Corporate Carbon Intensity Matter: Predicting Firms' Financial Performance

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Abstract

This paper examines the impact of carbon intensity on the firms' financial performance in the Indian context. Investigation using a sample of 184 firm-year observations for 23 Indian companies from thirteen different sub-industry sectors over the period 2009-2016 has been conducted. This study measures carbon intensity of the sample firms' based on recent (historical) hand-collected data of carbon emissions. Using the panel data analysis, this analysis consistently provides evidence that the carbon emission intensity adversely affects corporate entities' financial performance. This research demonstrates that carbon emissions have a negative impact of Return on Net Worth (RONW) and Earnings Per Share (EPS) of emissions-liable companies. Our findings are important to India and international regulators and standard-setters as they work toward developing standards for measuring, assuring, and reporting on a firm's carbon emission data.

Keywords: *Carbon emissions, RONW, EPS, Corporate Financial Performance.*

In the wake of growing global warming concerns, firms increasingly are asked to provide an answer on the impact of their corporate actions on climate change. Moreover, the firms are also facing internal, economic, regulatory, financial market and social pressure from different stakeholders to report on their climate change actions (Luo et al., 2013). The prior literature documents a positive relationship between environmental performance and firms' financial performance in the capital market (Freedman & Jaggi, 1982; Dye, 1985; Ullmann, 1985; Dowell, Hart, & Yeung, 2000; King & Lenox, 2001; Konar & Cohen, 2001; Al-Tuwaijri, Christensen, & Hughes Ii, 2004; Luo, Lan, & Tang, 2012; Saka & Oshika, 2014; Flammer, 2015 and Qiu, Shaukat, & Tharyan, 2016). The higher carbon intensity increases a firm's environmental risk exposure, which is negatively perceived by the lenders. So in order to absorb this environmental risk, lenders will charge an extra risk premium from the polluting firms. Consequently, it incurs costly penalties on the financial performance in all industry sectors (Wang et al., 2013).

The present investigation is being conducted using a sample of 184 firm-year observations for 23 Indian companies for which emission information was available in their sustainability reports during the sample period 2009-2016. By using panel data analysis, the present study confirmed our hypothesis that corporate carbon emissions affect firms' financial performance in the market. The findings of this study indicate that there is a significant positive relationship between the carbon intensity and Return on Net Worth (RONW). This study further explores that Earnings Per Share (EPS) of emissions-liable companies will be adversely affected in the market.

The previous literature revealed a positive relationship between Corporate carbon emissions and the Corporate Financial Performance in developed economies (Busch and Hoffmann, 2011; Iwata and Okata, 2011; Martinez and Bowen, 2013; Matsumura, Prakash, and Vera- Muñoz, 2014; Wang, Li, and Gao, 2014; Talbot and Boiral, 2015; Jung, Herbohn, and Clarkson, 2016; Li, Huang, Ren, Chen and Ning, 2016). However, fewer numbers of studies are conducted in emerging economies like India. So, motivated by this research gap, the present study extended the previous carbon accounting literature by examining the impact of carbon emissions on the financial performance of firms for a developing country. Further, this examination on Indian firms provides useful information to emissions-liable firms, lenders, and other stakeholders.

The structure of this article is as follows: - Section 2 reviews the relevant literature; Section 3 describes the data, and briefly discusses the variables under study. This section also gives a description of the theoretical model used for the empirical analysis of the study. Our empirical results are included in Section 4, and Section 5 has contained a few concluding remarks.

Literature review

The research throughout the world revealed a positive relationship between Corporate carbon emissions and the Corporate Financial Performance (Busch and Hoffmann, 2011; Iwata and Okata, 2011; Martinez and Bowen, 2013; Matsumura, Prakash, and Vera- Muñoz, 2014; Wang, Li, and Gao, 2014; Talbot and Boiral, 2015; Jung, Herbohn, and Clarkson, 2016; Li, Huang, Ren, Chen and Ning, 2016).

Murphy, (2002) in his review demonstrate that positive environmental performance, in terms of less carbon emission into the atmosphere and their proper disclosure in books of accounts, improve company's financial performance, in terms of profits, revenue and market value and negative environmental performance have their negative impact, in terms of decreased profits and market value. On the other hand, low-carbon technologies investment, proper emission disclosure and compliance with environmental regulations, produce a favourable return on equity (ROE) and return on assets (ROA) and have a more positive return on their stock. Furthermore, study specifies poor environmental performer companies are less profitable and have a weaker return on their stock. Further, Wagner et al. (2002) also reported that a high environmental performance improves ROCE but does not have a significant impact on ROS and ROE. In the same line, Clarkson et al. (2008) reveal that good environmental performer firms enjoy the benefits of over compliance. On the other hand, poor environmental performer firms have less profit and decreased market value. Similarly, Salama (2005) depicts a positive relationship between CEP and CFP. This suggests that managers should devote considerable attention to environmental stakeholders (e.g., environmental regulators, environmental groups, environmental public, and various entities human or non-human across the entire natural environment). In a subsequent study, Smale (2006) attempted to know the impact of carbon emissions on cost, output, and market share and firm profits. The study found that an emissions reduction under EU-ETS has a positive (or at least non-negative) impact on earnings before interest, tax, depreciation and amortisation (EBITDA). Finally, the paper

concludes that most EU-ETS participating sectors would be expected to profit in general, although with a modest loss of market share in the case of steel and cement, and closure in the case of aluminium.

Fisher-Vanden & Thorburn (2011) show a significant loss in the market value of firms announcing that they join Climate Leaders and at their subsequent announcement of a greenhouse gas mission's reductions goal and the magnitude of stock price decline is larger for firms with weak corporate governance structures, because of managers have greater discretion to make investment decisions that may not be in the interest of shareholders. Further probit analysis shows that firms with a higher number of shareholder resolutions related to climate change are more likely to participate in CL program. Controlling for these resolutions, it is also found that firms with weak corporate governance structures are more likely CL members. Thus, it seems that firms are entering the CL program despite the prospect of lowering shareholder value either because they are facing institutional pressures to do so, or because managers face less shareholder oversight, allowing them more discretion to make these types of voluntary environmentally responsible investment decisions. In addition, Iwata and Okada (2011) is also conducted a study on Japanese manufacturing industry data from 2004 to 2008 and reported a positive relationship between the carbon emissions and financial performance.

Hsu & Wang (2013) examined a sample of firms with news cover again Wall Street Journal (WSJ) during the period 1989–2008. Using event study the results show that firms with more negative words on climate change have significantly positive wealth effects. This study finds that market reaction is less positive in environmentally sensitive industries and in firms with poor environmental performance, though the effect for poor performance is insignificant. In this manner, Chapple et al. (2013) studied 58 Australian companies for which carbon credits are publicly traded. This study also revealed a positive relationship between the level of carbon emissions and firm value and find a significant negative relationship between the two. More recently, Matsumura et al. (2014) carried out an analysis of the CDP data of S&P 500 firms to know the association between carbon emission and value of the firms. The study reported that the market imposing a penalty on companies that emit large amounts of carbon or those that do not disclose carbon emission information.

Research methodology

Research objectives

The purpose of the investigation is to assess the impact of Carbon Intensity on the firms' financial performance. The Return On Net Worth (RONW) and Earnings per share (EPS) are the two financial performance parameters on which the effect of different variables are being assessed.

Data source and sample selection

We conducted our investigation using a sample of 184 firm-year observations for 23 Indian companies (Table 1) from thirteen different sub-industry sectors over the period 2009-2016. The sample consists of only those firms which publically published their emission data in their sustainability reports. The sample companies were selected on the basis of random function in excel out of 500 companies for the year 2016.

Table 1. Description of the sample firms

Company	Industry
GAIL Ltd	Gas Distribution
Chambal fertilizers and Chemicals	Fertilizers
ONGC Ltd	Crude oil & Natural Gas
Hindaclo Ltd	Non –ferrous metals
IOCL Ltd	Refineries
Maruti Suzuki India Ltd	Automobile
Dr.Reddy lab	Pharmaceuticals
Tata Chemicals ltd	Chemicals
Reliance Industries Ltd	Refineries
Petronet LNG Ltd	Gas Distribution
Shree Cement	Cement
Ultra Tech	Cement

Tata Power India Ltd	Power Generation & Distribution
NTPC Ltd	Power Generation & Distribution
Bharti Airtel	Telecome services
BPCL	Refineries
ACC Ltd	Cement
Adani Ports & Sezs Ltd	Infrastructure Developers
Ambuja Cements Ltd	Cement
Ashok Leyland Ltd	Automobile
JSWL Ltd	Steel
Oil Ltd	Crude oil & Natural Gas
Jubliant Life Sciences Ltd	Pharmaceuticals

Finally, a sample of 23 firms was formulated (Table 1) and data was selected for the period of 8 years from 2009 to 2016. The sample is representative in nature as the firms represent all firm groups from 13 different industries sub-sectors (Table 1). The activity sectors covered under this study were the automobile, cement, chemicals, crude oil & natural gas, fertilizers, gas distribution, infrastructure developers, non –ferrous metals, pharmaceuticals, power generation & distribution, refineries, steel and telecom services.

Further, we extracted the financial data needed to measure ROE, ROA and other control variables like size, beta, R&D and leverage of each sample firm from the Prowess Centre for Monitoring Indian Economy (CMIE) Database.

Econometric models

This paper investigates the potential impact of carbon intensity on the firms' financial performance. To do the same, we developed two testing models. The general form of the econometric models we used to test our hypotheses is as follows:

$$RONW_t = \alpha_0 CARBON\ INTENSITY + \alpha_1 BTVM + \alpha_2 CROSS\ BORDER\ LISTING + \alpha_3 OWNERSHIP + \alpha_4 BETA + \alpha_5 INDUSTRY + \alpha_6 LEVERAGE + \alpha_7 AGE + \alpha_8 TOTAL\ ASSETS + \varepsilon_t \quad (1)$$

$$EPS_t = \beta_0 CARBON\ INTENSITY + \beta_1 BTVM + \beta_2 CROSS\ BORDER\ LISTING + \beta_3 OWNERSHIP + \beta_4 BETA + \beta_5 INDUSTRY + \beta_6 LEVERAGE + \beta_7 AGE + \beta_8 TOTAL\ ASSETS + \varepsilon_t \quad (2)$$

Table 2. Description of Variables under study

Variable	Descriptions
RONW	RONW measures the amount of profit generated by the company on the total amount of shareholder's equity (Hart & Ahuja, 1996; Russo & Fouts, 1997; Haniffa & Cooke, 2005; Wagner et al., 2002 and Shen & Chang, 2009)
EPS	The portion of a company's profit allocated to each outstanding share of common stock.
CARBON INTENSITY	The level of carbon emissions, which is the amount of GHG emissions divided by the revenue of the corresponding year (Barth and McNichols, 1994; Campbell, Sefcik, and Soderstrom, 2003; Matsumura, Prakash, and Vera - Muñoz, 2014; Kumar and Firoz, 2017 and Park & Noh, 2017).
BTVM	The BTMV is used to control firms' growth, which is measured as the company's book value over its market value (Li, Y., Eddie, I., & Liu, J., 2014 and Kumar and Firoz, 2017).
CROSS BORDER LISTING	The listing of on the stock exchanges of foreign capital markets (Dummy Variable).
OWNERSHIP	This shows whether sample company is public or private (Dummy Variable).
BETA	Beta is a measure of systematic risk associated with the industry (Li, Y., Eddie, I., & Liu, J., 2014 and Kumar and Firoz, 2017).

INDUSTRY	An industry dummy variable which is categorized according to the 8-digit code of Global Industry Classification Standard (GICS). (Park & Noh, 2017).
LEVERAGE	Leverage is measured by total debt divided by total assets. (Myers and Majluf, 1984; Waddock and Graves, 1997; Orlitzky, Schmidt, and Rynes, 2003 ; Black, Jang, and Kim, 2006; Cheng, Ioannou, and Serafeim, 2014 and Kumar and Firoz, 2017)
AGE	The age of a firm is used to control for the effect of a company's lifecycle on firm value (Drobetz, Schillhofer and Zimmermann, 2004; Black et al., 2006 and Mishra, 2015).
TOTAL ASSETS	The proxy for size of a firm which is obtained by taking the natural logarithm of its total assets (Demsetz and Lehn, 1985; Gulati, 1995; McWilliams and Siegel, 2001; Black et al., 2006; El Ghoul, Guedhami, Kwok and Mishra, 2011; Ioannou and Serafeim 2012 and Matsumura, Prakash, and Vera - Muñoz, 2014).
εt	Error Term

Return on net worth (RONW)

Consistent with the prior studies (Hart and Ahuja, 1996; Russo and Fouts, 1997; Haniffa and Cooke, 2005 and Shen and Chang, 2009) this research is also used Return on Net Worth (RONW) as a proxy for firms' financial performance. The RONW is an accounting-based criterion of financial performance which measures the rate of return that the owners of common stock of a company receive on their shareholdings. Return on equity signifies how good the company is in generating returns on the investment it received from its shareholders. The formula for Return on Net Worth (RONW) is

Return on Net Worth = Net Income/Shareholder's Equity

Earnings per share (EPS)

Earnings per share (EPS) is the portion of a company's earnings allocated to each outstanding share of common stock. EPS serves as an indicator of a company's profitability. We have calculated EPS as follows:

EPS = Net Income/Average Outstanding Common Shares

Based on literature review (Section II) and Econometric Models we hypotheses that:

H1. There is a significant positive relationship between carbon intensity and firms' financial performance says Return on Net Worth (RONW) and Earnings Per Share (EPS).

H2. There is a significant positive relationship between Book to Market Value and firms' financial performance.

H3. There is a significant positive relationship between cross-border listing and firms' financial performance.

H4. There is a significant positive relationship between Ownership and firms' financial performance.

H5. There is a significant positive relationship between Beta and firms' financial performance.

H6. There is a significant positive relationship between industry sector and firms' financial performance.

H7. There is a significant positive relationship between Leverage and firms' financial performance.

H8. There is a significant positive relationship between Age and firms' financial performance.

H9. There is a significant positive relationship between Total Assets and firms' financial performance.

Empirical finding of the study

The Descriptive Statistics of the sample firms are reported in Table 3. Panel: A show descriptive statistics of the dependent variables. The financial performance in this study is measured by using Return on Net Worth (RONW) and Earnings Per Share (EPS), which are the dependent variables of this study. The mean of RONW is 15.65 percent which indicates that sample firms are profitable and having a good return on their investment whereas the standard deviation of RONW is 8.2979. The maximum and minimum value of RONW is 61.39 percent and -15.10 percent which portrays that some sample firms having a quite high return on their investment and some are not able to generate an adequate return on their investment. Furthermore, the second dependent variable used in this study to measure the financial performance is EPS which the mean value of this variable is 40.83 per share. The maximum and minimum values of EPS are 427.16 and 0 per share and these statistics indicate that sample firms consisted of some firms with very good financial performance in the market and some of having a negative return on their assets. The standard deviation for EPS variable is 51.71 whereas the medium value is 22.64.

Table 3. Descriptive Statistics of sample firms

Variables	Observation	Minimum	Maximum	Median	Mean	SD
Panel A: *(Dependent Variables)*						
RONW	184	-15.1000	61.3900	14.6750	15.6571	8.2979
EPS	184	0	427.1600	22.6450	40.8335	51.7141
Panel B: *(Independent Variables)*						
Carbon Intensity	184	2.9007	4272.98	0.1113	186.9320	663.3556
BTVM	184	10.9000	1964.8500	213.4200	293.0424	283.9202
Cross Broader Listing	184	Dummy	Dummy	Dummy	Dummy	Dummy
Ownership	184	Dummy	Dummy	Dummy	Dummy	Dummy
Beta	184	0.2315	1.7574	0.9003	0.9160	0.2315
Industry	184	Dummy	Dummy	Dummy	Dummy	Dummy
Leverage	184	0	2.3100	0.5600	0.6443	0.5341
Age	184	16	97	37	43.6228	21.8957
Total Assets	184	3442.6100	482112.0	22384.70	59312.60	82894.68

Notes: RONW is return on net worth which measures the amount of profit generated by the company on the total amount of shareholder's equity; EPS is Earnings Per Share which denotes the portion of a company's profit allocated to each outstanding share of common stock; Carbon intensity shows the level of carbon emissions, which is the amount of GHG emissions divided by the revenue of the corresponding year; The BTMV is used to control firms' growth, which is measured as the company's book value over its market value; Cross border listing is a dummy variable which denotes the listing of on the stock exchanges of foreign capital markets; Ownership is also a dummy variable which shows whether sample company is public or private; An industry dummy variable which is categorized according to the 8-digit code of Global Industry Classification Standard; The age of a firm is used to control for the effect of a company's lifecycle on firm value; Total assets is the proxy for size of a firm which is obtained by taking the natural logarithm of its total assets.

Panel B shows that the mean and median of carbon intensity are 186.93 and 0.1113, respectively, which indicates that the sample consists of some firms which have high carbon intensity levels and some have low carbon-emission levels. The mean and median of the book-to-market-value ratio (Btmv) are 293.0424 and 213.4200. The median and mean of beta portrayed in Table 3 are very high 0.9003 and 0.9160, respectively, which depict that the sample firms used in the study bear high operating risks. The mean and median of Leverage are 0.6443 and 0.5600, which is high and exhibits that sample firms are more dependent on borrowing for its operations. The age of the sample firms is moderate (mean=43.62), which means that selected firms are neither too young nor too old. Moreover, the maximum and minimum value of total assets are 482112.0 and 3442.6100 which significantly differ from each other and portrays that some sample firms are large-cap and some are the small cap.

Table 4. Correlation matrix

Variables	Carbon Intensity	BTVM	Cross Broader Listing	Ownership	Beta	Industry	Leverage	Age	Total Assets
Carbon Intensity	1								
BTVM	0.1008	1							
Cross Broader Listing	0.1104	-0.0677	1						
Ownership	-0.1509**	-0.0951	-0.2708***	1					
Beta	0.0788	-0.0473	0.3264	-0.0656	1				
Industry	0.3136***	-0.1166	0.0480	-0.1424**	-0.0151	1			
Leverage	-0.0376	-0.2486***	0.0028	-0.0698	0.0349	-0.0022	1		
Age	0.4328***	-0.0680	0.0813	0.0556	0.0471	0.1709**	0.0051	1	
Total Assets	-0.1373*	0.1325*	0.0286	0.3557	0.1568**	-0.0764	-0.0879	-0.0620	1

(The significance levels are given by: *** = p < 0.01, ** = p < 0.05, * = p < 0.10). Notes: Carbon intensity shows the level of carbon emissions, which is the amount of GHG emissions divided by the revenue of the corresponding year; The BTMV is used to control firms' growth, which is measured as the company's book value over its market value; Cross border listing is a dummy variable which denotes the listing of on the stock exchanges of foreign capital markets; Ownership is also a dummy variable which shows whether sample company is public or private; An industry dummy variable which is categorized according to the 8-digit code of Global Industry Classification Standard; The age of a firm is used to control for the effect of a company's lifecycle on firm value; Total assets is the proxy for size of a firm which is obtained by taking the natural logarithm of its total assets. Table 5. Regression Analysis of the impact of Carbon intensity of firms' financial performance

A prior condition to apply regression analysis is to test the multicollinearity among independent variables. The correlation matrix amongst variable of the study is presented in Table 4. A severe multicollinearity may produce misleading coefficient. Carbon intensity is positively and significantly correlated to the age of the firm at 1 percent level which indicates that older firms become older its operations also expands which leads to more emission more pollution in the atmosphere. The industry is positively and significantly correlated with the carbon intensity of sample firms which show that environmental-sensitive industries pollute more in the environment than less environmental-sensitive industries. Researchers throughout the world suggested different measure handle the problem of multicollinearity. Some important studies (e.g.: Hair et al., 2006) suggested that correlation coefficients below 0.9 may not cause serious multicollinearity problem, while Kennedy (1985) argued the value below 0.8 shows no severe multicollinearity. The correlation matrix (Table 4) portrayed that the correlated coefficient values are below this value, so there is no problem of multicollinearity amongst the variables under study.

Table 5

Variable	Expected Sing	**RONW** Model (i) Coefficient (*p-value*)		**EPS** Model (ii) Coefficient (*p-value*)	
Carbon Intensity	+	0.0008	*(0.0157)***	0.0053	*(0.0135)***
BTVM	*?*	-0.0024	*(0.1735)*	0.1206	*(0.0000)****
Cross Broader Listing	+	-3.9221	*(0.0000)****	-13.4622	*(0.0258)***
Ownership	+	-0.8194	*(0.3450)*	1.4982	*(0.8434)*
Beta	+	-6.5433	*(0.0023)****	-1.7047	*(0.8457)*
Industry	+	-8.5008	*(0.0084)****	-3.9807	*(0.0010)****
Leverage	+	-2.0761	*(0.0008)****	-10.4386	*(0.2329)*
Age	+	-0.1044	*(0.0000)****	-0.0827	*(0.5444)*
	+	-7.6806	*(0.0591)**	-5.2305	*(0.2035)*
Total Assets	*?*	32.0461	*(0000)****	32.4345	*(0.0021)****
Intercept					
Adjusted R-Squared		0.2442		0.4905	
F-statistic		7.5371		20.4721	
Prob (F-statistic)		0.0000		0.0000	

(The significance levels are given by: *** = p < 0.01, ** = p < 0.05, * = p < 0.10).

Notes: RONW is return on net worth which measures the amount of profit generated by the company on the total amount of shareholder's equity; EPS is Earnings Per Share which denotes the portion of a company's profit allocated to each outstanding share of common stock; Carbon intensity shows the level of carbon emissions, which is the amount of GHG emissions divided by the revenue of the corresponding year; The BTMV is used to control firms' growth, which is measured as the company's book value over its market value; Cross border listing is a dummy variable which denotes the listing of on the stock exchanges of foreign capital markets; Ownership is also a dummy variable which shows whether sample company is public or private; An industry dummy variable which is categorized according to the 8-digit code of Global Industry Classification Standard; The age of a firm is used to control for the effect of a company's lifecycle on firm value; Total assets is the proxy for size of a firm which is obtained by taking the natural logarithm of its total assets.

In Section IV, nine research hypotheses were developed to test the potential impact of carbon intensity on the firms' financial performance. Consistent with the hypothesis, the coefficient of Carbon Intensity is positively and significantly associated with RONW and EPS, respectively, at the 5 and 10 percent levels. These findings confirmed our H1 that firms' carbon intensity affects RONW in the market. These results are consistent with the prior environmental disclosure studies (i.e.: Barth and McNichols, 1994; Hai et al., 1998; Stanwick and Stanwick, 2000; Gozali et al., 2002; Campbell, Sefcik, and Soderstrom, 2003; Al-Tuwaijri et al., 2004; Matsumura, Prakash, and Vera- Muñoz, 2014 and Park & Noh, 2017).

Empirical results for control variables that are associated with the firms' financial performance are also reported in Table 5. Consistent with the prior studies (Li, Y., Eddie, I., & Liu, J., 2014) the book to market value (BTMV) is positively and statistically significantly related with the Earning Per Share (EPS) at 1 percent level (p-value<0.01). Further, the result of Models (i) and (ii) shows that the Cross Broader Listing is also positively and significantly related with the RONW at the 1 percent (p-value<0.01) and with the EPS at 5 percent levels (p-value<0.05). These outcomes confirmed our H3 that firms with cross-border listing have more favourable return than domestic listed firms. The coefficient of Beta (in Model, i) was found to be positively related to RONW (p value<1 percent). In addition, the coefficient for Industry is positively and significantly related to the RONW and the EPS at 1 percent levels (p-value<0.01) which is consistent with the fact (H6) that the industry sector in which firm operates have a significant impact on firms' financial performance. The coefficient for total assets is also statistically and significantly associated to RONW. These results are consistent with the argument that larger firms have a more favourable return in the market than the smaller firm. This paper does not find any evidence to support that sample firms' ownership status (whether government or private) affect the firms' financial performance.

Conclusion

We examined the impact of carbon intensity on firms' financial performance using a sample of 184 firm-year observations for 23 Indian companies from thirteen different sub-industry sectors over the period 2009-2016. In order to measure the level of carbon intensity, we used carbon emissions data disclosed by sample firms' in their sustainability reports. The present study observed a negative association between carbon intensity levels and firm financial performance. Specifically, this examination of Indian firms finds that the carbon intensity is positively and statistically significantly related to Return on Net Worth (RONW) at 5% and 10% percent level. This study also demonstrates that Earnings Per Share (EPS) of emissions-liable companies will be adversely affected in the market and significantly at 5% and 10% percent level. These findings are important for the manager, emission-liable firms and other stakeholders in order to access the consequences of environmental risk associated with a firm. The present study is limited to only 23 companies. However, the empirical findings of the study are important for the companies, the accounting profession, and for carbon emission regulators. Our findings are important to India and international regulators and standard-setters as they work toward developing standards for measuring, assuring, and reporting on a firm's carbon emission data.

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