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Pay for Environmental Performance:

The Effect of Incentive Provision on Carbon Emissions

Robert G. Eccles, Ioannis Ioannou, Shelley Xin Li, and George Serafeim*

Abstract

An increasing number of companies are striving to reduce their carbon emissions and as a result they provide incentives to their employees linked to the reduction of carbon emissions. In this paper, we examine the effectiveness of these monetary and nonmonetary incentives in reducing carbon emissions. We find evidence that the use of monetary incentives is associated with higher carbon emissions. This result holds both in cross-sectional and time-series analysis. Moreover, we find that the use of nonmonetary incentives is associated with lower carbon emissions. Consistent with monetary incentives crowding out motivation for prosocial behavior, we find that the effect of monetary incentives on carbon emissions is reversed when these incentives are provided to employees with formally assigned responsibility for environmental performance. Furthermore, by employing a two-stage multinomial logistic model, we provide insights into factors affecting companies' decisions on incentive provision, as well as showing that the impact of monetary incentives on carbon emissions remains significant even when we control for potential selection bias in our sample.

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1. Introduction

Climate change is currently a topic of great interest to corporations, investors, policy makers, and academics. The Stern Review, commissioned by the British Government, estimates the overall costs and risks of climate change to be equivalent to losing at least 5% of global GDP each year (i.e., over $3 trillion for 2010). Because of the role of greenhouse gases, especially carbon emissions, in causing global warming and the massive consequences that climate change may have on the planet, a plethora of initiatives seeking to reduce the carbon emissions of both public and private organizations have emerged around the globe. Accordingly, many corporations are providing incentives to their employees geared towards reducing carbon emissions resulting from the firm's operations. Typically, the incentives provided to employees fall within two broad categories: they can be either monetary (e.g., cash bonuses) or nonmonetary (e.g., public recognition usually in the form of awards). In this paper, we investigate how effective such incentives are in terms of reducing carbon emissions for the firms that provide them.

A number of organizations have voluntarily and unilaterally adopted corporate policies that require reduction of carbon emissions being generated by their operations. Such attempts at reducing carbon emissions can be perceived by employees as prosocial behaviors (Benabou and Tirole, 2006) if the underlying reasoning for reducing emissions is not maximizing private gains but contributing to the public good. However, many argue that companies voluntarily reduce carbon emissions because doing so is consistent with profit maximization. Greater energy efficiency saves money and reduces carbon emissions at the same time. Furthermore, mounting social awareness with regards to the detrimental effects of climate change and the real possibility of regulatory and legislative actions provide other reasons for companies to voluntarily limit their carbon emissions. Long-term investors who believe that future regulations are likely and/or who are "universal owners" and concerned about the effects of climate change on their overall portfolio will favor companies that are proactively responding to the relationship between carbon emissions and climate change. Finally, companies which make the investment today to reduce their carbon emissions will be in a strong position should regulation mandate reduced emissions or establish a price on them. All of these benefits to voluntarily reducing carbon emissions, even if they entail some short-term cost disadvantages due to the required investment, can create a competitive advantage in the long-term.

Once a firm decides to reduce carbon emissions, it has to effectively motivate its employees to achieve the carbon emission goal. Understanding why employees exert efforts to reduce carbon emissions can have significant implications for the optimal design of incentive contracts. On the one hand, if employees are intrinsically motivated to reduce carbon emissions because they believe this will contribute to the public good, then providing monetary incentives to reduce carbon emissions might actually crowd-out intrinsic or reputational motivation and lead to higher emissions. On the other hand, if employees exert efforts to reduce carbon emissions because they believe this is economically the best course of action to ensure maximizing long-term profitability and hence their own share of economic benefits from the firm, then monetary incentives will be effective at motivating employees. Here, we provide the first set of evidence towards answering this question. In particular, using panel data for a sample of firms across the globe, we find that firms that provide monetary incentives have higher carbon emissions compared to firms that provide no incentives. Furthermore, we find that firms that provide nonmonetary incentives have lower carbon emissions compared to firms that provide no incentives. We find these results after controlling for other determinants of carbon emission levels, such as the scale of the firm's operations, the adoption of corporate policies to reduce carbon emissions, the existence of commercial opportunities and risks from climate change, and the quality of sustainability governance. Moreover, we control for industry, country, and year fixed effects or for industry and country time-varying effects. In further analysis, we find similar results when we include firm fixed effects and estimate the coefficients using only within-firm variation, as well as when we track the time-series evolution of carbon emissions for a matched sample of firms.

Importantly, we further parse this question by varying the degree to which efforts to reduce carbon emissions is considered as prosocial behavior by employees. We posit that employees whose job descriptions explicitly include the responsibility for environmental performance and emissions reduction will be less likely to consider such goals as prosocial behavior since they are being rewarded for the instrumental reasons for doing so. Consistent with this argument, we empirically find that the negative effect of monetary incentives on reducing carbon emissions is completely mitigated when these incentives are provided to employees with direct responsibility for environmental performance. This is because their job responsibilities are based on an economic rationale for reduction in carbon emissions.

Finally, we implement a two-stage multinomial logistic model, explicitly accounting in the first stage for a number of factors that could drive the probability of a firm choosing to adopt a particular incentive scheme linked to carbon emission reduction. The results of this analysis are consistent with our main findings regarding the impact of monetary incentives. We also directionally find consistent but statistically insignificant results for the impact of non-monetary incentives on carbon emissions.

This study extends and complements a literature that investigates, documents, and explains the relative effectiveness of monetary vs. non-monetary incentives for improving task performance, especially when efforts are likely to be seen as prosocial behavior. First, by providing empirical evidence on such a critical issue as carbon emissions, we contribute to the debate in the literature on whether monetary incentives are effective in motivating particular and desired individual behaviors. On the one hand, there are several studies documenting the negative effects of monetary incentives broadly known as the "crowding-out" effect. That is, monetary incentives can crowd out intrinsic motivation or reputational motivation for agents engaging in a given task and therefore result in the worsening of task performance. On the other hand, Prendergast (1999) notes that there is little conclusive empirical evidence documenting that monetary incentives could crowd-out motivation and lead to worse performance in workplace settings. Similarly, Gibbons (1998) suggests that management practices based on economic models may dampen non-economic realities such as motivation and social relations, and that empirical data would be useful in deepening our understanding of this issue. Whether and under what conditions do the negative effects of monetary incentives emerge in a real work place setting remain open questions. Our analysis provides empirical evidence that for tasks involving prosocial elements, monetary incentives are not effective and actually detrimental unless they are provided to people for whom such tasks constitute part of their formal job responsibility; otherwise, non-monetary incentives are likely to be more effective.

In addition, we contribute to the accounting literature that deals with how the task type and the type of incentive scheme affect the efficacy of monetary incentives and may influence the design of management accounting and control systems. In reviewing numerous laboratory-based studies in this literature, Bonner et al. (2000) find that monetary incentives improve performance in only about half of the experiments and argue that, as tasks become more cognitively complex, monetary incentives become less effective. Complementing this line of work, our study posits that an additional task characteristic, its prosocial nature, significantly impacts the effectiveness of different types of incentives and should also be considered in the design of accounting and control systems.

The remaining of the paper proceeds as follows. Section 2 discusses the motivation for this study and presents the literature review. Section 3 presents the sample and summary statistics. Section 4 discusses the results from the analyses. Finally, section 5 concludes.

2. Motivation and Literature Review

Carbon emissions can be thought of as the classic case of an externality. Organizations that emit large amounts of carbon increase the probability of future adverse environmental events that may negatively affect numerous other organizations, investors, and society as a whole. However, they do not internalize all the costs associated with carbon emissions since organizations with high carbon emissions might not be themselves adversely and directly affected by climate change (for example, due to their geographic location and due to the absence of a global carbon tax). Due to the firm not directly bearing the costs of its negative externalities and the lack of Pigovian taxation, organizations emit more carbon than it is socially optimal.[1]

Because of the public good nature of carbon emission activity, civil society organizations, such as the Carbon Disclosure Project (CDP) and Ceres, have been active in increasing awareness about the effects of climate change and mobilizing stakeholders in efforts to reduce carbon emissions. Moreover,

[1] In the presence of negative externalities, the social cost of a market activity is not covered by the private cost of the activity, which could lead to an inefficient market and over-consumption of the product or resource. A Pigovian tax equal to the negative externality is thought to correct the market outcome back to efficiency.

inside organizations, numerous employee initiatives have been underway to reduce the carbon emissions of their organizations through reductions in energy and water consumption, travel, type of energy used, influencing customer behavior etc. In many cases, these grassroots movements have developed into enterprise-wide initiatives and they tend to be institutionalized inside organizations under the supervision of a Corporate Sustainability Officer (CSO). The fact that, in many cases, employees voluntarily exerted efforts to reduce carbon emissions, suggests that to a certain extent these efforts were guided by employees' determination to contribute towards the public good by decreasing negative externalities imposed by their organization on society. Therefore, it is likely that efforts to reduce carbon emissions inside organizations can be classified as prosocial behavior.

However, the broader issue of climate change – typically linked to carbon emissions - has become an increasingly important economic issue for companies due to several reasons. First, current and future expected regulations around the world would aim to limit the carbon footprint of corporations by either imposing a direct Pigovian tax on carbon emissions or by instituting cap-and-trade programs. In the former case, a firm pays a certain price for every ton of carbon emissions it generates during the course of its operations. In the latter case, corporations are allowed to emit carbon up to a certain amount, and if they exceed that amount then they need to buy carbon emission allowances in the market place. Both mechanisms increase operating costs in proportion to the amount of carbon emissions. Moreover, rapidly shifting social expectations regarding the environmental performance of corporations provides another economic rationale for reducing carbon emissions. Good environmental performance, including but not limited to a smaller carbon footprint, may be rewarded in the product, labor, and capital markets. Since customers, employees, and investors increasingly demand from companies to take measures to address climate change and limit their carbon emissions, firms with better environmental performance have more loyal and satisfied customers, who want to buy "greener" products" (Bhattacharya and Sen 2004), more engaged and satisfied employees, who want to work for a "greener" employer (Turban and Greening 1996), and face lower capital constraints since investors are building future carbon prices into their valuation decisions (Cheng, Ioannou, and Serafeim 2012). These reasons suggest that employees might perceive efforts to reduce carbon emissions as primarily an economic imperative that should be regarded as increasing sales or reducing operational costs.

Therefore, ex ante it is not clear whether employees are motivated to reduce carbon emissions for prosocial or instrumental reasons. However, the source of the motivation is an important determinant of the relative effectiveness of monetary vs. nonmonetary incentives. Benabou and Tirole (2006) develop a theory of prosocial behavior where the individual's behavior reflects an endogenous and unobservable mix of three types of motivation: intrinsic, extrinsic, and reputational. Intrinsic motivation is the innate satisfaction accruing to the individual regardless of perceptions by others. Reputational motivation is the satisfaction accruing to the individual from positive perceptions others have of him or her. Benabou and Tirole (2006) show that the presence of monetary incentives diminishes the reputational value associated with performing good deeds by creating doubt regarding the extent to which such deeds were performed in order to contribute to the public good or because of the monetary incentives themselves. Monetary incentives act like an increase in the noise-to-signal ratio, or even reverse the sign of the signal, with the associated crowding out of the reputational motivation making aggregate supply of effort downward sloping. This is in line with what psychologists term the "overjustification effect" (Lepper et al 1973). Furthermore, in their model, nonmonetary incentives, such as public recognition during award ceremonies, strengthen the signaling motive and encourages prosocial behavior.

A large number of experimental as well as archival studies have found empirical results that are consistent with monetary incentives crowding out prosocial behavior. For example, Gneezy and Rustichini (2000a) conducted an experiment with Israeli day care providers, finding that when they instituted a fine for parents picking their children up late, late pickups in fact increased. Essentially, the fine was seen as a fee, an instrumental economic incentive, which parents could decide to pay and assuage any moral resistance to non-compliance. Frey and Oberholzer-Gee (1997) found that monetary incentives decreased the acceptance rate among citizens of a local community about whether a nuclear waste repository should have been located in their town. Kunreuther et al. (1990) found similar results for the siting of a nuclear repository in Nevada, where raising tax rebates failed to increase support for the project since they signaled the opposite of prosocial behavior. Moreover, research has also shown that non-monetary incentives such as public recognition or peer pressure can strengthen reputational motivation and lead individuals to contribute more to public goods. For example, Jan Potters et al. (2007) show the effect of charities' frequent strategy of publicly announcing "leadership" contributions and the higher yields achieved when donors act sequentially rather than simultaneously.

However, the motivating power of monetary incentives has been confirmed in many workplace settings. Agency theory studies the effect of monetary incentives on individual performance, arguing that monetary incentives are used to align the principal's objectives with those of the agent's. Empirical research on the effect of such monetary incentive contracts (i.e., pay-for-performance contracts) finds that individuals respond to monetary incentives either by working harder or by self-selecting into those pay-for-performance jobs that best match their own ability level (Lazear, 2000). In psychology, the behavioral school also argues that monetary incentives have a positive effect on motivation by providing positive reinforcement, which in turn increases the frequency of the rewarded behaviors and results in enhanced performance (Skinner 1953).

These studies that have explored the effectiveness of monetary vs. nonmonetary incentives have been conducted at the level of the individual by examining the effect of incentives on individual performance. The overall empirical and experimental evidence seem to point to mixed effects of monetary incentives depending on the nature of the tasks involved. The general lessons that can be drawn from this body of research are that monetary (nonmonetary) incentives tend to be less (more) effective when tasks are perceived as motivated by public good concerns. Therefore, whether monetary (nonmonetary) incentives would be more or less effective in reducing carbon emissions is still an open question that warrants empirical investigation.

We conduct our analysis on firm-level by examining the effectiveness of monetary vs. nonmonetary incentives on carbon emissions. On an aggregate level, we have no *a priori* predictions on the effectiveness of monetary incentives vs. nonmonetary incentives since we have no *a priori* knowledge on whether employees within the sample firms perceive reducing carbon emissions as prosocial behavior or not. However, we hypothesize that monetary incentives are less effective in reducing carbon emissions when firms place such monetary incentives on employees who perceive reducing carbon emissions as prosocial.

3. Sample and Summary Statistics

We obtain information on firms' incentive structures regarding climate change management through the investor survey of the Carbon Disclosure Project (CDP). The investor CDP survey requests information on the risks and opportunities of climate change from the world's largest companies (by market capitalization) on behalf of institutional investor signatories (in 2011, there were a total of 551 institutional investor signatories with a combined $71 trillion in assets under management). The major goals of this survey are to provide investors with tools to assess the firms' climate risk, as well as to help firms develop abilities to provide comparable and relevant climate data to their shareholders. In the 2010 questionnaire, respondents included 84% of the European 300, 82% of the Global 500, 70% of the S&P 500, and 74% of the South African 100 companies. See Appendix I for a complete list of sample compositions around the world.[2]

Starting in 2007, the investor CDP survey asked questions about whether firms provide incentives to manage climate change goals (e.g., carbon emission reduction targets). Respondents could answer "Yes" or "No" to this question. Starting in 2009, CDP added a question on what types of incentives are provided for managing such goals. [3] These annual investor CDP surveys, to the best of our knowledge, are the first to provide direct, large-scale, cross-sectional data on the types of incentives provided by firms for a specific environmental performance dimension that would have otherwise not been available through

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[2] According to the survey administrators at CDP, the survey answers were by majority submitted by people within each company whose title contains the word "sustainability" or "environment". Larger organizations are more likely to circulate the survey for relevant departments to answer relevant questions.

3 In 2009, this question was open-ended, i.e. respondents could provide a description of its incentive programs related to managing carbon emission goals. We then code the types of incentives provided by a company for 2009 as monetary, non-monetary, or both, based on the respondents' description. In 2010 and 2011, standard options (monetary reward, recognition, prizes, and other non-monetary rewards) were offered for this question, which made our coding of incentive types as monetary or non-monetary easier. See Appendix II for a sample of the questions and answers from survey respondents.

archival datasets. The survey questions are designed to solicit answers on the existence of a particular management practice (e.g., yes/no answers), as opposed to answers on cognitive or affective assessment. Therefore, these questions are easier for generating more objective answers and are less subject to certain biases in survey studies, such as scaling effects.[4]

We merge the data from all the responses in investor CDP surveys (2007 to 2010) with the Thomson Reuters' ASSET4 database that provides information on firms' carbon emissions, sustainability governance structure, and the adoption of climate management policies.[5] We measure carbon emissions as the sum of scope 1 and scope 2 carbon emissions. Therefore, we exclude scope 3 carbon emissions because most companies do not disclose the level of scope 3 carbon emissions. Moreover, scope 3 emissions happen outside the boundaries of the organization and as a result they are largely outside the control of the employees and therefore less likely to be affected by the provision of incentives. After merging the two datasets, we have a final sample size of 1,683 firm-year observations (794 unique firms).

Table 1 shows the summary statistics and variable definitions for this sample. We use the natural logarithm of carbon emissions and the natural logarithm of carbon emissions scaled by sales (carbon emission intensity) as dependent variables measuring a firm's environmental performance. The independent variables of interest are a pair of indicator variables indicating whether the focal firm provides monetary or nonmonetary incentives directly linked to environmental performance. 42.1% of the firm-years are associated with monetary incentives, while 18.5% of the firm-years are associated with nonmonetary incentives. The vast majority of nonmonetary incentives come in the form of public recognition during award ceremonies. The second most frequent type of nonmonetary incentives is associated with a small amount of money that a company gives to the winners to give to a charity of their

[4] Scale design and anchor choice will influence respondents' ratings, making it difficult to make comparisons across respondents.

[5] ASSET4 was a privately held Swiss-based firm (acquired by Thomson Reuters in 2009). The firm collects data and scores firms on environmental and social dimensions since 2002. Research analysts of ASSET4 collect more than 900 evaluation points per firm, where all the primary data used must be objective and publically available. Subsequently, these 900 evaluation points are used as inputs to a default equal-weighted framework to calculate 250 key performance indicators (KPIs) that they further organize into 18 categories within 3 pillars: a) environmental performance score, b) social performance score and c) corporate governance score. Every year, a firm receives a z-score for each of the pillars, benchmarking its performance with the rest of the firms in the database.

preference, or to a pre-specified charity. The average size of the firms in our sample (as measured by sales, employees, or assets) is relatively large due to the inclusion criterion (largest firms by market capitalization) in the investor CDP survey. On average, the firms in the sample have $8.6 billion in sales, 21 thousand employees, and $16 billion in assets. Moreover, 60%, 70%, and 72% of the firm-years have corporate policies to reduce carbon emissions, transportation emissions, and supply chain emissions, respectively. Also, 70% of the firm-years are associated with the presence of a board committee responsible for sustainability and 65% identify commercial risks and opportunities from climate change. Finally, 47% provide an audit opinion on their sustainability disclosures.

Table 2 presents the correlation matrix for the variables considered in our analysis. Monetary incentives are positively correlated with carbon emission intensity, while nonmonetary incentives are negatively correlated with carbon emissions intensity. The majority of the control variables (those not related to size) are positively correlated with carbon emissions, raising the possibility that these variables and the use of monetary incentives may be driven by the same underlying economic and technological forces. We use these variables to capture these potentially unobservable factors when estimating the effect of monetary and nonmonetary incentives on firms' environmental performance.

4. Results

Base-line Analysis

We first estimate the association between the adoption of incentives and carbon emissions by employing ordinary least squares (OLS) models that control for year, industry, and country fixed effects. The model employed in Table 3 column (1) is:

(1) $Carbon\ emissions_{i,t} = \alpha_0 + \alpha_1\ Sales_{i,t} + \beta_1 Monetary_{i,t} + \beta_2\ Nonmonetary_{i,t} + Country\ Fixed\ Effects + Industry\ Fixed\ Effects + Year\ Fixed\ Effects$

The dependent variable is the natural logarithm of carbon emissions. Furthermore, we include a control for the scale of operations since the level of emissions is closely linked to the size of a firm's operations; we use the natural logarithm of sales to proxy for size. The independent variables of interest are two indicator variables that characterize whether a firm provides monetary or nonmonetary incentives to its employees. Table 3 column (1) shows the estimated coefficients and their statistical significance.

The model in column (1) explains 83.3% of the variation in the natural logarithm of carbon emissions. The coefficient on *Monetary* is positive and significant (0.215, t=3.08). In contrast, the coefficient on *Nonmonetary* is negative and marginally significant (-0.141, t=-1.76). The coefficient on sales, which can be interpreted as the elasticity, is close to one suggesting that a one percent increase in sales is associated with a one percent increase in carbon emissions.

A potential explanation for the documented association between monetary incentives and the level of carbon emissions is that both are correlated with an unobserved third factor. For example, firms that make a clear commitment towards reducing their carbon footprint based on a solid business case will be more likely to provide monetary incentives but may also have higher carbon emissions. The model in Table 3 column (2) addresses this alternative explanation by including control variables that are likely to contribute to carbon emissions as well as affect the incentive policies.

$$(2)\quad \textit{Carbon emissions}_{i,t} = \alpha_0 + \alpha_1\, \textit{Sales}_{i,t} + \beta_1 \textit{Monetary}_{i,t} + \beta_2\, \textit{Nonmonetary}_{i,t} + \gamma_1\, \textit{Corporate Policies}_{i,t} + \gamma_2\, \textit{Business Case for Climate Change Action}_{i,t} + \gamma_3\, \textit{Sustainability Governance}_{i,t} + \textit{Country Fixed Effects} + \textit{Industry Fixed Effects} + \textit{Year Fixed Effects}$$

We include controls for the adoption of corporate policies to reduce carbon emissions, transportation and supply chain emissions, because corporate policies on reducing carbon emissions would have a direct effect on a firm's carbon emission level and also correlates with a firm's decision of providing incentives to reduce carbon emissions. Moreover, we include a control variable for firms that discuss in their annual or sustainability report the commercial opportunities and risks caused by climate change since such firms have a business case for climate change actions and are thus more likely to be affected by forces in the operating environment that both impact their carbon emissions and their incentive provisions on carbon emissions. Also, to capture the firm's sustainability governance structure, we include controls for the commitment of the company towards sustainability, the presence of a board committee for sustainability, and a control for whether the firm undertakes an audit of its sustainability report.

Table 3 column (2) shows that the coefficients on *Monetary* and *Nonmonetary* remain positive and negative, respectively. Both are significant but the magnitude of the coefficient for monetary incentives somewhat decreases suggesting that this alternative explanation partly drives the association between *Monetary* and *Emissions*. All else equal, firms that provide monetary incentives have 17.8 percent higher emissions and firms that provide nonmonetary incentives have 14.6 percent lower emissions compared to firms that provide no carbon emission incentives at all. From the added control variables, the most significant coefficients are on the variables on corporate policy to reduce carbon emissions and on sustainability audit. Both coefficients are positive and significant. The model now explains 84% of the variation in carbon emissions.

Another potential explanation for the association between incentives and emissions is that we have imperfectly controlled for the scale of the firm's operations. To address this concern we include additional controls including the natural logarithm of the company's total assets and number of employees.

(3) $Carbon\ emissions_{i,t} = \alpha_0 + \alpha_1\ Sales_{i,t} + \alpha_2\ Employees_{i,t} + \alpha_3\ Assets_{i,t} + \beta_1 Monetary_{i,t} + \beta_2\ NonMonetary_{i,t} + \gamma_1\ Corporate\ Policies_{i,t} + \gamma_2\ Business\ Case\ for\ Climate\ Change\ Action_{i,t} + \gamma_3\ Sustainability\ Governance_{i,t} + Country\ Fixed\ Effects + Industry\ Fixed\ Effects + Year\ Fixed\ Effects$

Column (3) shows that the results do not significantly change. Because we are missing data on *Employees* for some companies the number of observations drops to 1,602. All three scale variables load with a positive and significant coefficient, as expected. However, the additional scale variables do not add much to the explanatory power of the model suggesting that sales as a scale variable is probably sufficient. The model now explains 85.7% percent of the variation in carbon emissions. Moreover, the coefficients on the incentives variables remain almost identical although their statistical significance slightly increases. Table 4, column (1) shows that the coefficient on *Monetary* is positive and significant (0.178, t=2.87) while the coefficient on *Nonmonetary* is negative and significant (-0.142, t=-1.93).

Table 4 presents several estimations that test the robustness of the results documented in Table 3. Column (1) uses as dependent variable the intensity measure, a measure that is more closely used as a target for carbon emissions reductions, and as a result no scale variables are included as controls. Including scale variables does not change our results and these variables are statistically insignificant. Moreover, when we alternatively use the natural logarithm of carbon emissions over sales as the dependent variable, our results effectively remain the same. The coefficient on *Monetary* is positive and significant (0.169, t=2.59) while the coefficient on *Nonmonetary* is negative and significant (-0.154, t=-1.99).

An additional concern is that we have inadequately controlled for industry membership by including 64 indicator variables; a more fine classification might be necessary. Because most of the variation in carbon emissions across companies is driven by industry membership, controlling precisely for industry membership is important. In column (2) of Table 4 we use an alternative industry classification that generates instead 104 indicator variables. Both coefficients of interest remain significant. The coefficient on *Monetary* is positive and significant (0.131, t=1.99) while the coefficient on *Nonmonetary* is negative and significant (-0.136, t= -1.97). We do note though that increasing the fineness of the industry classification, reduces dramatically the number of firms within each industry, effectively introducing firm fixed effects for some firms in the sample and hence decreasing the power of our tests.

A similar concern is that fixed effects are inadequately controlling for systematic shifts at the country or/and industry level in emission activity. To control for this effect, we introduce 130 time-varying country and 281 time-varying industry effects. A disadvantage of this approach is that introducing such a large number of indicator variables reduces the power of the statistical test because it effectively introduces firm fixed effects for some firms in the sample. Column (3) shows that the coefficient on *Monetary* remains positive and significant. The coefficient on *Nonmonetary* remains negative, though it becomes insignificant.

Firm Fixed Effects Model and Matching Analysis

In Table 5 we introduce firm fixed effects in the specification to isolate any time-invariant firm-specific effects that might be creating a spurious correlation between the independent variables of interest and the dependent variable. For example, we do not directly observe a firm's overall compensation structure which could both impact a firm's adoption of incentives in reducing carbon emission and the level of carbon emissions. Moreover, introducing firm fixed effects could control for firms' overall compensation structure to the extent that such structure is time-invariant during the sample period.

(4) $Carbon\ emissions_{i,t} = \alpha_0 + \alpha_1\ Sales_{i,t} + \beta_1 Monetary_{i,t} + \beta_2\ NonMonetary_{i,t} + \gamma_1\ Corporate\ Policies_{i,t} + \gamma_2\ Business\ Case\ for\ Climate\ Change\ Action_{i,t} + \gamma_3\ Sustainability\ Governance_{i,t} + Firm\ Fixed\ Effects + Country\text{-}year\ Fixed\ Effects + Industry\text{-}year\ Fixed\ Effects$

The disadvantage of this approach is that the statistical power is significantly impaired because we do not have data for a long time-series available for each firm. We estimate this model using only 906 observations for 275 firms that individually have at least three observations. In column (1) of Table 5 the dependent variable is the natural logarithm of emissions while in column (2) it is the natural logarithm of emissions over sales. The results from these models are similar to the results of Tables 3 and 4 but, as expected, they are statistically weaker. Column (1) suggests that firms that provide monetary incentives have 7.1 percent higher emissions and firms that provide nonmonetary incentives have 9.9 percent lower emissions compared to firms that provide no incentives. Column (2) suggests that firms that provide monetary incentives have 11.3 percent higher emissions and firms that provide nonmonetary incentives have 12.8 percent lower emissions compared to firms that provide no incentives. None of the control variables load with a significant coefficient. The explanatory power of the models increase to 97-98 percent, suggesting that a combination of firm, industry time-variant and country time-variant effects explain a dominant percentage of the variation in emissions. These findings increase our confidence towards arguing that it is incentives that lead to the change in emissions rather than other factors.

It is worth noting that the size of the coefficient on nonmonetary incentives is remarkable robust across the different specifications. Its statistical significance, not surprisingly, varies as we introduce additional control variables changing the power of the test. Moreover, it is hard to imagine how reverse causality is a concern here. We have no reason to expect why firms that will have abnormally low carbon emissions would provide nonmonetary incentives to their employees. These observations increase our confidence that nonmonetary incentives are effective in motivating employees to reduce carbon emissions.

Establishing the causal effect of monetary incentives is more problematic since reverse causality is a much more legitimate concern. Firms that emit more might be more likely to provide monetary incentives. We have tried to address this concern by the introduction of control variables that force estimation of the coefficients within fine classifications of an industry or even within a firm across time. To provide further evidence about whether there is a causal effect from monetary incentives to carbon emissions rather than the other way around, we conduct a matched-sample analysis. There are 103 units (firm-years) that switched from no incentive to monetary incentives only from year *t-1* to year *t*. [6] We label this group as the "treatment group." There are also 401 units providing no incentives in both year *t-1* and year *t*, which we label as the "control group."[7]

We first take all the units in the treatment group, and match each unit with two units in the control group that have: 1) exactly the same industry membership; 2) the closest value in carbon emissions scaled by sales in year t-1. We choose two matching units for each treatment unit to increase the power of the matching analysis and exploit information about the evolution of emission intensity in the control group. Since some of the treatment units only match to one control unit that meets the above matching criteria,

[6] We have excluded the firms that changed their incentive provision back and forth, i.e. switching from "no incentive" to "monetary incentive" and then back to "no incentive". These firms represent less than 2 percent of the initial sample. The reason for switching their incentive provision back and forth is unclear and discussions with company executives revealed that companies are unlikely to switch their incentive structure back and forth leading us to believe that these data points are likely coding or response errors.

[7] Among the 103 (401) units in the treatment (treatment) group, 2 (6) units miss emission variables for year t-1; 4 (11) units miss emission variables for year t; and 63 (204) units miss emission variables for year t+1. These missing variables would further reduce the final matched sample size.

we adjust the weight of such units to make every treatment unit carry the same weight in our calculation of the treatment effect. Then we measure emissions over sales in years t and t+1 to examine whether the treatment group that starts providing monetary incentives experiences an increase in emissions relative to the control group. Panel A of Table 6 shows the difference between treatment and control group for 185 pairs in years t-1 and t.[8] The matching procedure appears to be working effectively since there is no statistical difference in emissions between the treatment and control group in year t-1. In contrast, emissions are actually higher for the treatment group in year t. The differences-in-differences estimate is 0.122 and significant at the 5 percent level. The results remain statistically significant when we consider emissions at year t+1 (Panel B).[9]

Interaction Effects between Incentive Types and the Perceived Task Nature

As discussed in section 2, reduction of carbon emissions may also be conceptualized as prosocial behavior. Our findings are consistent with this idea by suggesting that monetary incentives might not only be ineffective but also detrimental in terms of task performance. In other words, monetary incentives may well crowd out intrinsic and reputational motivation for reducing carbon emissions. To provide more direct evidence of this mechanism, we generate interaction terms between the type of incentives provided and the type of formal position that the incentivized employee occupies. In this respect, we argue that for employees whose job description specifically and directly includes environmental responsibilities, it would be less likely that monetary incentives will crowd out prosocial behavior (in contrast to senior executives, board members, geographic subsidiaries, or business unit managers). Exactly because of the nature of the position and the formally assigned responsibility, tasks or actions related to the environment, and environmental performance more broadly, would be considered as part of the typical contractual arrangement between the firm and the employee and, therefore, they would be perceived as legitimate for

[8] A one-to-two match would ideally yield a matched sample size of 206 pairs. However, due to missing values described in footnote 7 and the fact that some treatment units only find one control unit that meets the criteria, the final matched sample size comprises 185 pairs.

[9] One potential explanation for the results is that firms in the treatment group may have had a more positive trend in the carbon emission level than firms in the control group. During our sample period, there is no obvious difference in preexisting trends (before year t-1) between the treatment and the control group. In fact, the results still hold if we match on the closest values in carbon emissions scaled by sales for more previous years (both for years t-1 and t-2).

economically-instrumental reasons and not as based on prosocial behavior. In other words, the effect of monetary incentives on carbon emissions is likely to be mitigated when these incentives are provided to employees with assigned responsibility for environmental performance. The model used for this test is:

(5) $Carbon\ emissions_{i,t} = \alpha_0 + \alpha_1\ Sales_{i,t} + \beta_1 Monetary_{i,t} + \beta_2\ Nonmonetary_{i,t} + \beta_3\ Environmental\ Position_{i,t} + \beta_4\ Monetary_{i,t} * Environmental\ Position_{i,t} + \beta_5\ Nonmonetary_{i,t} * Environmental\ Position_{i,t} + \gamma_1\ Corporate\ Policies_{i,t} + \gamma_2\ Business\ Case\ for\ Climate\ Change\ Action_{i,t} + \gamma_3\ Sustainability\ Governance_{i,t} + Country\ Fixed\ Effects + Industry\ Fixed\ Effects + Year\ Fixed\ Effects$

"*Environmental Position*" is an indicator variable that equals to one if the firm provides incentives to employees in positions directly responsible for environmental performance. In our sample, 27 percent of the total observations (i.e. across incentive types) and 55 percent of those providing monetary incentives offer these incentives to employees in roles and positions related to environmental performance. The results in Table 7 support our prediction. The coefficient on the interaction term between *Monetary* incentives and *Environmental Position* (an indicator variable that takes the value of one if the incentives are provided to employees with climate change relevant roles) is negative and significant when the dependent variable is the natural logarithm of carbon emissions (-0.393, t=-2.78) or the natural logarithm of carbon emissions over sales (-0.385, t=-2.74). Moreover, for firms that provide monetary incentives to employees in environmental positions we find that the net effect is approximately a decrease in carbon emissions by 11 percent that is significant at the 10 percent level of statistical significance.

Two-stage Multinomial Logistic Model

Up to this point, we have discussed and empirically documented a statistically significant relationship between both monetary (negative association) and nonmonetary (positive association) incentives and carbon emissions. Yet there is clearly an underlying selection issue that we have not shed light on: not all firms choose to provide incentives that are linked to carbon emissions. The existing literature on the issue of antecedents to prosocial behavior (e.g. Bansal & Roth, 2000; Aguilera et al. 2007; Sharma & Starik, 2002) argues that firms are driven towards engaging in socially responsible activities, such as the reduction of carbon emissions, by: a) potentially profitable economic opportunities, b) legitimacy seeking activities, typically resulting from institutional pressures and c) ethical, moral and/or normative concerns. Potentially profitable economic opportunities equates to economic instrumentality. Legitimacy-seeking activities equates to the reputational benefits of prosocial behaviour. Ethical, moral, and/or normative concerns equates to the intrinsic motivation aspect of prosocial behaviour. Accordingly, such motives may be classified in three distinct categories: economic (or instrumental) motives, reputational (or institutional) motives and ethical (or moral) motives (Aguilera et al. 2007; Bansal & Roth, 2000; Bronn & Vidaver-Cohen, 2009; Massa, 2012).

We argue that the adoption or not of an incentive scheme that aims to reduce carbon emissions will also be driven by these categories of company motivation, economic, reputational, and ethical and therefore we propose a first-stage multinomial logistic specification, modeling four distinct choices: a) no adoption, b) adoption of nonmonetary incentives only, c) adoption of monetary incentives only and d) adoption of both monetary and nonmonetary incentives.

First stage model: $\textit{Probability (Incentive type}_{i,t}) = \alpha_0 + \alpha_1 \textit{ Economic Motives}_{it} + \alpha_2 \textit{ Reputational Motive}_{it} + \alpha_3 \textit{ Ethical Motives}_{it}$

"*Incentive Type*" is a firm's actual choice from the aforementioned four choices. "*Economic (reputational or ethical) Motives*" represent variables that proxy for a firm's tendency to adopt incentive plans to reduce carbon emissions due to economic (reputational or ethical) motives. For all categories, we include several variables in order to capture as comprehensively as possible the three categories of motives discussed above. In particular, firms that are larger (*Sales)* may be more likely to adopt an incentive scheme since due to their scale of operations they are better positioned to realize efficiency gains or cost reductions linked to reducing carbon emissions (i.e., more likely to be motivated by economic opportunities). The size of a firm is also likely to affect its reputational concerns due to its visibility in a business environment. In addition, firms that specifically explore *Commercial Opportunities/Risks* associated with sustainability as indicated by their public disclosures would be more likely to adopt an incentive scheme since they are structurally better positioned to understand and explore economic opportunities linked to carbon emissions. We also include "*Bonus Plan*" as a variable for economic motives to adopt a certain incentive plan since whether a firm already has a performance-based bonus plan for all employees reflects a firm's belief in the effectiveness of monetary incentives as well as the difficulty of implementing an incentive plan.

Moreover, we proxy for a firm's reputational motives or institutional pressures for legitimacy that a firm may be facing (e.g., mimetic pressures) by calculating the percentage of other firms in any given country-year pair that have adopted monetary or nonmonetary incentives (*% monetary incentives for the country-year* and *% nonmonetary incentives for the country-year*).

We control for firms' ethical motives which will be perceived as prosocial by its employees in several ways. First, we argue that if a focal firm has been an early (pre-2002) signatory of the UN Global Compact (*Join UN Global Compact by 2002*) it did so based on ethical or reputational (rather than economic) motives and therefore we include an indicator variable as a predictor for incentive scheme adoption. Second, we argue that firms that have adopted a range of corporate policies that characterize a strong underlying sustainability culture (Eccles et. al, 2011) will also be more likely to adopt an incentive scheme linked to carbon emissions. Therefore, we control for a corporate policy to *Reduce carbon emissions*, to *Reduce transportation emissions*, and to *Reduce supply chain emissions.* Finally, firms that have a *Sustainability Committee* or perform a *Sustainability Audit* and are therefore relatively more transparent and credible with regards to their sustainability initiatives, and thus exhibit a stronger commitment towards this goal, will also be more likely to adopt incentive schemes linked to carbon emissions.

Panel A of Table 8 presents the results of the first-stage multinomial logistic specification. In the first-stage selection model, the probability of adopting a monetary (nonmonetary) incentive scheme is positively and significantly associated with the percentage of other firms in any given country-year pair that have adopted monetary (nonmonetary) incentives. The size of a firm, the existence of a sustainability committee, a bonus plan, and a corporate policy of reducing carbon emissions, as well as whether the firm is an early adopter of UN Global Compact, are all positively and significantly associated with the adoption of a monetary incentive scheme. The adoption of both monetary and non-monetary incentive schemes is also positively and significantly related to the size of a firm and the existence of a bonus plan. In addition, a firm that has assessed the commercial opportunities and risks associated with carbon emissions is also more likely to adopt both incentive schemes.

Panel B of Table 8 presents the second stage results from an OLS regression where we control for the estimated (from the first-stage) probability of adopting a specific type of incentive, in addition to country, industry and year fixed effects. Second stage model:

Carbon emissions$_{i,t}$ = α_0 + α_1 *Sales*$_{i,t}$ + β_1*Monetary*$_{i,t}$ + β_2 *Nonmonetary*$_{i,t}$ + β_3 *Both Monetary and Nonmonetary*$_{i,t}$ + β_4 *Predicted Probability of Adopting a Certain Incentive Type (from first stage)* + γ_1 *Corporate Policies*$_{i,t}$ + γ_2 *Business Case for Climate Change Action*$_{i,t}$ + γ_3 *Sustainability Governance*$_{i,t}$ + γ_4 *Other Control Variables Used in the First Stage* + *Country Fixed Effects* + *Industry Fixed Effects* + *Year Fixed Effects*

In the second stage analysis, consistent with our previous results, we find that the exclusive adoption of monetary incentives significantly increases carbon emissions, whereas we find directionally consistent but insignificant results for nonmonetary incentives. We do note that the insignificance of the coefficient on nonmonetary incentives is driven by an increase in the standard errors rather than a decrease in the size of the coefficient. The increase in the standard error is driven by the more onerous estimation requirements of the multinomial logistic model. Moreover, we find no effect on carbon emissions by the concurrent adoption of both monetary and nonmonetary incentives, suggesting a potential “cancel-out” of opposite effects from monetary and nonmonetary incentives. The coefficients on the control variables are similar to those in baseline regressions. Notice that the predicted probability of providing monetary incentives (calculated from the first stage) is positively and significantly associated with carbon emissions, indicating that there is a selection bias at least in the group that adopts monetary incentives (i.e. those who have a higher probability of adopting monetary incentives also have higher carbon emissions). Therefore, our additional tests to address those selection issues (through matching and two-stage selection model) are worthwhile.

A discussion of the size of the estimated effect

Our analysis estimates the size of the estimated effect from incentive provision in the range of 10-15 percent positive for monetary incentives and in the same range negative for nonmonetary incentives. One could ask whether such estimates are too small, too large, or within the boundaries of the actual experience of different companies. To be able to better answer this question we examined the magnitude of carbon emission changes for several companies.

Alcatel-Lucent has been taking measures to reduce carbon emissions that involve its entire workforce and the full range of its activity, from facility operations and logistics to IT and business travel. In 2011, the company reduced our carbon emissions from its operations (Scopes 1 and 2) by 11 percent.[10] Between 2008 and 2011, the company reduced its carbon footprint from operations by more than 22 percent, which is nearly halfway to the company's ultimate goal of 50 percent reduction by 2020. Between 2002 and 2009 Xerox cut its emissions by 31 percent. This was achieved by reducing energy consumption in its facilities, manufacturing operations and across its service and sales vehicle fleet.[11] Apple has concentrated on product design to reduce its carbon emissions. Apple supports that the company designs its products to use less material, ship with smaller packaging, be free of toxic substances, and be as energy efficient and recyclable as possible.[12] As a result, Apple's carbon emissions per dollar of revenue have decreased by 15.4 percent between 2008 and 2011. Stonyfield reworked its distribution system to ship its products more efficiently. Through these and other efforts, Stonyfield reduced its total annual carbon emissions by more than 40 percent between 2006 and 2008 while growing its business.[13]

These examples suggest that the estimated impact of incentive provision on carbon emissions in this study is within the boundaries of actual changes in carbon emissions experienced by companies in recent years.

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[10] See http://www.alcatel-lucent.com/eco/reducing-co2/.
[11] See http://www.xerox.com/about-xerox/environment/carbon-footprint/enus.html.
[12] See http://www.apple.com/environment/.
[13] See http://www.reliableplant.com/Read/20767/nh-yogurt-company-honored-for-reducing-co2-emissions.

5. Conclusion

In this paper, we assess the effectiveness of different types of incentive schemes that corporations have adopted to incentivize behavior by their employees towards reducing carbon emissions. Our results show thatthe adoption of monetary incentives is associated with higher carbon emissions. In contrast, the use of nonmonetary incentives is associated with lower carbon emissions. These results hold in cross-sectional analyses where we control for the size of the corporation, adoption of corporate policies to reduce emissions, the presence of commercial risks and opportunities due to climate change, and the quality of the organization's sustainability governance. Moreover, we find the same result when we introduce firm fixed effects and we use in the identification only within-firm variation or when we use a matched sample and we track carbon emissions over time. Importantly, we also find support for our results when we control for potential selection bias by explicitly accounting for the factors that may drive the decision of an organization of whether or not to adopt any incentive system at all aimed at reducing carbon emissions.

These results suggest that under some conditions (i.e., when employees perceive their action as prosocial behavior) the adoption of nonmonetary incentives might be more effective in reducing carbon emissions compared to monetary incentives. However, as in any non-laboratory analysis where the treatment effect is non-randomly applied, it is difficult to identify the causal effect. While it is conceivable that an unobservable factor exists that is positively correlated with monetary incentives, negatively correlated with nonmonetary incentives, and positively correlated with carbon emissions, we have not been able to identify such a factor. An alternative explanation is that reverse causality, at least with respect to monetary incentives, is generating our findings. In other words, firms that provide monetary incentives have higher carbon emissions. The analysis where we introduce firm fixed-effects partially addresses this concern and suggests that holding the firm constant, after the introduction of monetary incentives, carbon emissions increase. Moreover, the two-stage multinomial logistic model that we present yields results consistent with our initial analyses and suggests that the selection bias cannot alone explain our results. A slightly different alternative explanation that introduces more complexity is that firms that have higher carbon emissions and that *expect* their carbon emissions to increase in the future years provide monetary incentives. We partially address this concern with our matched sample analysis by matching in any pre-existing trends in carbon emission intensity and we find consistent results.

We recognize a number of other caveats related to our work. Our sample is comprised of large predominantly multinational organizations. It is possible that the effects documented here do not generalize to small firms that are competing only locally. Maybe the composition of the employee workforce holds different motivation for reducing carbon emissions. Moreover, we have been able to examine only four years of data. It could well be that analyzing data over a longer time horizon may produce somewhat different results if there is a time lag between the introduction of incentive systems and their eventual effect. We believe that all of these issues are fruitful areas for future research.

Still, this study raises an important practical question. The practical question is what is the best way for a firm to explain the voluntary adoption of a carbon reduction program and its related incentives? The economically instrumental argument is most palatable to investors and begs for a matching incentive scheme in order to be perceived as "real" rather than "greenwashing." This is evident in the tone of the annual reports prepared by CDP and PwC where the provision of monetary incentives is seen as "progress towards addressing climate change." Ironically, though, the associated monetary incentives may actually be counterproductive except for these employees whose jobs are directly focused on energy efficiency and the reduction of carbon emissions.

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Table 1: Descriptive Statistics and Variable Definitions

Variable	Variable Definition	Observations	Mean	Std. Dev.
carbon emissions	Natural logarithm of carbon emissions (scope 1 and 2 as measured in tons)	1,683	13.258	2.387
carbon emissions scaled by sales	Natural logarithm of carbon emissions (scope 1 and 2 as measured in tons) over sales	1,683	4.196	2.040
Monetary	An indicator variable that equals to 1 if the firm provides monetary incentives in that year	1,683	0.421	0.494
Nonmonetary	An indicator variable that equals to 1 if the firm provides non-monetary incentives in that year	1,683	0.185	0.388
Sales	Natural logarithm of sales (measured in million USDs)	1,683	9.062	1.449
Employees	Natural logarithm of number of employees	1,602	9.945	1.525
Assets	Natural logarithm of assets (measured in million USDs)	1,683	9.692	1.661
Reduce carbon emissions	An indicator variable that equals to 1 if the firm has a policy to reduce carbon emissions	1,683	0.596	0.491
Sustainability committee	An indicator variable that equals to 1 if the firm has a sustainability committee on the board	1,683	0.704	0.457
Commercial opportunities/risks	An indicator variable that equals to 1 if the firm has assessed commercial opportunities/risks related to climate change	1,683	0.647	0.478
Reduce transportation emissions	An indicator variable that equals to 1 if the firm has a policy to reduce carbon emissions related to transportation	1,683	0.694	0.461
Reduce supply chain emissions	An indicator variable that equals to 1 if the firm has a policy to reduce carbon emissions from its supply chain	1,683	0.720	0.449
Sustainability audit	An indicator variable that equals to 1 if the firm has its sustainability performance measures externally audited	1,683	0.473	0.499
Environmental positions	An indicator variable that equals to 1 if the firm provides incentives to employees in positions responsible for environmental performance.	1,659	0.269	0.443

Table 2: Correlation Matrix

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV
carbon emissions	1.000													
carbon emissions scaled by sales	0.806	1.000												
Monetary	0.187	0.102	1.000											
Nonmonetary	0.038	-0.018	0.287	1.000										
Sales	0.529	-0.076	0.168	0.089	1.000									
Employees	0.432	-0.072	0.150	0.084	0.831	1.000								
Assets	0.323	-0.181	0.149	0.067	0.803	0.568	1.000							
Reduce carbon emissions	0.374	0.291	0.175	0.108	0.213	0.158	0.079	1.000						
Sustainability committee	0.168	0.076	0.238	0.142	0.175	0.143	0.186	0.168	1.000					
Commercial opportunities/risks	0.152	0.067	0.117	0.007	0.159	0.125	0.185	0.110	0.149	1.000				
Reduce transportation emissions	-0.059	-0.180	0.105	0.103	0.159	0.181	0.111	0.225	0.123	0.053	1.000			
Reduce supply chain emissions	0.053	-0.087	0.196	0.107	0.213	0.217	0.174	0.278	0.234	0.153	0.305	1.000		
Sustainability audit	0.169	0.071	0.174	0.081	0.184	0.135	0.205	0.184	0.201	0.137	0.098	0.215	1.000	
Environmental positions	0.082	-0.011	0.547	0.336	0.154	0.151	0.176	0.122	0.163	0.128	0.113	0.155	0.104	1.000

Table 3: Incentives and Carbon Emissions

Dependent variable	Carbon emissions					
	(1)		(2)		(3)	
	Coefficient	*t-stat.*	*Coefficient*	*t-stat.*	*Coefficient*	*t-stat.*
Incentives						
Monetary	**0.215**	**3.08**[a]	**0.178**	**2.72**[a]	**0.178**	**2.87**[a]
Nonmonetary	**-0.141**	**-1.76**[c]	**-0.146**	**-1.88**[c]	**-0.142**	**-1.93**[c]
Scale						
Sales	1.004	31.14[a]	0.964	26.23[a]	0.242	2.29[b]
Employees					0.467	4.63[a]
Assets					0.369	4.90[a]
Corporate Policies						
Reduce carbon emissions			0.345	3.68[a]	0.291	3.01[a]
Reduce transportation emissions			-0.171	-1.87[c]	-0.165	-1.76[c]
Reduce supply chain emissions			-0.176	-2.07[b]	-0.190	-2.35[b]
Business case for climate change action						
Commercial opportunities/risks			0.076	1.11	0.044	0.66
Sustainability Governance						
Sustainability committee			0.134	1.62	0.081	1.08
Sustainability audit			0.267	3.48[a]	0.236	3.17[a]
Intercept	5.839	11.61	5.813	12.07	4.010	7.46
Country fixed effects	Yes		Yes		Yes	
Industry fixed effects	Yes		Yes		Yes	
Year fixed effects	Yes		Yes		Yes	
Adj R-squared	83.3%		84.0%		85.7%	
N	1,683		1,683		1,602	

(1): OLS regression using Sales as a proxy for scale; (2): OLS regression controlling for corporate policies, business case for climate change action, and sustainability governance; (3) OLS regression using number of employees (Employees) and Assets as additional proxies for scale. All OLS regressions control for country fixed effects, industry fixed effects and year fixed effects. The dependent variable is the natural logarithm of carbon emissions.

a. $p<0.01$; b. $p<0.05$; c. $p<0.10$

Table 4: Incentives and Carbon Emissions – Robustness tests

Dependent variable	Carbon emissions/ sales		Carbon emissions		Carbon emissions	
	(1)		(2)		(3)	
	Coefficient	*t-stat.*	*Coefficient*	*t-stat.*	*Coefficient*	*t-stat.*
Incentives						
Monetary	**0.169**	**2.59[a]**	**0.131**	**1.99[b]**	**0.185**	**2.63[a]**
Nonmonetary	**-0.154**	**-1.99[b]**	**-0.136**	**-1.97[b]**	**-0.107**	**-1.21**
Scale						
Sales			0.083	0.81	0.284	2.56[b]
Employees			0.563	7.07[a]	0.442	4.19[a]
Assets			0.397	4.74[a]	0.345	4.28[a]
Corporate Policies						
Reduce carbon emissions	0.338	3.66[a]	0.197	2.43[b]	0.338	3.14[a]
Reduce transportation emissions	-0.173	-1.88[c]	-0.148	-1.67[c]	-0.173	-1.65[c]
Reduce supply chain emissions	-0.191	-2.36[b]	-0.158	-1.87[c]	-0.182	-2.00[b]
Business case for climate change action						
Commercial opportunities/risks	0.070	1.03	0.040	0.60	0.062	0.83
Sustainability Governance						
Sustainability committee	0.122	1.51	0.075	0.97	0.102	1.21
Sustainability audit	0.253	3.34[a]	0.264	3.44[a]	0.233	2.82[a]
Intercept	5.578	12.88	4.083	8.28	3.811	6.30
Country fixed effects	Yes		Yes		No	
Industry fixed effects	Yes		No		No	
Year fixed effects	Yes		Yes		No	
Subsector fixed effects	No		Yes		No	
Country-year fixed effects	No		No		Yes	
Industry-year fixed effects	No		No		Yes	
Adj R-squared	78.1%		86.3%		84.6%	
N	1,683		1,602		1,602	

(1): OLS regression using the natural logarithm of carbon emissions scaled by sales as the dependent variable; (2) OLS regression using the natural logarithm of carbon emissions as the dependent variable and controlling for subsector fixed effects by using a finer classification of industry; (3) OLS regression using the natural logarithm of carbon emissions as the dependent variable and controlling for country-year fixed effects and industry-year fixed effects.

a. p<0.01; b. p<0.05; c. p<0.10

Table 5: Incentives and carbon Emissions – Within-firm Estimates

Dependent variable	**Carbon emissions** (1)		**Carbon emissions/sales** (2)	
	Coefficient	*t-stat.*	*Coefficient*	*t-stat.*
Incentives				
Monetary	**0.071**	**1.64**	**0.113**	**2.29**[a]
Nonmonetary	**-0.099**	**-1.39**	**-0.128**	**-1.57**
Scale				
Sales	0.117	0.83		
Corporate Policies				
Reduce carbon emissions	0.042	0.43	0.060	0.58
Reduce transportation emissions	-0.122	-1.17	-0.089	-0.77
Reduce supply chain emissions	0.079	1.10	0.096	1.30
Business case for climate change action				
Commercial opportunities/risks	0.091	0.76	0.149	1.18
Sustainability Governance				
Sustainability committee	0.000	0.00	-0.018	-0.25
Sustainability audit	0.187	1.47	0.193	1.33
Firm fixed effects	Yes		Yes	
Country-year fixed effects	Yes		Yes	
Industry-year fixed effects	Yes		Yes	
Adj R-squared	97.8%		98.6%	
N	906		906	

(1): OLS regression using the natural logarithm of carbon emissions as the dependent variable and controlling for firm fixed effects; (2): OLS regression using the natural logarithm of carbon emissions scaled by sales as the dependent variable and controlling for firm fixed effects.

a. p<0.01; b. p<0.05; c. p<0.10

Table 6: Incentives and carbon Emissions Scaled by Sales – Matched Sample

Panel A: Effect in year t

	Diff=Treatment-Control	p-value
t-1	0.021	0.676
t	0.143	0.028
Diffs-in-diffs	**0.122**	**0.046**[b]

Panel B: Effect in year t+1

	Diff=Treatment-Control	p-value
t-1	-0.080	0.504
t+1	0.355	0.057
Diffs-in-diffs	**0.435**	**0.049**[b]

Panel A shows the differences in the natural logarithm of carbon emissions scaled by sales in year t-1 and year t between the treatment group and its matched sample of control units (matched by exact industry and the closest values of carbon emissions scaled by sales in year t-1).

Panel B shows the differences in the natural logarithm of carbon emissions scaled by sales in year t-1 and year t+1 between the treatment group and its matched sample of control units (matched by exact industry and the closest values of carbon emissions scaled by sales in year t-1).

a. $p<0.01$; b. $p<0.05$; c. $p<0.10$

Table 7: Incentives and carbon Emissions – Employee type

Dependent variable	**Carbon emissions** (1)		**Carbon emissions/sales** (2)	
	Coefficient	*t-stat.*	*Coefficient*	*t-stat.*
Incentives				
Monetary	**0.288**	**3.50**[a]	**0.278**	**3.39**[a]
Nonmonetary	**-0.223**	**-2.12**[a]	**-0.227**	**-2.18**[a]
Environmental Position	0.243	1.94[c]	0.231	1.86[c]
Monetary * Environmental Position	**-0.393**	**-2.78**[a]	**-0.385**	**-2.74**[a]
Nonmonetary * Environmental Position	**0.101**	**0.76**	**0.098**	**0.74**
Scale				
Sales	0.961	26.05[a]		
Corporate Policies				
Reduce carbon emissions	0.355	3.75[a]	0.347	3.73[a]
Reduce transportation emissions	-0.174	-1.90[c]	-0.176	-1.92[c]
Reduce supply chain emissions	-0.181	-2.14[b]	-0.196	-2.42[b]
Business case for climate change action				
Commercial opportunities/risks	0.093	1.35	0.087	1.28
Sustainability Governance				
Sustainability committee	0.129	1.55	0.116	1.43
Sustainability audit	0.267	3.47[a]	0.252	3.31[a]
Intercept	5.771	11.63	5.521	12.27
Country fixed effects	Yes		Yes	
Industry fixed effects	Yes		Yes	
Year fixed effects	Yes		Yes	
Adj R-squared	84.1%		78.3%	
N	1,659		1,659	

(1): OLS regression using the natural logarithm of carbon emissions as the dependent variable, with interaction terms between the type of incentives (Monetary or Nonmonetary) and Environmental Position; (2): OLS regression using the natural logarithm of carbon emissions scaled by sales as the dependent variable, with interaction terms between the type of incentives (Monetary or Nonmonetary) and Environmental Position.

a. $p<0.01$; b. $p<0.05$; c. $p<0.10$

Table 8: Panel A – First-stage, Multinomial Logistic Regression

Incentive Type	*Firm Motives*	*Coefficient*	*t-stat.*
No Incentive		(base outcome)	
Only Non-monetary			
Sales	Economic/Reputational	-0.014	-0.13
Commercial Opportunities/Risks	Economic	0.105	0.36
Bonus Plan	Economic	0.280	0.93
% monetary incentives for the country-year	Reputational	0.020	0.02
% non-monetary incentives for the country-year	Reputational	9.788	**10.91**[a]
Join UN Global Compact by 2002	Reputational/Ethical	0.523	0.70
Sustainability Committee	Reputational/Ethical	0.286	0.86
Sustainability audit	Reputational/Ethical	0.010	0.04
Reduce carbon emissions	All three	0.472	1.56
Reduce transportation emissions	All three	0.064	0.20
Reduce supply chain emissions	All three	-0.297	-0.87
Intercept		-5.465	-5.03
Only Monetary			
Sales	Economic/Reputational	0.103	**1.72**[c]
Commercial Opportunities/Risks	Economic	0.173	1.05
Bonus Plan	Economic	0.522	**2.93**[a]
% monetary incentives for the country-year	Reputational	5.552	**12.36**[a]
% non-monetary incentives for the country-year	Reputational	-0.708	-1.47
Join UN Global Compact by 2002	Reputational/Ethical	0.881	**2.60**[a]
Sustainability Committee	Reputational/Ethical	0.568	**3.02**[a]
Sustainability audit	Reputational/Ethical	0.194	1.19
Reduce carbon emissions	All three	0.515	**3.04**[a]
Reduce transportation emissions	All three	-0.160	-0.90
Reduce supply chain emissions	All three	0.091	0.45
Intercept		-5.103	-8.99
Both Monetary and Non-monetary			
Sales	Economic/Reputational	0.268	**3.01**[a]
Commercial Opportunities/Risks	Economic	0.594	**2.50**[b]
Bonus Plan	Economic	0.714	**2.87**[a]
% monetary incentives for the country-year	Reputational	5.646	**7.54**[a]
% non-monetary incentives for the country-year	Reputational	6.371	**10.08**[a]
Join UN Global Compact by 2002	Reputational/Ethical	-0.059	-0.11
Sustainability Committee	Reputational/Ethical	0.399	1.30
Sustainability audit	Reputational/Ethical	0.157	0.72
Reduce carbon emissions	All three	0.268	1.14
Reduce transportation emissions	All three	-0.006	-0.02
Reduce supply chain emissions	All three	0.389	1.26
Intercept		-9.997	-10.25
Pseudo R2		0.2626	
N		1,683	

a. p<0.01; b. p<0.05; c. p<0.10

Table 8: Panel B – Second Step, OLS estimation controlling for the predicted probabilities of adopting a particular incentive scheme (first stage)

Dependent variable	Carbon emissions	
	Coefficient	*t-stat*
Only Non-monetary	-0.188	-1.40
Only Monetary	0.139	**1.88**[c]
Both Monetary and Non-monetary	0.029	0.28
Predicted Prob. of Providing Only Non-monetary	-0.728	-1.07
Predicted Prob. of Providing Only Monetary	0.729	**1.73**[c]
Predicted Prob. of Providing Both Incentives	0.438	0.94
Sales	0.938	**22.14**[a]
Sustainability Committee	0.080	0.91
Commercial Opportunities/Risks	0.049	0.70
% monetary incentives for the country-year	-0.556	-1.22
% non-monetary incentives for the country-year	0.335	0.57
Bonus plan	-0.028	-0.31
Join UN Global Compact by 2002	0.013	0.09
Reduce carbon emissions	0.301	**3.19**[a]
Reduce Transportation emissions	-0.151	-1.63
Reduce supply chain emissions	-0.210	**-2.46**[b]
Sustainability Audit	0.237	**3.06**[a]
Intercept	6.177	15.51
Country Fixed Effects	Yes	
Industry Fixed Effects	Yes	
Year Fixed Effects	Yes	
Adj R-Squared	85.11%	
N	1,683	

OLS regression using the natural logarithm of carbon emissions as the dependent variable, country fixed effects, industry fixed effects, year fixed effects and controlling for the predicted probabilities of adopting a particular incentive scheme. All standard errors are clustered at the firm level.

a. $p<0.01$; b. $p<0.05$; c. $p<0.10$

Appendix I – Investor CDP Survey Sample Compositions

Country	Office	Sample size (The largest companies, as measured by market capitalization)
Asia (ex-Japan)	Association for Sustainable and Responsible Investment in Asia (ASrIA) - Partner to CDP	170 largest Asian companies (excluding Japan, China, India & Korea) - Hong Kong (75), Taiwan (25 companies), Malaysia (15), Singapore (23), Indonesia (10), Thailand (10), Philippines (10), and China (2
Australia and New Zealand	Investor Group on Climate Change (IGCC) - Partners to CDP	ASX 200 / NZX 50
Belgium, Netherlands, Luxembourg	CDP Germany	Benelux 150
Brazil	CDP Brazil / Latin America together with the Brazilian Association of Pension Funds (ABRAPP), Fábrica Éthica Brasil and BANCO REAL – Partners to CDP	80 largest companies in Brazil listed on the BOVESPA São Paolo Stock Exchange
Canada	CDP North America	Canada 200
Central & Eastern Europe (CEE)	Iparfejlesztési Közalapítvány (IFKA – Public Foundation for the Progress of the Industry) - Partner to CDP	CEE 100 largest companies in CEE - Poland (56), Hungary (9), Slovenia (8), Czech Republic (6), Slovakia (4), Lithuania (4), Romania (3), Austria (2), Netherlands (2), (Serbia (1), Croatia (1), UK (1), Estonia (2) and USA (1)
China	Local Agent: SynTao	China 100
Europe	Europe	FTSEurofirst 300 Eurozone: 300 largest companies in Europe - UK (62), France (52), Germany (35), Switzerland (27), Spain (20), Sweden (19), Italy (18), Netherlands (14), Belgium (10), Norway (7), Austria (6), Denmark (6), Finland (6), Portugal (5), Ireland (4), Luxembourg (4), Greece (2), Australia (1), Mexico (1) and the USA (1)
France	CDP France	SBF 250
Germany and Austria	CDP Germany	Germany and Austria 250
Global CDP	UK and USA offices	Global 500: Top 500 companies within the FTSE Global Equity Index Series
India	Confederation of Indian Industry (CII	India 200

	CESD), and WWF India - Partners to CDP	
Iberia 125	CDP Southern Europe together with ECODES and BBVA - Partners to CDP	Spain 85: largest companies within IBEX 35 and FTSE Spain All Cap Index and Portugal 40
Ireland	CDP Ireland	Ireland 40
Italy	CDPSouthern Europe, together with Accenture, Banca Monte Paschi di Sienna and the Kyoto Club - Partners to CDP	Italy 100
Japan	CDP Japan	Japan 500
Latin America	CDP Brazil / Latin America together with the Brazilian Institute of Investor Relations (IBRI) and Fábrica Éthica Brasil - Partner to CDP	Latin America 50: 50 largest companies in Latin America - Brazil (16), Mexico (14), Chile (13), Peru (5) and Argentina (2)
Korea	Korean Sustainability Investing Forum (KoSIF) and Eco-Frontier - Partners to CDP	KRX 200: Korea Exchange 200 Index
Nordic Region	CDP Nordic, together with ATP and KLP Asset Management - Partners to CDP	Nordic 260: 260 largest companies in Nordic region - Sweden (90), Norway (65), Denmark (44), Finland (48), Bermuda (3), UK (3), and Canada (2), Cyprus (1), Iceland (1), Belgium (1), Malta (1), USA (1)
Russia	CDP London	RTS Index 50: 50 largest companies in Russia
South Africa	National Business Initiative (NBI) - Partner to CDP	FTSE/JSE 100
Switzerland	CDP Germany, together with Ethos and Pictet Asset Management - Partners to CDP	Switzerland 100: 100 of the largest companies (SPI Large & Mid Cap (SOCI))
Turkey	Sabanci University Corporate Governance Forum –Partners to CDP	ISE 100: 100 of the largest companies
UK	CDP UK	FTSE 350
USA	CDP North America	S&P 500
Electric Utilities	CDP UK and International Partners	250 of the largest Electric Utilities companies globally
Transport	CDP UK and International Partners	100 of the largest Transport companies globally

Appendix II – Investor CDP Survey Questions and Sample Answers

Year	Question	Sample answers
2007	Question 4(b) Individual Performance: Do you assess or provide incentive mechanisms for individual management of climate change issues including attainment of GHG targets?	Yes/No
2008	Question 4(b) Individual Performance: Do you assess or provide incentive mechanisms for individual management of climate change issues including attainment of GHG targets?	Yes/No
2009	26.1. Do you provide incentives for individual management of climate change issues including attainment of GHG targets?	Yes/No
	26.2. Are those incentives linked to monetary rewards?	Sample Answers Listed Below
2010	1.4. Do you provide incentives for the management of climate change issues, including the attainment of greenhouse gas (GHG) targets?	Yes/No
	1.5C2. The type of incentives?	Monetary Rewards/Recognition/ Prize /Other
2011	1.2. Do you provide incentives for the management of climate change issues, including the attainment of targets?	Yes/No
	1.2aC2. The type of incentives?	Monetary Rewards/Recognition/Other non-monetary rewards

The following 2009 sample answers to Q26.2 provide a glimpse into what firms mean by monetary incentives or non-monetary incentives when they answer the question.

***Monetary incentives*:**

…At a lower management level relevant managers' performance targets are related to the climate change program objectives and personal bonuses are influenced by the progress in achieving the goals. A senior manager owns the GHG target…

…Allianz managers that are in charge of climate change products and services have their incentives related to monetary rewards. Allianz Group is furthermore considering the introduction of a monetary incentive scheme for individual Allianz operating entities and executives that are responsible for the reduction of GHG emissions in line with our Group Climate Strategy. Such a bonus related incentive is already in place at Allianz Germany for respective managers implementing carbon emission reduction measures…

…BG Group operates a cash-based Annual Incentive Scheme (AIS) for its employees. The performance of both the company and the individual combine to determine the value of the award paid under the AIS. The GHG reductions targets form part of the scorecard for the group (which covers all employees) against which performance is evaluated…

***Non-monetary incentives*:**

…ConAgra Foods recognizes project teams for outstanding projects related to "Climate Change and Energy Efficiency" (as well as four other categories related to sustainability performance) through our internal Sustainable Development Awards program. Team members from the five project finalists in each category are invited to Omaha for an awards event and conference. Project teams recognized with a Sustainable Development Award are given $5,000 to donate to an environmental nonprofit in their local community…

…Through the ISO14001 certification process, Air France - KLM is involving each employee in order to inform him about company's environmental policy and to stimulate him to participate actively into the Air France - KLM commitments, which includes climate change issues…

…Campbell has several employee recognition programs that can and have been used to provide incentives for management of GHG targets. The Company's most prestigious global recognition, the Campbell Extraordinary Performance Awards has a specific Sustainability Category and both of last year's winners in that category included projects with measurable impacts on GHG targets…