change and green finance, this study empirically assesses the economic consequences of carbon disclosure. We use the RBV as a conceptual foundation for analysis within carbon accountability research to understand companies' responsibility practices towards their constituents in the UK, which has one of the highest levels of carbon emissions in Europe but is rigorously developing regulations. The current literature seems to be lacking such an investigation, particularly within this specific setting.

The RBV's theoretical framework is expected to form a basis for understanding how incorporating climate change mitigation efforts into business policies can be associated with the bottom line of firms' performance through disclosure to the public. We tested this theoretical prediction by employing several empirical assessments. We utilised firms' voluntary carbon disclosure in the CDP and developed a composite measure of financial performance for FTSE350 firms over the 2007–2015 period.

Our results show that enhanced carbon disclosure in the period examined was positively associated with FP. Findings suggest that if businesses are to put the RBV framework into practice to maximise cost savings and accelerate business benefits, they need to proactively integrate climate change mitigation efforts into their business policy and produce high-quality carbon disclosure communications to signal their superior performance to the public realm.

The study also provides evidence that firms that achieved high FP reported highly positive carbon disclosure compared to modest disclosure for firms with low FP.

In an increasingly competitive world, and as the level of carbon disclosure and stakeholder demands for carbon-related information increase, it is becoming evident that managers should consider a company's carbon management and its subsequent quality-reporting activities as strategic issues.

A limitation of the study is that the sample firms are the largest 350 companies by capitalisation, which have their primary listing on the London Stock Exchange. Therefore, caution should be taken in generalising the present study's outcomes to other businesses.

Additionally, this study did not examine whether developing an RBV competitive advantage from a proactive carbon management policy leads to better risk management. Therefore, future research could explore the question of whether promoting sound carbon mitigation policies decreases a firm's market risk or is a cost burden and increases such risks. Furthermore, Brexit may open new research directions to investigate the carbon disclosure profile of the UK and its impact on firms' FP. This possibility is especially relevant given the current political climate in the UK, as Brexit-related uncertainty implies that the UK may withdraw from the EU Emissions Trading System and establish its own policy to combat climate change and mitigate GHG emissions cost-effectively.

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Table 1. Sample Distributions based on Industry and Year

Industry/Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total	Per cent
Basic Materials	4	9	8	10	12	10	8	8	7	76	7.78
Consumer Goods	8	13	8	12	15	19	17	21	20	133	13.61
Consumer Services	24	29	24	28	33	32	35	35	40	280	28.66
Health Care	4	7	7	6	7	7	7	8	7	60	6.14
Industrials	26	32	28	31	37	39	37	39	37	306	31.32
Oil and Gas	5	6	5	4	5	6	8	6	1	46	4.71
Technology	2	1	2	2	2	2	3	1	2	17	1.74
Telecommunications	0	2	2	2	2	1	1	1	2	13	1.33
Utilities	5	7	6	5	4	5	4	6	4	46	4.71
N	78	106	90	100	117	121	120	125	120	977	100

Table 2. Descriptive Statistics of Model Variables

Variable	N	Mean	Median	SD	Min	Max
FPI	977	4.9	5	2.1	0	10
CDS	752	71.16	73	20.41	4	100
SIZE	977	21.76	21.61	1.49	17.69	26.13
LEV	977	24.29	22.91	13.55	1.55	55.34
BET	977	0.87	0.82	0.34	0.05	2.69
BRS	966	9.31	9	2.42	4	20
NED	965	58.77	60	12.95	0	92.86
MAN	975	2.27	0.24	7.65	0	45.1
SUB	977	97.13	98.2	22.52	24.11	161.6
FMA	975	36.90	35.68	28.16	0	95.01
COM	977	23.90	28	12.67	1	40

This descriptive statistics are based on our sample from 2007 to 2015.

Table 3. Spearman (Pearson) Correlation Analysis of Model Variables

Variables	FPI	CDS	SIZE	LEV	BET	BRS	NED	MAN	SUB	FMA	COM	IND
FPI	1	0.071*	-0.088**	-0.184***	-0.218***	0.113***	0.007	-0.124***	-0.058	0.055	-0.151***	-0.0216
CDS	0.076**	1	0.326***	0.011	-0.087**	0.202***	0.298***	-0.209***	-0.248***	-0.132***	0.032	-0.053
SIZE	-0.090***	0.311**	1	0.141***	0.043	0.606***	0.323***	-0.567***	-0.256***	0.098***	-0.252***	-0.014
LEV	-0.209***	-0.001	0.136***	1	-0.216***	0.076**	-0.058	-0.056	-0.036	-0.010	-0.041	0.129***
BET	-0.213***	-0.084**	0.171***	-0.157***	1	-0.023	0.111***	-0.007	0.027	0.199***	0.081**	0.167***
BRS	0.081**	0.188***	0.643***	0.092***	0.060*	1	0.124***	-0.346***	-0.283***	0.173***	-0.105***	0.067*
NED	-0.045	0.298***	0.403***	-0.044	0.151***	0.164***	1	-0.212***	-0.222***	0.127***	-0.011	-0.116***
MAN	-0.084***	0.052	-0.189***	-0.028	0.052	-0.174***	-0.103***	1	0.118***	-0.112***	0.194***	-0.061*
SUB	-0.013	-0.236***	-0.235***	0.049	-0.005	-0.243***	-0.169***	-0.303***	1	0.007	0.065*	0.126***
FMA	0.009	-0.136***	0.125***	-0.091***	0.246***	0.164***	0.116***	-0.100***	-0.018	1	-0.037	0.086**
COM	-0.135***	-0.006	-0.294***	-0.029	-0.042	-0.145***	-0.094***	0.012	0.087***	-0.155***	1	0.483***
IND	0.001	-0.046***	-0.022	0.093***	0.189***	-0.043	-0.118***	-0.024	0.150***	0.025	0.521***	1

*This table reports the pairwise coefficients for our sample from 2007 to 2015 of 977 firm-year observations. The upper (lower) triangle reports the Spearman (Pearson) correlations. *, ** and *** denote significance at 10%, 5% and 1%, respectively.*

Table 4. The Association between Carbon Disclosure and Financial Performance

	OLS (1)	TOBIT (2)	GLS - RE (3)	IV-2SLS (4)
CDS	0.018*** (0.004)	0.018*** (0.004)	0.013*** (0.004)	0.027*** (0.008)
SIZE	-0.546*** (0.074)	-0.549*** (0.071)	-0.408*** (0.107)	-0.596*** (0.089)
LEV	-0.040*** (0.005)	-0.041*** (0.005)	-0.044*** (0.007)	-0.040*** (0.005)
BET	-1.671*** (0.219)	-1.682*** (0.223)	-1.086*** (0.234)	-1.683*** (0.242)
BRS	1.727*** (0.339)	1.732*** (0.359)	0.766** (0.383)	1.508*** (0.366)
NED	0.014** (0.006)	0.014** (0.006)	0.003 (0.006)	0.014** (0.006)
MAN	-0.039*** (0.008)	-0.040*** (0.010)	-0.037** (0.018)	-0.042*** (0.009)
SUB	-0.006* (0.003)	-0.002 (0.003)	-0.005 (0.006)	-0.007** (0.004)
FMA	0.002 (0.003)	0.002 (0.003)	0.002 (0.003)	0.004 (0.003)
COM	-0.051*** (0.007)	-0.052*** (0.007)	-0.540*** (0.011)	-0.051*** (0.007)
IND	0.983*** (0.209)	0.997*** (0.192)	1.239*** (0.347)	0919*** (0.216)
YEAR Effects	Yes	Yes	Yes	Yes
Constant	14.524*** (1.325)	14.600*** (1.380)	13.821*** (2.313)	15.717*** (1.439)
Log- Likelihood		-1484.997		
Hausman test			0.460	
Durbin Wu-Hausman				0. 483
R^2/ Pseudo R^2	0.25	0.07	0.22	0.24
N	747	747	747	651

*This table reports the results of four estimation methods: (1) OLS (2) TOBIT (3) Random-GLS (4) IV-2SLS. Heteroscedasticity-robust standard errors are in parentheses. *, ** and *** denote significance at 10%, 5% and 1%, respectively. (two-tailed test).*

Table 5. The Association between Carbon Disclosure and Financial Performance based on Sub-sample of FPI and the Industry Effect

	High FPI		Low FPI	
	OLS	**TOBIT**	**OLS**	**TOBIT**
CDS	0.011*** (0.004)	0.012*** (0.004)	-0.004 (0.003)	-0.004 (0.003)
SIZE	-0.455*** (0.068)	-0.460*** (0.067)	0.120* (0.065)	0.121* (0.063)
LEV	-0.020*** (0.005)	-0.020*** (0.005)	-0.015*** (0.004)	-0.015*** (0.004)
BET	-0.518** (0.210)	-0.527** (0.234)	-0.786*** (0.166)	-0.788*** (0.167)
BRS	0.964*** (0.334)	0.971*** (0.352)	0.403 (0.279)	0.402 (0.276)
NED	0.015*** (0.005)	0.015** (0.006)	0.004 (0.005)	0.004 (0.004)
MAN	-0.033*** (0.008)	-0.033*** (0.011)	-0.001 (0.007)	-0.001 (0.006)
SUBO	0.002 (0.004)	0.002 (0.003)	0.001 (0.002)	0.001 (0.002)
FMA	-0.002 (0.002)	-0.002 (0.002)	-0.001 (0.002)	-0.001 (0.002)
COM	-0.036*** (0.007)	-0.036*** (0.006)	-0.001 (0.006)	-0.001 (0.006)
IND	0.368** (0.186)	0.380** (0.172)	0.266 (0.187)	0.267 (0.1177)
IND*CDS				
YEAR Effects	Yes	Yes	Yes	Yes
Constant	13.508*** (1.291)	13.603*** (1.222)	1.158 (1.215)	1.136 (1.216)
Log- Likelihood		-656.681		-433.8144
CDS+IND*CDS				
R^2/ Pseudo R^2	0.19	0.06	0.16	0.06
N	411	411	336	336

*Panel A reports the results for clustering our sample into higher (lower) than the mean value (4.9) of FPI. OLS and TOBIT were applied. Heteroscedasticity-robust standard errors are in parentheses. *, ** and *** denote significance at 10%, 5% and 1%, respectively. (two-tailed test).*

Table 6. The Association between Carbon Disclosure and Variables of FPI

DV Model	ROA OLS	ROE OLS	AT OLS	D/E OLS	IC OLS	RV OLS	COE OLS	P/E OLS	Z OLS	P/B OLS	FPI GLS-FE
CDS	0.026*** (0.009)	0.180*** (0.038)	0.004*** (0.001)	0.505*** (0.143)	0.006 (0.073)	-0.039** (0.015)	0.000 (0.003)	-0.033 (0.032)	0.008*** (0.003)	0.030*** (0.007)	0.011** (0.004)
SIZE	-1.453*** (0.178)	-6.300*** (0.756)	-0.050*** (0.017)	-13.674*** (2.452)	-5.435*** (1.270)	-1.889*** (0.213)	-0.151*** (0.057)	1.215** (0.577)	-0.704*** (0.052)	-1.121*** (0.136)	-0.162 (0.324)
LEV	-0.067*** (0.011)	0.271*** (0.058)	-0.009*** (0.001)	6.176*** (0.234)	-0.604*** (0.077)	0.018 (0.014)	0.001 (0.004)	0.049 (0.038)	-0.052*** (0.003)	0.067*** (0.010)	-0.049*** (0.010)
BET	-1.787*** (0.533)	-8.300*** (2.001)	-0.190*** (0.048)	-20.241*** (6.946)	7.291* (3.822)	18.909*** (0.890)	4.671*** (0.226)	4.738** (2.177)	-0.371** (0.160)	-0.583** (0.281)	-0.760*** (0.276)
BRS	5.003*** (0.812)	23.892*** (3.913)	-0.193** (0.081)	39.540*** (13.822)	10.785* (6.257)	-0.983 (1.161)	0.017 (0.297)	3.714 (3.369)	1.348*** (0.260)	2.616*** (0.687)	0.374 (0.442)
NED	0.053*** (0.015)	0.200*** (0.056)	0.002 (0.001)	0.165 (0.211)	-0.008 (0.101)	-0.051*** (0.018)	0.001 (0.005)	0.050 (0.044)	0.007 (0.005)	0.036*** (0.010)	0.002 (0.007)
MAN	-0.038 (0.023)	-0.110 (0.112)	0.000 (0.002)	0.061 (0.505)	-0.181 (0.175)	0.146*** (0.034)	-0.003 (0.008)	0.093 (0.087)	-0.035*** (0.006)	-0.023 (0.021)	
SUBO	-0.001 (0.008)	-0.018 (0.031)	0.000 (0.001)	-0.107 (0.108)	0.003 (0.056)	-0.005 (0.012)	-0.004 (0.003)	0.082*** (0.031)	-0.003* (0.002)	-0.020*** (0.006)	0.334 (0.225)
FAR	-0.004 (0.006)	-0.063** (0.026)	-0.002*** (0.001)	-0.370*** (0.111)	0.041 (0.044)	0.007 (0.008)	0.001 (0.002)	0.038* (0.023)	0.009*** (0.002)	-0.004 (0.004)	0.003 (0.004)
COM	-0.013 (0.010)	0.005 (0.035)	0.006*** (0.001)	-0.193 (0.125)	0.058 (0.060)	-0.035*** (0.013)	0.008** (0.003)	-0.075** (0.037)	-0.006** (0.002)	0.004 (0.005)	-0.076*** (0.022)
IND	-0.008 (0.466)	0.763 (1.829)	0.092** (0.042)	14.831** (6.480)	-7.760** (3.924)	0.216* (0.605)	-0.107 (0.154)	-0.476** (1.677)	-0.554*** (0.136)	-0.619** (0.290)	
YEAR	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	28.271*** (3.677)	95.771*** (13.292)	2.364*** (0.281)	159.660*** (47.308)	127.070** (22.840)	61.743*** (4.387)	9.412*** (1.116)	25.647** (10.184)	17.294** (0.936)	19.939*** (2.670)	-22.115** (23.640)
R^2	0.15	0.15	0.21	0.57	0.13	0.72	0.59	0.06	0.40	0.16	0.12
N	1,196	1,141	1,195	1,162	1,197	1,197	1,064	1,107	1,184	1,058	0.460

*This table reports the results of regressions for each variable of FPI as a continuous variable. Where ROA is return on assets, ROE is return on equity, AT is asset turnover, D/E is debt to equity ratio, IC is interest coverage ratio, RV is stock return volatility, COE is cost of equity, P/E is price earnings ratio, Z is Altman z-score, and P/B is market to book ratio. OLS was applied. The last column reports the results of the Fixed-Effects-GLS estimation method, while MAN and IND omitted because of the collinearity. Heteroscedasticity-robust standard errors are in parentheses. *, ** and *** denote significance at 10%, 5% and 1%, respectively. (two-tailed test).*

Figure 1

Planning & Developing Sustainable Governance for Climate Change
Integration of Climate Change into Business Startegy
Low-carbon Initiatives & Emissions Reduction Targets
Communications of GHG Emissions Performance
Plan–Do–Check–Act
Proactive Carbon Management Strategies
Communicated to Outsiders by
Determining Climate Change Risks & Opportunities Resulting in Change in Business Operations, Expenditures & Revenues
Energy/Power Consumption
Emissions Methodology, Data, Performance & Trading
External Assurance/ Verification Conducted
Plan–Do–Check–Act
Carbon Disclosure (Discharge of Accountability)
RBV
Provision of
RBV
VRIN Intangible Resource
+
Competitive Advantage
+
RBV
RBV
+
Financial Performance
+

Appendix 1: Financial Performance Index (FPI)

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1. Accounting Measures

1.1 Return on Assets (ROA)

= Net Income / Average Total Assets

Is a firm's ROA > the Industry Average?

a value of 1 if yes; 0 otherwise.

ROA measures the efficiency of assets in generating income (Busch & Hoffman, 2011).

1.2 Return on Equity (ROE)

= Net Income / Common Shareholders Equity

Is a firm's ROE > the Industry Average?

a value of 1 if yes; 0 otherwise.

ROE measures the shareholder return (Busch & Hoffman, 2011).

1.3 Asset Turnover (AT)

= Net Sales / Average Total Assets

Is a firm's AT > the Industry Average?

a value of 1 if yes; 0 otherwise.

AT measures the company's ability to use its assets to generate sales (Cochran & Wood, 1984).

1.4 Debt-to-Equity Ratio (D/E)

= Short and Long-Term Debt / Shareholders' Equity

Is a firm's D/E < the Industry Average?

a value of 1 if yes; 0 otherwise.

D/E measures the creditor influence as it captures the significance of creditors as stakeholders relative to equity investors (Roberts, 1992).

1.5 Interest Coverage Ratio (IC)

= {Net Income / [1 - (Effective Tax Rate / 100)] + (Total Interest Expense - Total Interest Income)} / (Total Interest Incurred - Total Interest Income)

Is a firm's IC> the Industry Average?

a value of 1 if yes; 0 otherwise.

IC determines whether the company can pay the interest on its loans in a timely manner (Harrison & McMillan, 2003).

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2. Market Measures

2.1 Stock Return Volatility (RV)

$$Standard\ Deviation\ of\ Return_{it} = \sqrt{\frac{1}{n}\sum_{t}^{n}(R_{it} - R_{mean})^2}$$

i= firm, t= year

Is a firm's RV < the Industry Average?

a value of 1 if yes; 0 otherwise.

RV measures the level of daily return volatility over the 12 months as a proxy for the unsystematic risk (Jo & Na, 2012).

2.2 Cost of Equity (COE)

= (Risk-free Rate + [Beta x Country Risk Premium])

Is a firm's COE < the Industry Average?

a value of 1 if yes; 0 otherwise.

COE measures the expected return, given its total risk (Lee et al., 2010).

2.3 Price-Earnings Ratio (P/E)

= Market Value per Share / Earnings per Share (EPS)

Is a firm's P/E < the Industry Average?

a value of 1 if yes; 0 otherwise.

P/E measures the market expectations for a company's growth (Fogler & Nutt, 1975).

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3. Combined Measures

3.1 Altman Z-score (Z)

=1.2 * (Working Capital / Tangible Assets) + 1.4 * (Retained Earnings / Tangible Assets) + 3.3 * (EBIT / Tangible Assets) + 0.6 * (Market Value of Equity / Total Liabilities) + (Sales / Tangible Assets)}

Is a firm's Z-score > the Industry Average?

a value of 1 if yes; 0 otherwise.

Z measures the probability of a firm suffering financial distress or bankruptcy (Miller & Reuer, 1996).

3.2 Market-To-Book Ratio (P/B)

= Market Capitalisation / Book Value of Common Equity

Is a firm's P/B > the Industry Average?

a value of 1 if yes; 0 otherwise.

P/B captures the industry's growth opportunities (Barnea & Rubin, 2010).

Data Source: Bloomberg Database.