

Green Incentives for Environmental Goals

Abstract

This paper examines antecedents of firms' use of green incentives. We analyse a cross-industry panel of 531 firms from the 2007-2013 Carbon Disclosure Project investor survey. In line with predictions from the management control literature, we find that the use of green incentives is positively associated with a firm's experience in monitoring environmental performance, supporting a sequential model of management control systems' implementation. We also find that conformity pressure to industry peer practices and to enhancing environmental performance affects the firm's use of green incentives in accordance with social conformity theory. We further find that green incentives behave differently across the organizational hierarchy. Consistent with managerial and social arguments explaining time-to-adoption of management practices across organizations, we also observe that green strategy and monitoring experience are associated with an earlier adoption of green incentives. Conversely, conformity pressure to industry peer practices predicts a later adoption.

Keywords: incentive systems; green management; strategic control; conformity pressures.

1. Introduction

As environmental concerns become ever more prevalent, firms are taking a more proactive approach to environmental management. Being considered an environmentally friendly company has become more than just words on the corporate website, reshaping how companies are managed. This proactive attitude entails the design and implementation of management control systems to monitor environmental performance and ensure that employees' actions are aligned with the firm's environment goals.

One such mechanism is the implementation of economic incentives designed to align the organization with environmental goals, referred to as green incentives (PRI, 2012). Recent surveys report a growing number of firms using this mechanism (CDP, 2013; TCB, 2012). In 2013, the Carbon Disclosure Project (CDP)¹ reported that 77.5% of the responding companies used green incentives compared to 46.1% in 2007. In addition, the CDP survey indicates that firms provide green incentives at different levels of the hierarchy: 35.3% of firms reported the use of green incentives to top managers, 55.9% to mid-level managers, and 43.9% to all other employees. The increasing diffusion of this control mechanism makes empirical research highly relevant to both academics and practitioners. Yet, the question of how organizations implement it remains largely unanswered.

Organizations are still learning how to address environmental issues because of their limited experience in evaluating them and designing specific control systems to implement green objectives (Derchi et al., 2013; Henri et al., 2013; Henri and Journeault, 2010; Ioannou et al., 2016). Prior studies highlight the challenges that organizations face to effectively incorporate green aspects into management practices (Derchi et al., 2013; Ditillo and Lisi, 2016; Kolk and Perego, 2014).

To address the question of adoption of green incentives, we start examining ex-ante conditions associated with the use of green incentives. For instance, a majority (61.4%) of companies in our database implement an environmental management system based on ISO 14001 certification before adopting green incentives. As the recognition process of an ISO 14001 certification requires formal monitoring of the organization's environmental impact (Psomas et al., 2011; Jiang and Bansal, 2003), this empirical observation suggests that implementing a

¹ The Carbon Disclosure Project (CDP) is an international, not-for-profit organization working to drive climate change protection in business. In 2018, the CDP worked for more than 650 investor signatories representing an excess of US\$87 trillion in managed assets (see CDP website).

measurement and reporting process specific to environmental considerations might constitute a condition for the subsequent use of green incentives.

We also note that companies known for green management leadership do not always make use of green incentives. In a sample of firms consistently ranked in the top quartile of Refinitiv ESG's (formerly ASSET4)² environmental score distribution between 2011 and 2013 for at least seven consecutive years, 87.1% of them uses green incentives at different levels of the organizational hierarchy, confirming the apparent importance of these systems to align organizations to the intended strategy. In addition, we observe significant variation in the time-to-adoption of green incentives even across top performing firms.³ Although non-adopting firms may provide implicit green incentives (e.g., in the form of promotions or discretionary salary increases) (with their use not being observed by Refinitiv ESG) instead of explicit ones, this evidence suggests that, for some companies, green incentives are not required and alternative control systems can be used for implementing green objectives.

Some firms use green incentives for reasons other than aligning employees' goals with green objectives (Ansari et al., 2010; De Geuser et al., 2009; DiMaggio and Powell, 1983; Hopwood, 2009) such as conforming to outside stakeholders' expectations. Previous studies have shown that firm commitment towards CSR is more substantive or symbolic depending on the intensity of institutional pressures and the uncertainty generated by informational asymmetries (Perez-Batres et al., 2012; Aresu et al., 2022). Empirical research on the influence of external social pressure on firms' decision to adopt incentive systems and its behavioural implications does not examine in depth whether firms can provide formal incentives to managers and employees just to symbolically conform to external pressures (Simons, 1990; Merchant and Van der Stede, 2007). Moreover, the difficulty to incorporate green aspects into management practices (Derchi et al., 2013; Ditillo and Lisi, 2016; Kolk and Perego, 2014) and the lack of experience in environmental performance measures (Henri and Journeault, 2010; Ilinitch et al., 1998; Zabel and Roe, 2009) may prevent their use to translate into improved performance (Derchi et al., 2013; Henri et al., 2013; Henri and Journeault, 2010).

² ASSET4 was a product of Thomson Reuters that since 2002 has been collecting Environmental, Social and Governance (ESG) public information from more than 6,000 global listed firms. In October 2018, Thomson Reuters' Financial & Risk subsidiary was sold to Refinitiv and ASSET4 was renamed Refinitiv ESG.

³ For example, based on 2007-2013 CDP investor surveys, a leading global technology company in power and automation and a large Japanese conglomerate reported to have adopted green incentives for their first time in 2013 after having been consistently recognized by Refinitiv ESG analysts as top performers for respectively 12 and 10 consecutive years (since the date they entered the database).

From a research standpoint, prior empirical work on the antecedents of green incentives is sparse (Cohen et al., 2022; Derchi et al., 2013; Henri and Journeault, 2010). Most of the literature takes an external perspective on CSR performance, examining a company's impact on society at large, including not only environmental aspects (e.g. reducing carbon footprint), but also social aspects, like fighting modern slavery or providing local communities with access to water. These various dimensions of CSR differ in terms of their measurability properties (Chatterji et al., 2016; Ioannou et al., 2016).⁴ In particular, environmental performance measures are more standardized, objective, and widely accepted than measures for other CSR dimensions. Environmental measures are grounded on scientific evidence and recommendations on how to reduce environmental impact and mitigate climate change. Standards based on climate science provide managers with precise environmental measures and have credible and rigorous targets. For instance, initiatives like the Greenhouse Gas (GHG) Protocol and Global Reporting Initiative provide standardized methodologies to measure the environmental impact of energy production and carbon emission (Berrone and Gomez-Mejia, 2009b). More recently, the 2021 COP26 meeting brought even more attention, funding, and coordination into measures of environmental performance.⁵ Over the last decade, an increasing number of large multinational companies have adopted science-based targets set by external experts to reduce carbon emissions in accordance with limiting global temperature rise to below 2°C above pre-industrial levels based on the 2015 Paris Agreement (SBTi, 2021).^{6, 7}

⁴ While, for instance, more tangible elements (e.g. carbon footprints) can be measured objectively, softer elements are harder to measure and therefore harder to incorporate into a management control system (e.g. the 'good faith efforts' performance target, as used by Walmart International (2014, p. 55)).

⁵ See: <https://ukcop26.org/the-conference/sustainability/>

⁶ By mid-2021, more than 1,000 large firms, including Walmart, McDonalds, BMW, and Nike, had already released or committed to release science-based targets based on the recommendations of the Science Based Targets initiative (SBTi). The SBTi is a non-profit organization that independently assesses and approves companies' targets based on climate science and conditional on keeping global temperature increases below two degrees Celsius compared to pre-industrial levels. See: <https://sciencebasedtargets.org/companies-taking-action/>

⁷ Berrone and Gomez-Mejia (2009b) indicate that measurement of environmental performance is exposed to risk of manipulation that limits reliability, as companies can relocate their "dirty operations" to other geographies with poor environmental restrictions. Substantial evidence exists on this issue, indicating that most firms improve their environmental performance not by relocating their operations to other locations, but rather by genuinely reducing their carbon emissions. Prior case-study research reveals that many organizations, over the last fifteen years, were able to reduce their carbon footprint organically, through technological and managerial improvements (Ligonie, 2021; Summerbell et al., 2016; SBTi, 2021). Also, there is empirical evidence that firms' accumulated experience in producing CSR reports is associated with improved CSR activities and reduced carbon emissions, supporting the argument that better measurement relates to performance improvements (Derchi et al. 2021). Finally, more than 50% of our sample firms display absolute reduction of their scope 1 CO₂ emissions over the period examined, while the way majority (93%) of sample firms issuing a CSR report adopt GRI measurement and disclosure standards voluntarily, suggesting this issue is minor in our sample.

In contrast, social performance measures still lack a consistent set of objective and universal standards. They encompass a broad (and still under discussion) set of dimensions that define the multiple relationships between the organization and its stakeholders. Social impact includes aspects such as engagement with local communities, impact on the standard of living through access to water, education, and health care, promotion of employee volunteering in local communities, avoidance of modern slavery by addressing child and migrant labor issues, and compliance with international human rights standards.⁸ Their design is still happening at a higher level of abstraction and multiple proposals—combining objective and subjective techniques, and measures with unclear signal to noise ratios and uncertainty regarding their potential for manipulation—compete for pre-eminence. Interestingly, Maas (2018) shows that, among the different types of CSR goals, human rights and community engagement goals are the least diffused within compensation plans and are mainly captured using qualitative targets that are difficult to measure with precision and hard to interpret. In line with this argument, Berrone and Gomez-Mejia (2009b) argue that the field of social performance measures is still wide open, with managers and academics exploring the various options yet struggling to reach consensus. They conclude that measuring social performance is more difficult than environmental performance and the standardization of measures for the latter can be included in compensation plans. Lower standardization and objectivity of social performance measures also raise concerns regarding verifiability and contractibility (Chatterji et al., 2016; Ioannou et al., 2016). Thus, environmental performance measures are more amenable to explicit incentive systems than social performance measures.

Prior work has also examined the effect of CSR goals (Cai et al., 2011; Deckop, 2006; Hong et al., 2016; Maas, 2018; Mahoney and Thorn, 2006; McGuire et al., 2003) and environmental measures in executive compensation (Coombs and Gilley, 2005; Stanwick and Stanwick, 2001; Berrone and Gomez-Mejia, 2009a; Cohen et al., 2022; Cordeiro and Sarkis, 2008; Derchi et al., 2021; Flammer et al., 2019; Ioannou et al., 2016; Russo and Harrison, 2005). Some of these studies distinguish substantive and symbolic uses of executive compensation for environmental and social goals showing different effects in terms of CSR performance (Flammer et al., 2019).

⁸ We acknowledge that social dimension also includes internal performance measures such as employee safety and satisfaction, product quality, and customer satisfaction, as they all have a very important social impact. However, most of the literature interprets environmental and social impact of the company as its impact on society at large rather than internally, thus with an external perspective. Indeed, six out of ten UN Global Compact principles for responsible business focus on the social dimension of corporate sustainability, of which human rights represents the cornerstone (<https://www.unglobalcompact.org/what-is-gc/our-work/social>). Accordingly, previous research has provided relevant empirical evidence on the social activities of corporations (Rangan et al., 2015). We thank one of the reviewers for suggesting to add this clarification.

Yet, prior work provides no specific guidance on the antecedents of green incentives as well as their timing.

Implementing green objectives requires new management control practices (Eccles et al., 2014; Ioannou et al., 2016). Prior work in performance measurement and compensation design supports the relevance of financial and nonfinancial information for contracting (Prendergast, 1999; Davila and Venkatachalam, 2004). However, this line of research does not address the design of these systems when organizations explore novel performance dimensions. The use of green incentives is indeed a relatively recent phenomenon, which means that the conditions for these measures to be relevant and legitimate tools are quite recent. In other words, companies have only recently begun to use green incentives, even if some companies had already a green strategy. Moreover and in contrast to other non-financial performance measures such as customer satisfaction and quality, environmental performance measures have been recently developed and organizations are still learning about their accuracy, congruency, level of noise, and behavioural implications when used for contracting (Ioannou et al., 2016; Kolk and Perego, 2014; Derchi et al., 2013; Henri and Journeault, 2010; Berrone and Gomez-Mejia, 2009b; Ilinitich et al., 1998; Zabel and Roe, 2009).⁹ In addition, the majority of traditional nonfinancial performance measures focus on internal processes while the largest share of environmental measures focus on effects outside the boundaries of the organization.¹⁰ Finally, non-financial performance measures also differ in terms of their cause-effect relationships, an aspect especially important for environmental performance. While the use of non-financial performance measures is linked to their property as leading indicators of future financial performance, the argument for the use of environmental measures relies only partly on this leading role. They are also used because of regulation and, often more importantly, because of the CSR mandate that organizations are either being forced by shareholders or becoming aware of their social responsibilities.

⁹ Much of early literature on nonfinancial performance measures documented that organizations had been using multiple nonfinancial metrics to monitor performance for many years (e.g., customer satisfaction and retention, operating efficiency indicators, training hours, employee satisfaction) (Kaplan, 2009; Merchant and Van der Stede, 2007, Epstein and Manzoni, 1998). Rather than the accuracy and consistency of measures, organizations struggled with systematically integrating them in formal management control systems (Kaplan, 2009). In contrast, the measurement scope of environmental performance is still a significant challenge (e.g., reporting of Scope 3 emissions is not required based on GHG Protocol for measuring carbon emissions) (Ilinitich et al., 1998; Henri and Journeault, 2010; Berg et al., 2022). Specific measurement procedures and standards have been developed only recently (e.g. first edition of GHG Protocol for accounting and reporting Scope 1 carbon emissions was published in 2001 and then updated in 2015 including Scope 2 reporting guidance).

¹⁰ E.g., Scope 3 of the GHG Protocol entails measurement of a company's carbon emissions that are produced both upstream and downstream its internal operations.

All these arguments indicate that the use of green incentives is, by no means, a given, but rather a consequence of the convergence of different forces. The objective of this paper is therefore to examine when companies start using green incentives and its antecedents across hierarchical levels of the organization.

We examine the use of incentives linked to environment goals such as CO₂ reductions, energy efficiency achievements, sales of environment-friendly products, circular economy, climate change risk mitigation plans, development of new processes or product design, and changes in the behaviour of individuals for the benefit of the environment. We look at both antecedents within the organizational hierarchy and time-to-adoption. Based on Simons' control framework (1994, 1990), we examine whether the existence of certain control systems for implementing green objectives precede the adoption of green incentives, as well as whether their presence varies across hierarchical levels within the organization (i.e. top managers, mid-level managers, and employees). Based on a sociological perspective (Ansari et al., 2010; DiMaggio and Powell, 1983), we further examine whether firms use green incentives as a response to conformity pressures. We conclude our empirical investigation by developing two additional sets of hypotheses grounded on theories of diffusion of management practices (Ansari et al., 2010; DiMaggio and Powell, 1983; Rogers, 1995) to explain the time-to-adoption of green incentives.

We test our hypotheses using a cross-industry sample of 531 global listed firms that answered the CDP investor survey in the years 2007-2013. In the fields of management and accounting, prominent empirical studies have used CDP data, providing evidence of the data quality (Ioannou et al., 2016; Matsumura et al., 2014; Reid and Toffel, 2009).

We find that experience in monitoring environmental performance is positively associated with the use and time-to-adoption of green incentives, consistent with management control predictions (Simons, 1994, 1990) and supporting a sequential association between monitoring and incentives (Simons, 1994; Simons and Davila, 2021). In contrast, we find no association between green strategy and green incentives, although green strategy is associated with monitoring. Taken together, these results indicate that monitoring environmental performance is an antecedent of green incentives, yet having a green strategy is not the only path to monitoring and to green incentives (Lisi, 2015; Rodrigue et al., 2013). Interestingly, our results indicate that monitoring experience exerts different effects across hierarchical levels within firms. In particular, we find that experience in monitoring environmental performance is associated with the use of green incentives for top managers and other employees, but not mid-level managers. Moreover, we observe that conformity pressure to improve environmental

performance moderates negatively the effects of monitoring experience on green incentives use and is associated with slower time-to-adoption. Conformity pressure to enhance environmental performance rather than to industry practices, however, does not affect time-to-adoption of green incentives. These findings are consistent with the literature on the diffusion of management practices showing that rational and social arguments are associated with time-to-adoption (Ansari et al., 2010; DiMaggio and Powell, 1983). Taken together, these findings provide a holistic view on the use of green incentives.

Our work contributes to environmental management accounting research literature (Henri and Journeault, 2010; Ioannou et al., 2016; Journeault, 2016; Lisi, 2015; Pondeville et al., 2013; Rodrigue et al., 2013) on several dimensions. First, we contribute with unique empirical evidence on the antecedents and timing of green incentives' use (Derchi et al., 2013; Joshi and Li, 2016). Second, our findings inform the understanding of antecedents of green incentives across organizational hierarchies as well as time-to-adoption. Finally, we contribute to green management diffusion research (Delmas and Toffel, 2008) by documenting how both strategic and social conformity drivers influence the use of green incentives.

This research has also important implications for practice. From a regulatory perspective, we offer policy makers a better understanding of how firms use management control systems for environmental conservation. From an investor perspective, our findings inform socially responsible asset managers how companies adapt to be more responsive to environmental demands. Finally, our results inform prediction models on which firms are prone to use green incentives, as well as the role of incentive systems for green strategy implementation.

2. Conceptual Framework and Research Hypotheses

Managers design incentive systems to align employees' objectives with the goals of the firm (Baker et al., 1988; Prendergast, 1999). As environmental aspects gain strategic relevance, incentive systems are redesigned to be consistent with the new strategy. Not surprisingly, a growing body of practitioners' literature addresses the integration of environmental objectives in top executives' goals and compensation contracts (PRI, 2012).

We refer to green incentives as the explicit use of environmental measures in compensation contracts (Henri and Journeault, 2010). Prior literature on the topic has taken four main perspectives. The first one is prescriptive, describing how firms should design green incentives (Berrone and Gomez-Mejia, 2009b; Lothe et al., 1999). In parallel, an early stream of research in environmental economics draws analogies from mainstream agency theory and analytically investigates how incentives should be adjusted to implement a green strategy (Zabel and Roe,

2009). Overall, this perspective highlights the informativeness and contractibility challenges that green performance measures face to promote goal congruence across the hierarchy, as well as behavioural issues that may hinder the effectiveness of green incentives.

A second group of studies empirically examines the association between CEO compensation and CSR performance with mixed conclusions. Stanwick and Stanwick (2001) find a strong positive relationship between overall CEO compensation and the environmental reputation of firms. In environmentally sensitive industries, Campbell et al. (2007) identify a risk premium in the compensation of those CEOs that undertake climate change-related risks. Similarly, Cordeiro and Sarkis (2008) observe that environmental performance affects CEO's compensation, but only for firms that tie their executive compensation plans to corporate environmental goals. Although good environmental performance increases CEO pay, the use of green governance mechanisms such as compensation contracts do not always strengthen this link (Berrone and Gomez-Mejia, 2009a). Kolk and Perego (2014) explore four cases from the Netherlands and question the use of CSR-linked executive bonuses as a credible sign of CSR vis-à-vis "another perverse mechanism meant to keep up bonus level."

A third group of studies examines empirically the effects of compensation contracts tied to environmental or CSR performance objectives. Russo and Harrison (2005) show that only the existence of a linkage between the plant manager's compensation and the facility's environmental performance helps reduce plant-level toxic emissions. Deckop et al. (2006) document that short-term CEO compensation negatively relates to CSR performance, whereas long-term compensation is positively associated with it. Mass (2018) and Hong et al. (2016) note also that providing executives with direct incentives for CSR may correlate positively with the firm's subsequent CSR performance. Ioannou et al. (2016) focus on the reduction of carbon emissions and find that firms setting more difficult goals or providing specific monetary incentives to managers achieve a higher percentage of the goals. Flammer et al. (2019) find that the use of CSR targets in executive compensation leads to an increase in the number of corporate initiatives to the benefit of the local community and the environment as long as CSR contracting terms are well-specified. Derchi et al. (2021) show that as firms accumulate experience and learn how to use CSR-linked executive compensation over time, their social and environmental performances improve monotonically starting in the third year after adoption and for at least the subsequent eight years. Finally, Cohen et al. (2022) study large publicly-listed international firms around the world and document that inclusion of ESG-related performance measures in executive pay lead to improvements in ESG ratings, reduction of CO₂ emissions, and changes in total variable compensation.

More recently, a fourth group of studies focus on corporate governance as well as external regulatory factors that may drive a company to include CSR criteria into executive compensation contracts. Ikram et al. (2019) find that companies with stronger corporate governance are more likely to use formula-based, objective CSR-linked compensation. Aresu et al. (2022) show that country-level environmental and social regulatory pressures positively influence the use of CSR-linked executive compensation and that board independence strengthens this effect, whereas blockholders' ownership weakens it. Cohen et al. (2022) also reveal that a company's public environmental commitment, shareholder pressure, environmental protection regulations and ESG disclosure mandates as well as the environmental sensitivity of the industry are associated with use of ESG-related pay.

Despite the growing number of studies, empirical evidence on the role of green incentives remains inconclusive. Various studies focus on the link between CEOs' and executives' compensation contracts and environmental performance and do not investigate the use of green incentives for mid-level manager and other employees. Other literature concentrates on more general CSR-linked incentives being used to manage reputation and comply with regulatory and shareholder pressures. Yet, there is little empirical evidence on managerial antecedents of green incentives and no prior work on their provision at different hierarchical levels and the timing of their adoption. As a result, it remains unclear whether and when firms use green incentives to reinforce the implementation of their green strategy or, alternatively for sociological reasons.

2.1. Antecedents of Green Incentives

From a management perspective, companies incorporate green aspects in their strategies because of the potential financial benefits associated with environmental performance (Bénabou and Tirole, 2010; Porter and Linde, 1995). In that context, pro-environment activities such as waste reduction, energy conservation, and material reutilization positively affect productivity and reduce operating costs (Porter and Linde, 1995). Superior green performance also enhances corporate reputation and generates revenues by satisfying green customer needs (Hart, 1995). In addition, green performance can reduce compliance and liability costs, as well as long-term risks associated with resource depletion, pollution, and energy costs fluctuations (Shrivastava, 1995).

From a sociological perspective, firms engage in environmentally responsible initiatives to enhance their legitimacy to conformity pressure often with a symbolic purpose (Mathews, 1993). Companies invest in eco-efficient processes and management systems to address this pressure, even "at the expense of shareholders' interests" (Moser and Martin, 2012, p. 798).

Consistent with these two perspectives, we develop two sets of hypotheses to explain a firm's decision to use green incentives. Taking a managerial perspective, we argue that implementation of a green strategy happens in a context where firms do not fully understand environmental aspects (Eccles et al., 2014), making it hard to define and implement their intended green strategy (Derchi et al., 2013; Henri et al., 2013; Henri and Journeault, 2010; Ioannou et al., 2016; Kolk and Perego, 2014). As a result and following Simons' strategic control framework, we posit that the use of green incentives is part of the strategy implementation process and benefits from accumulating experience in monitoring and measuring environmental performance.

In periods of strategic change such as the implementation of a green strategy (Eccles et al., 2014), control systems contribute to managing the change process (Simons, 1994). Based on Simons' framework (1994, 1990), incentives are used as diagnostic control systems to drive the implementation of intended strategies following a set of sequential steps (Simons and Davila, 2021). First, the company defines a green strategy. Next, it translates this strategy into performance objectives, defines goals associated with these objectives, then designs environmental performance measures to monitor their implementation, and initiates corrective actions when needed. Finally, the company may choose to include these measures as part of the incentive systems to motivate and focus employees across the hierarchy on the implementation of the green strategy.

In the field of CSR management, Eccles et al. (2014) show that high sustainability companies exhibit different organizational processes compared to a matched sample of low sustainability companies, including executive compensation plans tied to CSR goals. Furthermore, prior research in environmental management argues that green strategies require firms to address environmental performance through investing in new products and processes, as well as implementing new business models aiming at reducing environmental impact, yet maintaining or even increasing productivity of operations (Porter and Linde, 1995). Green strategy-driven organizations, therefore, are expected to use new measurement and control systems, including green incentives, to implement environmental goals.¹¹

¹¹ Based on Baker et al. (2018) and Painter (2020), green strategies also include financing decisions that integrate climate-change issues (i.e. green bonds). Indeed, companies issuing green bonds might provide green incentives to their managers and employees to promote the achievement of specific environmental goals. The global green bond market, however, has remained relatively small; the first corporate green bonds were issued in November 2013. Finance-related arguments associated with green bonds are therefore of limited relevance to our empirical setting (covering the period 2008-2013). Yet, we recognize the relevance of this argument and thank one of the anonymous reviewers for this suggestion.

These arguments suggest a relationship between green strategies and the use of green incentives as captured in the following hypothesis:

H1: *Firms with an explicit green strategy are more likely to use green incentives*

When companies first define a green strategy or green objectives, they have limited knowledge and experience about environmental aspects (Ioannou et al., 2016; Kolk and Perego, 2014; Berrone and Gomez-Mejia, 2009b); they have no performance benchmark and limited information about their peers' initial efforts. Therefore, they invest in measurement systems dedicated to green management before using green incentives (Ioannou et al., 2016; Kolk and Perego, 2014; Berrone and Gomez-Mejia, 2009a). Implementing an effective green strategy requires developing knowledge about what data to collect and how, understanding cause-effect relationships, and analysing environmental information from the firm and its peers.¹²

As firms accumulate experience in managing and monitoring environmental performance, they learn to identify relevant objectives, set appropriate goals, and select performance measures (Lisi, 2015; Rodrigue et al., 2013). Thus, greater monitoring experience facilitates the use of green incentives.¹³ Examples of monitoring systems include budgeting, performance reporting, direct supervision, and internal auditing.¹⁴ Hence, we empirically test whether, and to what extent, the experience in monitoring environmental performance influences the subsequent use of green incentives:

H2: *Firms with more experience in monitoring environmental performance are more likely to use green incentives*

Research on the diffusion of voluntary corporate practices posits that “whereas economic models draw on informational arguments about the value of an innovative management practice, social accounts tend to emphasize growing levels of pressure towards social

¹² Our measure of monitoring experience captures the progress of each firm across this sequence of steps: strategy formulation, setting of goals and objectives, selecting performance measures, and finally designing incentives. We predict that experience across these different aspects is associated with the use of green incentives (H2). We do not argue that monitoring experience captures a specific step in this sequence. Future work can explore proxies more specific to each of these steps. These different steps can behave as sequential complementarities. Future research can study these complementarities within the concept of “control packages.” (Grabner et al., 2020).

¹³ Prior research on CSR management suggests that monitoring of CSR activities and outcomes correlate with CSR incentives (Berrone and Gomez-Mejia, 2009a; Derchi et al., 2021; Radu and Smaili 2021). These studies, however, do not distinguish between social and environmental performance measures, despite their multiple differences (Chatterji et al., 2016; Ioannou et al., 2016; Derchi et al., 2021; Berrone and Gomez-Mejia, 2009b). Moreover, they do not examine whether different levels of monitoring impact a company's choice to adopt CSR incentives.

¹⁴ Refinitiv ESG database collects corporate information on whether the CSR or annual report discloses CO₂ and equivalent emissions, and whether the CSR report is audited by an external party. Accordingly, the number of firms disclosing CO₂ and equivalent emissions information in the annual report or in the CSR report, sharply increased from 18.7% in 2002 to 59.4% in 2013. Moreover, diffusion of CSR committees increased from 9.7% in 2002 to 61.2% in 2013 and diffusion of external auditing on the CO₂ and equivalent emissions information content of the CSR reports has passed from 0.3% in 2002 to 31.2% in 2013.

conformity” (Ansari et al., 2010, p. 67). This symbolic use of management systems is in contrast with a substantial use grounded on rational arguments (H1 and H2). A substantial use is typically associated with a cost-benefit analysis leading to a likely effective use of these systems. In contrast, a symbolic use is associated with conformity pressures, regardless of any substantive improvement to environmental performance that the use of this management practice may lead to (e.g., Flammer et al., 2019; Filatotchev and Nakajima, 2014; Westphal and Zajac, 1994). Arguably, companies do not integrate the practice within the organization, but rather aim at showing compliance toward external stakeholders and gain legitimacy while hiding lack of effectiveness (Ansari et al., 2010; Westphal and Zajac, 1994). Cultural aspects and normative expectations of outside stakeholders push organizations to use specific management practices to conform to social norms (Abrahamson, 1991; DiMaggio and Powell, 1983) and gain legitimacy¹⁵ in the eyes of their constituencies (Ansari et al., 2010) rather than for economic cost-benefit calculations. Research on legitimacy theory and CSR management (e.g., Eesley and Lenox, 2006; Aguilera et al., 2007; Bell et al., 2014) suggest that firms’ responses to legitimacy pressures lead to changes in their corporate governance and strategic controls (Filatotchev and Nakajima, 2014). Substantial and symbolic uses are always in place and intertwined; yet theory indicates that the former of them dominates in certain circumstances, while the latter dominates in other circumstances.

Green incentives represent an interesting empirical setting to examine the influence of social (conformity) accounts on incentives adoption for a series of reasons. First, multiple stakeholders demand urgent environmental actions. This fact can explain (in part) company’s actions in search of legitimacy regardless of substantial improvement (Ansari et al., 2010). Second, corporate decisions to intentionally green wash could also justify the use of green incentives as long as those are mildly designed to communicate apparent green behaviours to internal and external audiences (Marquis and Toffel, 2012; Szabo and Webster, 2021). Third, lack of experience in managing and measuring environmental performance could explain the unintentional adoption of badly designed green incentives driven primarily by conformity reasons.

We focus on two types of conformity pressures: (1) to enhance environmental performance (i.e. improve social perception of the company’s environmental performance); (2) to apply industry peer practices (i.e. mimic specific behaviours of peers).

¹⁵ In this study, we refer to Suchman’s (1995, p. 574) definition of legitimacy as the “generalized perception ... that the actions of an entity are desirable ... or appropriate, within some socially constructed system of norms, values, beliefs, and definitions.”

Companies face pressure from different constituencies, such as national regulatory bodies for environmental protection, the UN Kyoto protocol, and activism from non-profit organizations like Greenpeace. These organizations aim at having firms improve their environmental performance by reducing CO₂ and equivalent pollutant emissions, increasing the use of renewable energies and recycling materials, and diminishing waste production. Conformity pressure is greater for companies whose environmental performance is lower than external expectations (Clarkson et al., 2008). Consistent with these arguments, prior research in environmental accounting has found that firms whose social legitimacy regarding environmental performance is threatened, increase environmental disclosures (Al-Tuwaijri et al., 2004; Bhimani et al., 2016; Cho et al., 2012; Cho and Patten, 2007; Clarkson et al., 2008; Cormier et al., 2005; O'Dwyer et al., 2011; Simnett et al., 2009). Moreover, a group of studies show that stakeholders' pressures influence the information monitored in a green management system, as well as the use of eco-control systems (Bouma and Kamp-Roelands, 2000; Bouten and Hoozée, 2013; Ditillo and Lisi, 2016; Henri and Journeault, 2010; Henri et al., 2013; Journeault, 2016; Lisi, 2015; Pondeville et al., 2013; Rodrigue et al., 2013). Following these arguments, we examine whether pressures to conform to environmental performance are associated with green incentives:

H3: *Firms are more likely to use green incentives when they face higher conformity pressures regarding environmental performance.*

In the context of green management, Bansal and Roth (2000) note that industry peers' pressure makes it difficult to deviate from the norm. Increasing frequency and of interactions within an industry also place firms under greater scrutiny when they deviate from the norm. In addition, Rodrigue et al. (2013, p. 310) show that "any benchmarking showing that a firm performs worse than its industry peers on an environmental issue acts as an additional catalyst for improvement." Pressure to conform is thus likely to affect a firm's decision to mimic its peers and adopt green incentives. Consistent with these arguments, we contend that some firms mimic industry peers and use green incentives symbolically to comply with external stakeholders and gain legitimacy, regardless of their impact on environmental performance (Ansari et al., 2010; Westphal and Zajac, 1994).¹⁶

¹⁶ As mentioned above, substantial and symbolic uses are intertwined; yet these forces act with different intensity across different settings. In particular, it is plausible to consider that the former is more intense on average for the hypotheses H1 and H2 and the latter is more intense for hypotheses H3 and H4. Thus, some firms may adopt monitoring systems and then adopt green incentives symbolically, but on average those that adopt monitoring systems will, later on, adopt green incentives as a substantial step in their process to implement a green strategy.

H4: *Firms are more likely to use green incentives when they face higher conformity pressure to industry peers' practices.*

2.2 Time-to-Adoption of Green Incentives

An extensive body of research examines the diffusion of managerial innovations (Abrahamson, 1991; Rogers, 1995). One focus of this literature is the speed of diffusion of new management practices and the characteristics of early adopters versus late adopters.¹⁷

Early (or faster) adopters of management practices are attracted by the expected benefits resulting from the use of a new practice (DiMaggio and Powell, 1983). Ansari et al. (2010) refer to these explanations as rational reasons leading to substantive implementation of this practice within the organization. Their strategy leads them to focus on environmental performance and have the tools to adopt green incentives earlier. Thus, defining a green strategy and having greater experience in monitoring environmental performance are expected to be associated with faster adoption of green incentives. At this early stage, diffusion of the management practice is low and thereby not much information exists to reduce the uncertainty and risk of adoption (Ansari et al., 2010). Social pressure is not expected to be an early antecedent of a management practice because the perceived reputation and legitimacy benefits associated with symbolic use are lower than the costs and risks of first experimentation (Ansari et al., 2010).

As an innovative management practice spreads and a critical mass is reached, companies adopt it when social conformity becomes the main driver (Ansari et al., 2010; DiMaggio and Powell, 1983). Companies that do not consider environmental performance to be economically rational, only include it as part of their strategy as a response to conformity pressures and thus these companies delay their time-to-adoption. Consistent with this argument, Bhimani et al. (2016) provide field evidence indicating a strong inclination for late adopters to be responding to industry-mimetic pressures when releasing CSR disclosures.

We reflect the differences between strategy-driven and conformity pressure-driven organizations to adopt green incentives in the following hypotheses:

H5: *Firms that define a green strategy and have greater experience in monitoring environmental performance adopt green incentives faster.*

Similarly, some firms may feel the pressure to conform to industry peers and then adopt green incentives substantially, but on average those under high conformity pressure will adopt green incentives symbolically.

¹⁷ Rogers (1995) distinguishes between adoption and diffusion. Adoption is a process detailing the stages that an organization undergoes from first hearing about a practice to finally adopting it. Diffusion refers to a group of phenomena indicating how an innovation spreads. In our work, we focus on the concept of diffusion (time-to-adoption). Throughout this paper, both terms are used interchangeably.

H6: *Firms that face higher conformity pressures to environmental performance and to industry peer practices adopt green incentives slower.*

3. Research Design

We develop our sample from CDP investor survey. CDP is a not-for-profit organization working for climate change protection in business. Starting in 2002, CDP has been collecting data from the world's largest companies on behalf of institutional investor signatories.¹⁸ By 2018, over 6,300 firms have reported data to CDP, accounting for more than 60% of the market capitalization of the world's largest 30 stock exchanges.

Since 2007, the CDP investor survey asks questions regarding the use of incentives to motivate employees achieving green targets. The focal question of this study is a 'Yes or No' inquiry formulated as follows: "Do you provide incentives for the management of climate change issues, including the attainment of targets?"¹⁹ The CDP survey also asks about the managerial position of people subject to incentives like CEO, CFO, facility managers, and other employees. Incentives can be monetary and nonmonetary, while targets refer to any objective that mitigates the environmental impact of business. Typically, monetary incentives are included in the annual bonus and are cash-based. Nonmonetary incentives involve intangible rewards based on public recognition, taking the form of medals, and prizes. Alternatively, nonmonetary incentives take the form of tangible awards, such as company products and services, external gifts, free hours for volunteering and grants for donations (Appendix A provides examples of green incentives from companies' answers to 2013 CDP investor survey). From 2007 to 2013, respondents to this question have increased substantially from approximately 400 to 1,350 firms, with a response rate of around 80%, stable over the years.

¹⁸ The goal of this data collection effort is to provide investors with information to assess firms' risks and opportunities related to environmental aspects. In 2019, CDP manages the largest global database of primary corporate climate-related information in the world, and leverages on measurement and data disclosure to identify leading firms in carbon management. CDP elaborates scores calculated according to a standardized methodology, which measures the overall quality of company environmental disclosures. RobecoSAM, the company behind the Dow Jones Sustainability Indices, and Sustainalytics, which provides ESG ratings to Yahoo Finance and collaborates with Morningstar, use CDP questions as part of their annual sustainability ranking.

¹⁹ This statement refers to question number 1.2 of 2013 CDP investor survey. The formulation of the question has remained substantially unchanged from 2007 to 2013. We believe that the binary nature of the response in combination with the fact that the question remained unchanged and response rate was high and stable in this period reduce substantially potential issues on the veracity of CDP responses (see Ioannou et al. (2016) for details). This question captures a factual aspect of the management of companies, whether they use green incentives or not. Factual items can be asked multiple times with alternative wording, but this approach is intended to reduce the noise of the response and increase the power of the research design. Using a single item, often done for factual questions to reduce the burden of responding to the survey, affects the power, which is reflected in higher standard deviations.

As described in Table 1, we initially identify a panel of 6,976 firm-year observations, corresponding to 1,709 unique companies that, in the period 2007–2013, reported whether they use green incentives. We exclude data from firms in the financial sector.²⁰ Thus, we obtain a panel of 5,529 firm-year observations, corresponding to 1,328 unique firms, with number of respondents increasing over the years, from 284 in 2007 to 1,063 in 2013. Subsequently, we combine the remaining CDP observations with the Refinitiv ESG database. Refinitiv ESG analysts collect firm-specific information from publicly available sources, including public disclosures, company websites, CSR reports, NGO reports, as well as press releases. Refinitiv ESG then applies a proprietary measurement procedure and rates firms’ CSR performance on three dimensions: environmental, social, and corporate governance. We next retrieve annual corporate financial information from Thomson Reuters’ Datastream. To alleviate the potential sampling bias caused by smaller companies, we remove firms with net sales and total assets less than \$10 million, and number of employees less than 10. Finally, we drop observations from countries with less than five distinct firms to reduce measurement error due to country misrepresentation and exclude companies with missing data due to model specifications. We obtain a sample of 1,044 firm-year observations, corresponding to 531 unique large companies headquartered in 18 countries and operating in 15 CIGS Industry Groups (see Appendix B for more detailed sample distribution statistics including the diffusion of green incentives by country, industry, and year).²¹

Insert Table 1 about here

To check for sample selection bias, we verify size, industry, and country distributions of the sample as compared to the CDP database. The CDP database includes 3,212 firms whose 2013 aggregated end-year market capitalization accounts for \$47,000 billion. In the same period, the market value of our sample accounts for \$13,400 billion, and industry and country distributions show similar proportions to CDP.

²⁰ Eccles et al. (2011) argue that the issue regarding financial institutions showing their commitment to CSR by focusing on energy and water in their sustainability reporting, is that environmental issues are simply not material to the sustainability of the institution itself.

²¹ Annual sales range from \$106 million and \$478 billion (mean \$24.2 billion, median \$10.8 billion), and employees from 19 to 2.2 million (mean 54,900, median 27,000). These characteristics are line with Ioannou et al. (2016) arguing that, in the context of climate change, public policy and civil society pressures are predominantly placed on the world’s largest companies.

3.1. Variable Measurement

We create a binary variable (*Green_Incentives*) to measure green incentives; this variable takes value of one each year the firm uses green incentives, and zero otherwise. Over the 2007-2013 period, firms increasingly used environmental performance measures in employees' incentive systems. In addition, sample firms show high consistency over time in using green incentives (not tabulated): 98.08% of companies using green incentives in year t , continue to use them in year $t+1$. We use the first year in which a firm reports using green incentives to measure time-to-adoption and distinguish early from late adopters. By construction, 2007 users are the earliest adopters and 2013 adopters are the last to introduce green incentives.

Additionally, we identify three categories of employees in line with Ioannou et al. (2016): top managers (e.g., CEO, CFO); mid-level managers (e.g., facility managers, business unit managers); and all other employees. We create three binary dependent variables that take value of one each year that a firm provides incentives to top managers (*Green_to_Top*), mid-level managers (*Green_to_Mid*), other employees (*Green_to_Other*), and zero otherwise.

We employ two Refinitiv ESG items to build the variable *Green_Strategy* and capture the existence of a business strategy for green management. With carbon emissions representing the most urgent issue for organizations to fight the worst effects of climate change (Paris Agreement COP21, 2015), we use the item "Emission Reduction Policy Elements/Emissions", a binary variable taking value of one for each year a firm discloses to have a policy to reduce carbon emissions, and zero otherwise.²² We also use the item "Commercial Risks and/or Opportunities Due to Climate Change", a binary variable equal to one for each year a firm reports the commercial risks and opportunities that climate change represents for its business, and zero otherwise.²³ We multiply the two terms and obtain the interaction variable *Green_Strategy*, resulting in a binary variable with the value of one when firms both declare having a CO₂ emission reduction policy and recognize the environment as a source of competitive risk and/or opportunity, and zero otherwise.

²² To assign a 1/0 value to this indicator, Refinitiv ESG analysts use the following question: "Does the company have a policy to reduce emissions?" Based on the Refinitiv ESG measurement methodology, the presence of the policy is assigned to firms fulfilling three conditions: (1) only a direct statement by the company matters for assessment; (2) inferences through legal obligations are not taken into account; and (3) the company shows a commitment towards tackling climate change or reducing its environmental emissions in general.

²³ Refinitiv ESG has identified an indicator for "climate impact business attention" based on the following question: "Does the company make a clear statement that it believes that climate change can represent commercial risks and/or opportunities?" This question has been over the years reformulated as: "Is the company aware that climate change can represent commercial risks and/or opportunities?"

Much of prior research in environmental accounting has investigated multiple aspects of environmental disclosure and auditing, but has not examined internal aspects that influence measurement and reporting quality (Bebbington et al., 2008; Christensen, 2016; Christensen et al., 2021; Simnett et al., 2009). Monitoring experience (*Monitor_Exp*) captures the firm's internal processes to monitor environmental performance. This variable is constructed as follows. Based on Refinitiv ESG, we collect information on three different types of monitoring systems that focus on environmental aspects of the organization at different levels of the organizational hierarchy. We consider the corporate use of these three systems as a proxy for the whole set of other management control systems such as performance measurement, benchmarking, competitive analysis, and employee selection and training that sample firms use to monitor their environmental strategy.

First, we collect data on firms' public reporting of CO₂ and equivalent emissions information. Disclosure of emissions information is often made in annual reports, websites, through media communication, or in CSR reports, which are publicly disclosed non-financial reports, predominantly produced on a voluntary basis and intended to meet the information needs of all stakeholders (Bebbington et al., 2008; Christensen, 2016; Simnett et al., 2009). We use reporting of carbon emissions that complies with established disclosure standards such as Scope 1 and Scope of 2 of GHG Protocol. The use of this quantitative measure of environmental performance reduces concerns about vague and qualitative environmental performance information in public disclosures (Michelon et al., 2015). Arguably, some companies gather, analyze, and decide to disclose CO₂ and emissions data without issuing a formal CSR report. Conversely, other companies could issue a CSR report without including specific carbon emissions information (this latter case seems less frequent in a sample of large listed companies that typically include specific environmental disclosures like carbon emissions based on GRI and SASB guidelines).²⁴ As the disclosure of CO₂ and equivalent emissions information requires managers to collect, measure, analyze, and report information on environmental aspects of the firm's activities (Christensen, 2016), the reporting process helps firms gain knowledge and better manage the environmental performance of their operations (Bouten and Hoozée, 2013; Christensen, 2016). *CO₂_Report_Exp* measures the number of years that a company has reported CO₂ emissions information publicly.

²⁴ To verify this point, we measure the correlation between CSR reporting and CO₂ emission disclosure across our sample firms and find a positive coefficient of 0.39. The relatively low value of this coefficient reveals significant variation between companies' choice about CSR reporting and CO₂ emissions disclosure.

Second, we use audits that provide external assessments on the content of the CSR reports including the CO₂ and equivalent emissions information (when disclosed). CSR external auditors verify the quality and compliance to standards of the CSR report. They perform an assessment, elaborate their opinion, and then certify the content of the CSR report through adding the auditor's signature, statement, and any potential recommendation (Simnett et al. 2009; Boiral et al., 2019). As stated in Simnett et al. (2009, p. 941), these assessments are a form of external monitoring that serves "as a useful control mechanism to enhance the credibility of disclosed information and facilitate greater user confidence." *CO₂_Audit_Exp* computes how many years the reporting of the CO₂ emissions information has been audited by an external party mandated for assessing and insuring the content the CSR report.

Third, we collect information on the implementation of environmental management systems based on ISO 14001 certification. ISO 14001 certification is a voluntary process-based framework to help manage environmental aspects of facilities. Based on ISO 14001, firms identify environmental goals and develop an environmental strategy. Consequently, companies design measurement procedures to monitor the environmental impact of facilities, as well as training initiatives to ensure that employees are aware of objectives (Jiang and Bansal, 2003). Certified companies are, however, not required to set green incentives for their employees, and considerable managerial discretion is given to integrate the standard requirements. Although some of the literature on ISO 14001 highlights the symbolic function of this system and the lack of consensus on its actual effectiveness (Delmas and Toffel, 2008; Psomas et al., 2011), a firm's experience in implementing a certified environmental management system provides an indication of monitoring efforts. *ISO_Certificate_Exp* measures the number of years a firm has held an ISO 14001 certification.²⁵

Monitor_Exp is a reflective construct manifested in these three indicators that captures the common pattern in the variance generated by the different corporate experiences in using the three selected monitoring systems. Specifically, *Monitor_Exp* is the only factor with an eigenvalue greater than one of a common factor analysis exploiting the shared variance of the observed indicators. This factor captures a firm's experience monitoring environmental performance as this construct focuses on the broader environmental performance rather than

²⁵ All indicators are measured as number of years of use prior to the proxy date. By construction, corporate experience in using these three monitoring systems does not refer to consecutive years of usage. We acknowledge that this may generate measurement error in the variable *Monitor_Exp*. We consider, however, that in this sample there exists a very high internal consistency in companies' choice to use these monitoring systems. Indeed, more than 98% of sample companies using a certain monitoring system in year *t* reports the use of the same system in year *t+1*. Overall, this high percentage strengthens the quality of *Monitor_Exp*.

focusing only on carbon emissions. Using a factor score also mitigates potential measurement errors in the main indicators as previous studies show that assessment by auditors is quite heterogeneous (Boiral et al., 2019) and ISO 14001 certification often plays a symbolic function (Delmas and Toffel, 2008; Psomas et al., 2011). Appendix C reports the factor loadings as well as the percentage of the variance of each indicator captured in the variance in the common factor. All loadings are large with coefficients greater than 0.60.²⁶ The factor analysis provides strong reliability statistics: KMO statistic of sampling adequacy is 0.68 and the Cronbach alpha coefficient is 0.76 (Nunnally, 1978). Higher values of *Monitor_Exp* are associated with greater experience. Cronbach alpha and loading on one factor suggest that this variable captures firms' use of management control systems other than green incentives.²⁷

We use total tons of annual carbon emissions scaled by net sales to measure a company's environmental performance.²⁸ We obtain carbon emissions data from Refinitiv ESG database. The variable *Environ_Performance* measures conformity pressures to enhance environmental performance; it is built as the yearly difference between the firm's performance and the mean of corporate carbon emissions calculated at the industry level (GICS Parent Sector). To increase the time consistency of this variable, we compute *Environ_Performance* as the average over the three years preceding the proxy date. To reduce dropping firms with missing data, we also calculate the average of the prior two years or use the prior year data, for firms having missing information on the preceding 3rd and 2nd year, respectively.²⁹

Conformity pressures to industry peers' practices reflect the mimicking pressures that a firm faces at the industry level. We measure this construct computing *Industry_Use* as the percentage of other firms in any given industry-year that use green incentives.

²⁶ Kline (2002) indicates that with sample sizes of at least 100 observations, factor loadings of 0.30 or higher are considered significant.

²⁷ As additional test, we perform a confirmatory factor analysis to compute a factor score assuming monitoring experience to be a latent construct as reflected by the three measures: *CO2_Report_Exp*, *CO2_Audit_Exp*, and *ISO_Certificate_Exp*. Results from performing our analyses using this factor score are strongly consistent with our main findings, strengthening the validity of our measurement procedure for the variable *Monitor_Exp*. We thank one of the anonymous reviewers for suggesting to run this test.

²⁸ We compute carbon emissions by using firm's total CO₂ and equivalent emissions in tons as reported by Refinitiv ESG. Because companies generally disclose CO₂ and equivalent emissions according to various protocols (ex: Greenhouse Gas (GHG) Protocol, Kyoto Protocol, EU Trading Scheme), Refinitiv ESG reports the value from the GHG Protocol in case of multiple disclosures.

²⁹ To increase our confidence level regarding the reliability of this extended indicator, we check for potential measurement biases related to the different time windows used in computation. Pairwise correlation between the three-year time span parameter and the mixed-year measure is extremely high and strongly significant for *Environ_Performance* ($r = 0.97$, $p < .0005$). Further, results from our analyses remain substantially unchanged for models using only three-year or mixed multiple-year average measures.

We control for firm size (*Size*) as we expect larger firms to make greater use of green management practices (Cormier et al., 2005; Marquis and Toffel, 2012; Reid and Toffel, 2009). We measure *Size* using the natural logarithm of the number of employees. We also include the ratio of research and development expenditures to net sales (*R&D*) and the ratio of market value to book value (*Mkt_to_Book*) to control for firm orientation to innovation and expected growth opportunities, respectively. Following Ittner et al. (1997), *R&D* and *Mkt_to_Book* ratios are computed as the averages of the five yearly ratios preceding the proxy date. We also calculate the average of the prior four or three years for firms with missing data for the preceding fifth and fourth year, respectively.³⁰

We control for the exogenous noise in environmental performance potentially affecting a firm's use of environmental performance measures in incentive systems (Banker and Datar, 1989; Holmstrom, 1979; Pondeville et al., 2013). We create the variable *Environ_Noise* as the average of three years' standard deviations in corporate carbon emissions for firms in the same industry. Like Ittner et al. (1997), this indicator measures the noise in environmental performance that is beyond a firm's control. We assume that this exogenous noise is an increasing function of the variance in industry environmental performance.

We also include the binary variable *CSR_committee* that identifies a firm's appointment of one or more groups of knowledgeable board members, senior executives, or other managers to whom corporate environment or, more generally, CSR-related tasks and responsibilities are delegated on a daily basis (Berrone and Gomez-Mejia, 2009a). The expertise of such committee is expected to help managers better assess and decide on corporate environmental as well as social performance, including the setting of green incentives (Paine, 2014). The inclusion of *CSR_committee* also helps mitigate any confounding effect due to unobserved broader CSR strategies and performance as well as individual managers characteristics (i.e., CEO power) influencing the design and effectiveness of green incentives (Abernethy et al., 2015).

We also control for *Volatility* and *Distress* to capture firm risk (Bansal and Clelland, 2004; Cheng et al., 2014; Sharfman and Fernando, 2008) and its financial adversity (Ittner et al., 1997). We measure *Volatility* using the stock price volatility item from Datastream. We measure *Distress* using Altman's bankruptcy prediction model (1968) for each of the prior five years. We assign to each firm a score of one in the years the probability of bankruptcy is lower

³⁰ Pairwise correlation between the five-year time span parameter and the mixed-year measure is high and strongly significant for *R&D* ($r = 0.96$, $p < .0005$) and *Mkt_to_Book* ratios ($r = 0.99$, $p < .0005$). Results from our analyses remain substantially unchanged using only five-year or mixed multiple-year average measures.

than 1.81, and zero otherwise; we then average the indicators over the five-year period (Ittner et al., 1997).

We use firm's visibility within its industry to control for the potential reverse causality between *Industry_Use* and *Green_Incentives*. Although *Industry_Use* is computed at a broader level of measurement (i.e. industry level), it is possible that it is bi-directionally related to *Green_Incentives*. The proportion of peers using green incentives indeed can depend on a particular firm using green incentives (Antonakis et al., 2010). This is more likely for highly visible firms whose behaviour drives peers' mimicking (Ansari et al., 2010; DiMaggio and Powell, 1983). We measure firm's visibility using the ratio of annual sales to the total of the industry (*Mkt_Share*).

Finally, we use GICS Parent Sector dummies to control for differences across industries in firms' responses to green management demand (Cho and Patten, 2007; Simnett et al., 2009). We also control for country using dummies to explain country influences on firms' use of green incentives (Aresu et al. 2022; Marquis and Toffel, 2012), and year dummies to account for unobserved changes in norms and expectations between 2007 and 2013 (Cohen et al., 2022).

4. Results and Discussion

4.1. Antecedents of the Use of Green Incentives

We test hypotheses H1, H2, H3, and H4 estimating the following equation:

$$\begin{aligned} \text{Green_Incentives}_{it} = & \alpha_0 + \alpha_1 \text{Green_Strategy}_{it-1} + \alpha_2 \text{Monitor_Exp}_{it-1} + \\ & \alpha_3 \text{Environ_Performance}_{it-1} + \alpha_4 \text{Industry_Use}_{it} + \alpha_5 \text{Green_Incentives}_{it-1} + \alpha_6 \text{Mkt_Share}_{it-1} + \\ & \alpha_7 \text{Size}_{it-1} + \alpha_8 \text{R\&D}_{it-1} + \alpha_9 \text{Mkt_to_Book}_{it-1} + \alpha_{10} \text{Environ_Noise}_{it-1} + \alpha_{11} \text{CSR_Committee}_{it-1} \\ & + \alpha_{12} \text{Volatility}_{it-1} + \alpha_{13} \text{Distress}_{it-1} + \alpha_{14} \text{Industry}_i + \alpha_{15} \text{Country}_i + \alpha_{16} \text{Year}_t + \varepsilon_{it} \end{aligned} \quad (1)$$

where ε represents the residual, i represents firm i , and t represents year t .

We estimate Equation (1) using a logistic regression. In particular, we include the firm's use of green incentives at time $t-1$ as the conditional probability of using green incentives in time t is a function of the past experience in having already implemented the system (Heckman, 1979).³¹ We include firm's visibility in its industry (*Mkt_Share*) to control for potential endogeneity due to the reverse causality of conformity pressures to industry peer practices (*Industry_Use*) and we lag all other covariates one year to limit simultaneity issues. Finally, we cluster standard errors by firm to control for heteroskedasticity and non-independence among observations for firms with multiple-year observations.

³¹ Based on Heckman (1979), omitting to control for this factor could significantly bias the results.

Table 2 provides descriptive statistics and correlations for all variables. In the final sample, 68.8% of the responding companies make use of green incentives. Firms vary substantially as reflected by both *R&D* and *Mkt_to_Book* ratios, indicating a large range of strategic orientations. Moreover, the Altman (1968) bankruptcy model predicts that the mean (median) sample firm is in financial distress in 25.9% (0%) of the five years prior to the proxy date. Finally, firms also vary considerably in terms of green management practices, environmental performance, and industry noise.

Insert Table 2 about here

Pearson correlation coefficients in Table 2, Panel B does not show multicollinearity concerns. These statistics reveal that firms using green incentives are larger and bear more financial distress. They also have greater experience in using monitoring systems for environmental performance, they face higher pressures to conform to industry practices, and they are more likely to have a business strategy for green management as well as a sustainability committee.

Table 3 reports the results. The first model presents the results testing our hypotheses. The other three models interact monitoring experience (*Monitor_Exp*) with conformity pressures to environmental performance (*Environ_Performance*), and industry peers' practices (*Industry_Use*) to test whether and how the effect of monitoring experience varies with changes in conformity pressures. Model 4 interacts the two conformity pressure variables.

Insert Table 3 about here

We do not find support for H1: having a green strategy is not associated with green incentives, indicating that organizations use green incentives through various paths but not as a direct consequence of a formal green strategy implementation.³² We find support for H2, monitoring experience (*Monitor_Exp*) is positive and significant ($p < 0.05$), indicating that firms with greater experience in measuring, reporting, and auditing environmental performance are more likely to use green incentives. Additionally, the results are consistent with the argument

³² While *Green Strategy* is not significant in Table 3, it is significant in our simultaneous equation specification as an antecedent of monitoring experience and in predicting time to adoption in Table 7. Overall these results indicate a complex interaction between these variables beyond what theory predicts at this point. We appreciate the comment of one of the reviewers for exploring the role of green strategy.

that, in the context of green management, companies find it difficult to design green incentives if they lack monitoring experience (Berrone and Gomez-Mejia, 2009b). Consistent with H3, environmental performance (*Environ_Performance*) is positive and significant ($p < 0.05$): positive deviations from industry level affect a firm's choice to adopt green incentives. Finally and consistent with H4, the coefficient of industry peers' practices (*Industry_Use*) is positive and significant ($p < 0.01$), indicating that the adoption of green incentives also responds to conformity pressures.³³

Models 2 and 3 in Table 3 extend the testing of the hypotheses examining the existence of a combined effect of monitoring experience and, respectively, conformity pressure to environmental performance and industry peers' practices. Model 2 interacts *Monitor_Exp* and *Environ_Performance*, the coefficient is negative and significant ($p < 0.01$). Greater (lower) conformity pressure decreases (increases) the effect of monitoring experience on green incentives adoption. In other words, the effect of monitoring experience substitutes in part that of conformity pressure for environmental performance with regard a firm's choice to use green incentives.

Results from Model 3 bring additional insights on the influence of conformity pressures. The coefficient of the interaction term between *Monitor_Exp* and *Industry_Use* is not significant, indicating that conformity pressures to mimic industry peers' practices do not affect the association between monitoring experience and green incentives.

Finally, Model 4 examines the existence of a combined effect between conformity pressure to environmental performance and conformity pressure to industry peer practices. Interestingly, the interaction term between *Environ_Performance* and *Industry_Use* is negative and significant ($p < 0.05$), greater (lower) conformity pressure decreases (increases) the effect of mimicking pressure on green incentives use. In other words, conformity pressure to enhance environmental performance and conformity pressure to mimic industry peers' behaviour substitute partly each other in their influence on a firm's choice to use green incentives.³⁴

³³ Holding all other variables at their means, a firm with one standard deviation higher monitoring experience (*Monitor_Exp*) has a 1.38 times higher odds ratio to adopt green incentives. An increase of a one standard deviation in the conformity pressure to enhance environmental performance (*Environ_Performance*) or in the proportion of industry peers using green incentives (*Industry_Use*) raises the odds that a firm adopts green incentives of respectively 1.45 and 9.75 times.

³⁴ We further explored cross-sectional variation on these results for different types of firms. Green strategy remains insignificant except for high market-to-book firms. Monitoring experience is significant for companies with low R&D intensity and low market-to-book, while environmental conformity pressure is not significant. Finally, peers' pressure is significant for high R&D intensity and high market-to-book firms. Overall, these results suggest an interesting research question on firm characteristics and the use of green incentives. We thank one of the reviewers for suggesting this analysis.

4.2. Incentives Provided to Different Management Levels

To further investigate the antecedents of green incentives, we examine the hypothesized effects for three hierarchical levels within firms. Prior research indicates that the design of incentive systems is a function of the nature of the tasks performed, as well as the level of delegation (Milgrom and Roberts, 1992; Moers, 2006). It is, therefore, possible that the antecedents of green incentives depend on managerial position. Similar to Ioannou et al. (2016), we identify three categories of employees using the following variables: top managers (*Green_to_Top*), mid-level managers (*Green_to_Mid*), and all other employees (*Green_to_Other*). We replace *Green_Incentives* in Equation (1) with these variables and run three seemingly unrelated regressions (SUR) allowing our dependent variables to correlate (i.e. a firm may assign green incentives to multiple hierarchical levels simultaneously).³⁵ We further use direct measures of conformity pressure to industry peer practices, using the proportion of other firms providing green incentives to top managers (*Green_to_Top_Peers*), mid-level managers (*Green_to_Mid_Peers*) and other employees (*Green_to_Other_Peers*). Based on the proposed specifications, we use a subsample of 810 firm-year observations.

Table 4 presents the results. The coefficients of monitoring experience (*Monitor_Exp*) are positive and strongly significant ($p < 0.01$) for top managers and other employees, providing partial support to hypothesis H2. The coefficient of conformity pressures to enhance environmental performance (*Environ_Performance*), however, is insignificant in all three models while the coefficient of conformity pressures to industry peer practices (*Industry_Use*) remains positive and significant ($p < 0.05$) only for top managers. Overall these findings invite for additional research on the design of green incentives at different levels of the organization.

Insert Table 4 about here

4.3. Self-Selection and Simultaneity Concerns

Endogeneity can be a concern due to self-selection issues, simultaneity, and potential correlated omitted variable bias (partly due to potential measurement error in variables).

Reporting to CDP is indeed a choice that firms make as the perceived benefits of doing so outweigh the perceived costs. For example, firms that decide to report green incentive information to CDP may be more motivated to use green incentives than firms that do not

³⁵ As the dependent variables are binary indicators, we control the robustness of the findings performing logistic regressions and computing the AMEs of the covariates. Results remain substantially unchanged.

disclose. Observed use therefore is a result of the company's unobserved motivation for green management rather than of strategic control or conformity pressure. This reasoning raises the issue of whether firms that choose to disclose this information are by any means different from firms that choose not to disclose, as the inferences about the external validity regarding the antecedents of using green incentive may be incorrect. This process may lead to self-selection (i.e. the use of green incentives is a variable where firms self-select into responding to that question), which can result in biased determination of the coefficients (Lennox et al., 2012). Based on Matsumura et al. (2014), we evaluate this bias using a maximum likelihood probit regression with a Heckman procedure, where we jointly estimate Equation (1) and the firms' choice to disclose green incentives information to CDP. In particular, we use the following equation to examine the disclosure choice:

$$\begin{aligned}
 Disclose_CDP_{it} = & \delta_0 + \delta_1 Disclose_CDP_{it-1} + \delta_2 Industry_Disclosure_{it} + \delta_3 Green_Strategy_{it-1} \\
 & + \delta_4 Environ_Performance_{it} + \delta_5 Size_{it-1} + \delta_6 Mkt_to_Book_{it-1} + \delta_7 CSR_Committee_{it-1} + \\
 & \delta_8 Volatility_{it-1} + \delta_9 Distress_{it-1} + \delta_{10} Industry_i + \delta_{11} Country_i + \delta_{12} Year_t + \epsilon_{it}
 \end{aligned} \tag{2}$$

Disclose_CDP is an indicator variable equal to one if the firm reports green incentives information to CDP, and zero otherwise (green incentives' information is missing). We have selected the independent variables in the probit disclosure model based on research on environmental disclosures (Matsumura et al., 2014; Clarkson et al., 2008). In particular, we include the lagged green incentives disclosure indicator, *Disclose_CDP_{it-1}*, as firms that responded to this CDP question in the previous years are more likely to respond in the current year. Consistent with Stunny (2013), we expect positive coefficient on *Disclose_CDP_{it-1}*. *Industry_Disclosure* measures the ratio of the number of firms in the industry disclosing green incentives information to the total number of firms in the same industry. Based on industry pressures and individual optimal disclosure decision (Matsumura et al. 2014), we expect a positive coefficient on *Industry_Disclosure*.

In line with previous evidence from environmental disclosure research (Matsumura et al. 2014; Clarkson, et al 2008), we control for whether the company has a formal environmental strategy (*Green_Strategy*) and prior environmental performance (*Environ_Performance*), as we expect these factors to be associated with a firm's likelihood to report information to CDP voluntarily. Moreover, we control for other firm-level characteristics that may affect the likelihood that a firm responds to the CDP questionnaire and discloses information on green incentives. Similar to Matsumura et al. (2014), we include *Size*, *Mkt_to_Book*, and *Distress*; we expect greater values for these variables to influence positively a firm's choice to disclose green incentive information to CDP. In addition, we control for stock price *Volatility* as we expect a

negative coefficient on this variable consistent with Cheng et al. (2014). Finally, we include industry, country, and year fixed effects.

Table 5 presents the results. Overall, results are in line with our initial findings. The coefficient on *Monitor_Exp* is positive and significant (p-value <0.05), supporting the prediction that monitoring experience promotes subsequent use of green incentives. Also, the coefficients on *Environ_Performance* and *Industry_Adopt* are positive and significant (respectively, p-value <0.05; and p-value <0.01), supporting the hypothesised association between conformity pressures and green incentive adoption. In addition, Table 5 shows the likelihood ratio χ^2 statistic that tests for the null hypothesis that there is no self-selection. This test is significant (p<0.01), highlighting the importance of correcting for self-selection bias in our empirical model.

Consistent with expectations, we find that firms disclosing green incentives information to CDP in the prior year are more likely to disclose this information in the current year (p<0.01), indicating that the disclosure decision is sticky. In addition, the coefficients on *Industry_Disclosure* and *Green_Strategy* are positive and significant (p<0.01), in line with the probability of disclosure increasing as, respectively, more firms in the industry disclose and a specific business strategy for green management has been in force.³⁶

Similarly to Matsumura et al. (2014), we run this analysis using a two-step limited likelihood probit estimation, which is less efficient but more robust than the maximum likelihood estimation. Our results (untabulated) remain unchanged.³⁷

Insert Table 5 about here

Organizational design choices, such as implementing monitoring and incentive systems, can be sequential or simultaneous³⁸ (Armstrong et al., 2010; Van Lent, 2007). We test this process

³⁶ We also perform this analysis controlling for self-selection bias when firms report green-incentive adoption information for different managerial positions (i.e. top manager, mid-level managers and other employees). Overall, results do not change.

³⁷ To satisfy the exclusion restriction when using Heckman procedure (Lennox et al., 2012), we include in the selection model the variable *Industry_Disclosure* that is conceptually excluded from the green incentive adoption model. Following Lennox et al. (2012) that highlight the importance of testing for multicollinearity when using Heckman procedure, we find that the variance inflation factor of the inverse Mills ratio for the disclosure-choice model, when it is included in the green adoption equation, is less than 2, thus indicating that multicollinearity is not a concern.

³⁸ Companies in our sample generally adopt environmental reporting and governance-like systems ahead of green incentives, following Simons' predictions (1994; 1990). Yet, it is still possible that a company's adoption of green

using two simultaneous equations where *Green_Incentives* and *Monitor_Exp* are modelled as mutually dependent. In particular, we test the simultaneous variation of monitoring and incentive systems using the following equations:

$$\begin{aligned} \text{Green_Incentives}_{it} = & \alpha_0 + \alpha_1 \text{Green_Strategy}_{it-1} + \alpha_2 \text{Monitor_Exp}_{it-1} + \\ & \alpha_3 \text{Environ_Performance}_{it-1} + \alpha_4 \text{Industry_Use}_{it} + \alpha_5 \text{Green_Incentives}_{it-1} + \alpha_6 \text{Mkt_Share}_{it-1} + \\ & \alpha_7 \text{Size}_{it-1} + \alpha_8 \text{R\&D}_{it-1} + \alpha_9 \text{Mkt_to_Book}_{it-1} + \alpha_{10} \text{Environ_Noise}_{it-1} + \alpha_{11} \text{CSR_Committee}_{it-1} + \\ & \alpha_{12} \text{Volatility}_{it-1} + \alpha_{13} \text{Distress}_{it-1} + \alpha_{14} \text{Industry}_i + \alpha_{15} \text{Country}_i + \alpha_{16} \text{Year}_t + \varepsilon_{it} \end{aligned} \quad (3)$$

$$\begin{aligned} \text{Monitor_Exp}_{it-1} = & \gamma_0 + \gamma_1 \text{Green_Incentives}_{it} + \gamma_2 \text{Green_Incentives}_{it-1} + \gamma_3 \text{Green_Strategy}_{it-1} \\ & + \gamma_4 \text{Environ_Performance}_{it-1} + \gamma_5 \text{CSR_Reporting_Exp}_{it-1} + \gamma_6 \text{CSR_Audit_Exp}_{it-1} + \\ & \gamma_7 \text{Mkt_Share}_{it-1} + \gamma_8 \text{Size}_{it-1} + \gamma_9 \text{R\&D}_{it-1} + \gamma_{10} \text{Mkt_to_Book}_{it-1} + \gamma_{11} \text{Environ_Noise}_{it-1} + \\ & \gamma_{12} \text{CSR_Committee}_{it-1} + \gamma_{13} \text{Volatility}_{it-1} + \gamma_{14} \text{Distress}_{it-1} + \gamma_{15} \text{Industry}_i + \gamma_{16} \text{Country}_i + \gamma_{17} \\ & \text{Year}_t + \varepsilon_{it} \end{aligned} \quad (4)$$

Equation (3) replicates Equation (1) specification, predicting the use of green incentives to be associated with experience in monitoring environmental performance, as well as all other covariates of Equation (1). We then posit that a firm's decision to invest in monitoring in the current or previous periods can be driven by its plan to use green incentives in the future as well as its current use of green incentives. Accordingly, Equation (4) predicts *Monitor_Exp* at time $t-1$ as a function of *Green_Incentives* at times t and $t-1$, as well as specific covariates, including *Green_Strategy* and *Environ_Performance*, the control variables from Equation (1) and two instrumental variables that are expected to be associated with *Monitor_Exp*, but not correlated with *Green_Incentives*. In particular, we assume that a company's accumulated experience in preparing and issuing a CSR report (*CSR_Report_Exp*) as well as its experience in having an external audit of the CSR report (*CSR_Audit_Exp*) are directly associated with its experience in monitoring environmental performance (*Monitor_Exp*), but not with *Green_Incentives*. Obviously, green incentives are associated with CSR reporting and auditing but through monitoring experience. Based on Simons' arguments on the sequencing of control systems (1990; 1994), it is hard to come up with a rationale where CSR reporting and auditing would impact green incentives without the effect of monitoring experience as captured in the model that we use.³⁹ We do not include the potential prediction effect of social conformity for industry

incentives may come before environmental reporting, internal environmental auditing, or certified environmental systems.

³⁹ Following previous studies (Antonakis et al., 2010; Christensen, 2016), we select instrumental variables that are directly associated with the endogenous regressor, yet relate only indirectly to the dependent variable through

peers practices, (*Industry_Use*) on the firm's monitoring experience of environmental performance (*Monitor_Exp*) given that theory does not support such a relationship.

We run a three-stage least squares (3SLS) estimation procedure where we first apply an instrumental variables approach to produce consistent estimates and then use generalized least squares to account for correlated error terms across the two equations (Wooldridge, 2002).⁴⁰ Using a system of simultaneous equations with an instrumental variable approach also helps mitigate omitted variables concerns including unobserved control systems as well as potential measurement errors in the variables. To select valid instruments in Equation (4), we follow the approach described by Larcker and Rusticus (2010). First, we assess whether weak instruments are a problem by computing the partial F statistics and partial R² of Equation (4) regression. The Cragg-Donald Wald F statistic is above the threshold recommended by Stock, Wright, and Yogo (2002) and partial R² is 0.51, indicating that the instruments are appropriate. Second, for the system of two equations we run a test for over-identifying restrictions, which is appropriate under the assumption that at least one of the instruments is valid. Test result (p-value = 0.20) confirms the quality of the instruments and documents that using an instrumental variable estimation strengthens confidence in the validity as well as the efficiency of the initial findings (Angrist and Pischke, 2009).

Table 6 presents the results. Overall, our system of simultaneous equations produces similar findings as the baseline specification. *Green_Strategy* in the first equation remains insignificant, while *Monitor_Exp* in the first equation is positive and strongly significant (p-value <0.01), supporting the association between monitoring experience and green incentives use. Moreover, results from the second equation display that both *CSR_Report_Exp* and *CSR_Audit_Exp* are strongly associated with *Monitor_Exp* as expected. However, the coefficient on *Green_Incentives_t* in the second equation is not significant reflecting the absence of a bi-directional relation and therefore supporting the existence of a sequential association

influencing the endogenous regressor. In particular, we use the company's accumulated experiences gained over time by preparing and disclosing CSR reports (*CSR_Report_Exp*) and by having external audits of these reports (*CSR_Audit_Exp*) since we expect these variables to be directly associated with monitoring experience (*Monitor_Exp*); two items of the latter green-focused measure (i.e., disclosure of carbon emissions data and external audit on this disclosure) are directly associated with these broader CSR-focused predictors of a company's choice to monitor and disclose carbon emissions. However, it is theoretically not clear how would CSR reporting and auditing experiences be related to the propensity of using green incentives at time t+1 without affecting first the company's experience in managing and monitoring environmental performance.

⁴⁰ For a system of simultaneous equations to be identified, there must be at least as many non-collinear exogenous variables in the remaining system as there are endogenous right hand side variables in an equation (Wooldridge, 2002). This condition is satisfied in our system because *CSR_Report_Exp* and *CSR_Audit_Exp* are not directly correlated with *Green_Incentives*, while *Industry_Adopt* is not directly correlated with *Monitor_Exp*.

between monitoring and incentives. In addition, the R-squared of the second equation is 0.72 indicating that Equation (4) is well specified with high predicting power. This further strengthens the confidence in the robustness of our findings. However, this result is not consistent with previous research investigating eco-control systems as a package (Journeault, 2016). Yet, the evidence is in line with prior research in management accounting highlighting the importance for firms to accumulate experience in managing and monitoring environmental performance before being able to identify relevant objectives that capture their green strategy, set appropriate goals, and select performance measures reflecting the objectives with accuracy (Lisi, 2015; Rodrigue et al., 2013). Finally, *Environ_Performance* and *Industry_Use* are positive and significant ($p > 0.01$) in Equation 3, providing additional support to H3 and H4.⁴¹

 Insert Table 6 about here

4.4. Social Conformity or Contagion

Based on contagion theory of accounting methods, two different arguments explain why firms are influenced by prior adopters: information-based and spillover-based contagion (Reppenhagen, 2010). For information-based contagion, prior adopters in the same industry convey practice-specific information that is relevant for the firm’s own subsequent adoption decision as companies in the same industry face similar ‘intrinsic propensity to adopt’ (Reppenhagen, 2010, p. 631). For spillover-based contagion, prior adoption by industry peers affects competition and thus results in new costs and benefits for the firm facing the adoption choice (Reppenhagen, 2010, p. 634).

Based on contagion theory of accounting methods, even the use of a management practice by a single industry peer is informative for the firm and thus influences its subsequent adoption decision (Reppenhagen, 2010). In contrast, conformity pressure is independent of any managerial arguments (i.e. information diffusion and spillover effects) and affect a company’s choice to use a practice only when a critical mass exists, that is once social conformity pressures have achieved a certain level (Ansari et al., 2010; DiMaggio and Powell, 1983).

To verify the effects of social conformity vis-à-vis contagion, we perform a logistic regression on an adjusted version of Equation (1) where we substitute the dependent variable *Green_Incentives* with another binary variable $\Delta Green_Incentives$, taking the value of one for companies that adopt green incentives in year t+1 and zero otherwise. In particular, we examine

⁴¹ We also perform this analysis controlling for simultaneity bias when firms report green-incentive adoption information for different managerial positions (i.e. top manager, mid-level managers and other employees). Overall, results do not change.

those firms that adopt green incentives in year $t+1$, those that in the same period do not adopt the system, and those that keep the system in place from year t to year $t+1$. This delta variable captures any change in the actual rate of adoption of green incentives as a function of specific antecedents. As displayed in Figure 1, results display the existence of a non-linear positive relationship between *Industry_Use* and $\Delta Green_Incentives$. Average marginal effects on green incentives adoption show an S-shape curve; that is, effects remain insignificant up to conformity pressures of around 40% and then increase for higher values of pressures until 80% level.

Insert Figure 1 about here

Our results do not provide strong evidence for contagion theory (Reppenhagen, 2010), but are rather consistent with conformity pressure driving management practices diffusion (Ansari et al., 2010; DiMaggio and Powell, 1983). As green incentives spread across companies, the adoption decision is increasingly driven by social conformity, but only after a critical mass is reached (i.e. around 40% in our setting) (Ansari et al., 2010).

4.5. Robustness Tests

We perform multiple additional checks to control for other specific endogeneity issues related to this study. None of these tests identify significant variations to our findings.

First, we control for sample selection bias potentially caused by the increasing extension of the CDP database over the years. The CDP database does not provide prior information on the use of green incentives by firms entering the database in year t . As a result, CDP data does not cover the complete adoption cycle of green incentives for some firms. To reduce this issue, we rerun Equation (1) partitioning the sample in different periods (i.e. over the years 2010-2013 where both Refinitiv ESG and CDP coverage is maximized).⁴²

Second, we estimate Equation (1) on a restricted sample of non-US firms. Sample composition is moderately skewed towards US companies, representing about 32% of the sample. This overrepresentation can be a potential source of sample selection bias.

Third, we control for measurement error in the independent variable *Monitor_Exp* by running Equation (1) over a panel including only those firms that are represented for the entire time series. In another analysis, we also check for measurement error in *Industry_Use*. In particular, we rerun Equation (1) after replacing this variable with a more constrained definition

⁴² Results from these robustness analyses are not tabulated. Findings are consistent with those reported.

of industry peers, capturing the proportions of other firms of similar asset size (based on quartiles of the variable *Size*) that use green incentives in the same industry.

Fourth, we acknowledge that some firms may adopt green incentives earlier than reporting CO₂ and equivalent emissions information publicly. On this matter, we observe that 18% of adopting sample firms adopt green incentives at least one year before disclosing, 8% start using these incentives in the same year of disclosure, while the vast majority of companies (74%) adopt them at least one year after disclosing. As such, we perform an additional robustness check by running Equation (1) over a restricted sample including only non-adopting companies and companies adopting green incentives at least one year after having started to publicly disclose CO₂ emissions information.

Fifth, we include from Refinitiv ESG the firm's prior environmental, social and governance score measuring directly its annual CSR performance as additional covariate being likely to influence the use of green incentives (Aresu et al. 2022; Cohen et al., 2022; Ikram et al., 2019; Krüger, 2015; Derchi et al., 2021).⁴³

Moreover, we acknowledge that some companies can discontinue the use of green incentives (i.e. in our sample we identify only 13 companies discontinuing this control system). Thus, we perform a logistic regression on an adjusted version of Equation (1) where we use, as dependent variable, a binary measure, taking the value of one for companies that discontinue green incentives from year *t* to year *t*+1 and zero otherwise. In this way, we test whether antecedents of corporate use of green incentives also explain their discontinuation. To do this, we examine the sample of firms that, from year *t* to year *t*+1, discontinue green incentives, those that do not adopt the system, and those that keep the system in place. Results from this analysis (not tabulated) show that greater monitoring experience and conformity pressure to environmental performance impact negatively the probability of discontinuing green incentives. Overall, these findings confirm the importance of strategic control and social conformity in a company's decision to use green incentives and provide additional support to the validity of our empirical models and results.

4.6. Time-to-Adoption of Green Incentives

To test hypotheses H5 and H6, we follow Davila and Foster (2005) and use a hazard model specification that allows modelling duration data. The observation period for each company

⁴³ We use Refinitiv ESG score as a proxy for the firm's CSR performance in accordance with prior literature (Cheng et al., 2014). Results from this analysis (not tabulated) show that, *ceteris paribus*, prior CSR score is not associated with subsequent use of green incentives. Findings from the testing of hypotheses H1, H2, H3, and H4 remain strongly consistent with those reported.

starts with its entry in the CDP database and ends when the company adopts green incentives. The hazard function is modelled as follows:

$$h(t, X(t)) = h(t, 0) \exp[\beta'X(t)] \tag{5}$$

where $h(t, X(t))$ is the hazard rate at year t and $X(t)$ are the explanatory variables that are potentially time varying. To impose the least structure in our specification we use a Cox proportional hazard model with right censoring and time-varying covariates. The Cox is a semi-parametric model and does not require estimates of the baseline hazard function ($h(t, 0)$), which is assumed to be common across firms. Covariates affect the proportion of a firm’s hazard function relative to any other firm’s hazard.⁴⁴

Table 7 presents the results. Reported coefficients are hazard ratios. A coefficient greater (less) than one implies a shorter (longer) influence on time-to-adoption of green incentives.⁴⁵ We run the analyses on a sample including only the firms reporting to CDP up to their adoption date. So, we create an unbiased right-censored sample of 1,028 firm-year observations.

Following our hypotheses, we expect the hazard ratios of *Green_Strategy* and *Monitor_Exp* to be greater than one while *Environ_Performance* and *Industry_Use* to be lower than one. Overall, management practices diffusion theory partially explains the time-to-adoption of green incentives. The coefficients of *Green_Strategy* and *Monitor_Exp* are significant ($p < 0.05$) and greater than one. This result provides evidence of faster adoption of green incentives across companies that have defined a green strategy and monitoring experience. Firms with an environmental strategy and greater experience in monitoring environmental performance are in a better position to use green incentives for strategic control.

 Insert Table 7 about here

However, we find only partial support for hypothesis H6, stating that, as compared to faster adopters, firms taking longer time before adopting green incentives face higher conformity

⁴⁴ We acknowledge that some firms in our sample could have adopted green incentives before 2007 leading to left-censoring issue as those firms are excluded from the survival analysis. So, results are conditional to not having green incentives at the beginning of the spell. Caution is therefore needed at interpreting the results as it is possible that companies that already have green incentives at the time of observation period can be different from those that do not have them. Yet, the variables that explain time-to-adoption conditional on not having adopted green incentives at the beginning of our observation period are informative about this phenomenon, albeit with the caveat mentioned. Nevertheless, robustness tests in the paper do consider this left-censoring possibility.

⁴⁵ Time-to-adoption analysis is a research design that has been used in management control systems’ research (Sandino, 2007) to better understand the behavior of organizations. Our research design structure allows us to have access to a rare event—established companies adopting a new management control system—and we believe it is worth exploring such a unique setting. Because of the uniqueness of the setting, understanding the antecedents and timing of green incentives’ adoption is a finding of interest to a certain group of management accounting scholars.

pressures to environmental performance and to industry peer practices. The coefficient of *Environ_Performance* is not significant. Yet, the coefficient of *Industry_Use* is lower than one and strongly significant ($p < 0.01$). This result indicates that higher conformity pressures to industry peers' practices (*Industry_Use*) lead to slower adoption of green incentives. This finding is consistent with theory of conformity pressure for management practices diffusion (Ansari et al., 2010; DiMaggio and Powell, 1983).

In addition, it is worth noting an earlier use of green incentives by larger firms. This evidence is in line with the literature on the diffusion of managerial innovations, claiming that larger organizations have resource advantages and, therefore, are more likely to adopt new practices at an earlier stage (Rogers, 1995). In contrast, we find that exogenous noise in environmental performance (*Environ_Noise*) relates to a later adoption of green incentives. This is consistent with performance measurement research arguing that the use of performance measures is inversely related to their measurement noise (Banker and Datar, 1989; Holmstrom, 1979).

5. Conclusions

This work examines empirically the antecedents and the timing of green incentives adoption using a cross-industry panel of 531 global firms over the 2007-2013 period. We document that both strategic control and conformity pressure are important antecedents explaining a firm's decision to use green incentives. In particular, we find that the probability that a firm uses green incentives is positively associated with its experience in monitoring and measuring environmental performance (Simons, 1994, 1990), yet does not relate directly with the existence of a green strategy. We also document that firms' experience in monitoring environmental performance affects the provision of green incentives to both top managers and other employees, but not to mid-level managers. We believe that the design of green incentives across hierarchical levels constitute an interesting area for future research.

Our results indicate that the probability of a firm using green incentives is positively associated with conformity pressure to environmental performance and to industry peers' practices (Ansari et al., 2010; DiMaggio and Powell, 1983). That is, as their environmental performance is lower than the industry mean, firms are more likely to use green incentives. Similarly, as the proportion of industry peers using green incentives increases, firms are more likely to mimic this behaviour. Moreover, industry peers' pressure shows increasing marginal effects on the rate of adoption between 40% and 80%.

Interestingly, we find that conformity pressure to enhance environmental performance moderates negatively the effects of both monitoring experience and mimicking pressure on the

use of green incentives. In contrast, conformity pressure to mimic peer practices and monitoring experience affect green incentives use independent of each other. This evidence is in line with the theory on the diffusion of management practices arguing that a firm's decision to use a management practice is driven by managerial or social motives (Ansari et al. 2010; DiMaggio and Powell, 1983).

We further document the absence of a bi-directional relationship between monitoring environmental performance experience and green incentives, which is consistent with a sequential association. We interpret this result based on prior research in management accounting highlighting the importance for firms to accumulate experience in managing and monitoring environmental performance before being able to identify relevant objectives that capture their green strategy, set appropriate goals, and select performance measures reflecting the objectives with higher accuracy (Lisi, 2015; Rodrigue et al., 2013).

Finally, we document that both managerial and social motives help explain the time-to-adoption of green incentives. In particular, we find that firms with a green strategy and greater experience in monitoring environmental performance are more likely to use green incentives at an earlier stage. In contrast, we observe that conformity pressure to industry peer practices is positively associated with the use of green incentives at a later stage. Overall, we believe that, taken together, these findings are highly informative and shed light on the use of green incentives by firms.

As with any empirical study, this work is subject to limitations. We proxy a firm's experience in monitoring environmental performance using a choice variable that can be associated with unobserved company-specific characteristics and systems, potentially confounding the results. Implementing a disclosure choice model to control for self-selection and a simultaneous equation model addresses (in part) this concern and corroborates the existence of a positive sequential association between monitoring experience and green incentives. Moreover, some indicators used to measure environmental monitoring experience can be incomplete or biased. For example, focusing on the disclosure of CO₂ emissions information can miss capturing other environment-related aspects that could be measured quantitatively (e.g., waste disposal, energy efficiency, and environmental related innovation) and, therefore, possibly reduces the power of the relationship estimated. Employing the auditing indicator may also lead to a selection issue as only companies disclosing information can be audited. Moreover, the auditing measure can contain errors-in-measurement as it could include CO₂ emissions but also environment-unrelated information (e.g. injury rate), while not include other environment-related information (e.g. waste control). Using simultaneous equations with instrumental variables and

employing a factor score capturing the common pattern in the variance across multiple systems partly mitigate these biases and strengthen our confidence in the results. Yet, we acknowledge possible limitations in the measurement of monitoring experience.

Our results are specific to green incentives and, therefore, cannot be directly generalized to other settings. However, they can be generalized through their validation of theory (Speklé and Widener, 2018). The managerial argument is perhaps the most distinct in our paper as it has not been developed and tested the way we do. Our results support the sequencing predictions of Simons' work, indicating that this argument has predictive power in alternative settings. Moreover, the sociological arguments coming from institutional theory have been confirmed in other settings and, in this dimension, we contribute to their working on green incentives and through our distinction of two types of conformity pressure: social and industry specific.

The limitations in our research design call for further research to better understand the phenomenon and extend our findings. An open question is whether green incentives used to reinforce strategy implementation are more effective than the ones used as a response to industry performance pressure or to mimic peers' behaviour. Additionally, do these effects vary across the different levels of the organizational hierarchy? Exploring these questions represent interesting avenues for future research. Future work could also study the conditions under which green incentives are used in a substantive as opposed to a symbolic way (Flammer et al., 2019). For example, future research could identify the relative importance of green incentives and provide a more detailed backdrop for the interpretation of our results. Additional studies could also draw from organizational and economic theories to advance knowledge on the antecedents of green incentives at different hierarchical levels. Lastly, future work could use a broader perspective, explore the role of social performance measurement, and examine whether experience in monitoring social aspects spills over into environmental aspects.

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Appendix A: Examples of Green Incentives from 2013 CDP Investor Survey

Company A (Retail)

monetary

‘... buyers in the U.S. and key leaders in our global sourcing network have sustainability objectives (which includes climate and energy objectives) on the evaluations to ensure that they work with our suppliers to drive improvements in the supply chains of the products that we purchase.’

Company B (Healthcare)

monetary

‘... Mr.XXX, Head of the Corporate Center Department Environment and Sustainability is responsible for the day-to-day management of the “Company B” Sustainability Program and the integrated “Company B” Climate Program and accomplishment of related milestones. As part of his variable income component, Mr. XXX receives financial incentives that are directly linked to the success of the ‘Company B’ Sustainability Program and thus also for the “Company B” Climate Program. Performance indicators include agreed milestones and set targets within the “Company B” Sustainability and “Company B” Climate programs.’

Company C (Industrial Goods and Services)

monetary

‘... Monetary reward can range to \$5000 per team or location. “Company C” has set company-wide goals on GHG emissions, energy and water usage. By 2015, “Company C” will: Grow revenues from eco-certified products at a rate 2X “Company C”s growth; Reduce “Company C”s energy intensity by 50%; Reduce water consumption and GHG emissions by 25%; Inspire a competitive energy future. Employees are encouraged to participate in programs intended to drive the company toward attainment of these environmental goals. Employees who show particular initiative or are helpful in ways that help the company toward goal attainment may be recognized through the compensation process for their efforts ...’

Company D (Personal & Household Goods)

monetary

‘... A proportion of the management group's annual bonus is related to the achievement of a 5% reduction in energy, water, waste and CO₂ emissions ...’

Company E (Telecommunications)

nonmonetary

‘... “Company E” supports employees in making environmentally sustainable transportation choices, benefitting the environment and communities in which “Company E” does business. “Company E” provides eligible users use of a free online carpool ride matching service to support the formation and success of carpooling groups ... In addition, “Company E” provides a free taxi service to eligible employees who use sustainable transportation modes (i.e., carpool) for their daily travel to and from work and who are unable to travel home via their regular sustainable transportation mode ...’

Company F (Construction and Materials)

monetary

‘... The Sustainability Strategy Council is made up of functional leaders across the business who are charged with implementing sustainability and climate change goals, processes and reporting throughout their unit of business. These goals and responsibilities have become part of the Development, Performance and Rewards system, “Company F” annual assessment program, for

each functional unit. Attainment of goals accounts for 40 percent of annual incentive rates. In addition, a significant portion of our executives' compensation is tied to company annual and longer-term performance. Financial performance measures key to growing our business and delivering value to our shareowners are included in our compensation plans. In addition, focus on leading efforts in sustainable agriculture (including climate change mitigation) and maintaining a talented and diverse workforce are two examples of key drivers of our long-term growth that are considered when determining individual annual incentive awards...'

nonmonetary

'... The Sustainable Yield Pledge Awards promote, recognize and reward people and work that exemplify "Company F" corporate values and support the company's commitment to sustainability, including rewarding progress in resource reductions and improved environmental footprint. Of the 159 award submissions from 2012, 10 percent included reductions in GHG emissions. Our senior leadership selects category winners. Distinguished external judges selected a Judges' Choice winner, and our employees selected the People's Choice winner. The winning teams are recognized with a ceremony hosted by "Company F"'s CEO and VP of Sustainability. Each winning team is also awarded a cash donation for an organization in their communities.'

Company G (Technology)

monetary

'... Employee bonus is tied to continuous improvement efforts, including in energy efficiency and/or carbon emissions reductions ...'

nonmonetary

'... Employees can achieve Learning Excellence Credits (LEC) for participating in sustainability related courses (Incentive varies by department). If a course is not offered through LEC, employees can submit an external class for approval ...'

'... Employees at any level are recognized and rewarded for excellence by other employees via the quarterly 'Applause' recognition program. The Applause Program recognizes and applauds employees who consistently uphold 'Company G''s values, drive departmental goals (personal performance goals) and those who exceed job expectations contributing to the company's success. The Applause Program is used to recognize employees for their contribution to our environmental and climate change programs ...'

'... "Company G" matches employee volunteer hours including environmental or Climate Change activities/organizations with cash grants up to \$1,000 per calendar year ...'

'... All employees are eligible to donate to charities including environmental or Climate Change organizations and "Company G" will match their cash donation up to \$1,000 per calendar year ...'

Appendix B: Green incentives across countries, industries, and over time

	Percent of Firms with Green Incentives				Percent of Firms with Green Incentives				Percent of Firms with Green Incentives		
	N	Mean	SD		N	Mean	SD		N	Mean	SD
<u>Country distribution</u>				<u>Industry distribution</u>				<u>Year distribution</u>			
Australia	31	0,71	0,46	Automobiles & Parts	42	0,90	0,30	2007	59	0,49	0,50
Brazil	12	0,25	0,45	Basic Resources	66	0,61	0,49	2008	95	0,55	0,50
Canada	46	0,74	0,44	Chemicals	62	0,66	0,48	2009	148	0,57	0,50
Switzerland	38	0,39	0,50	Food & Beverage	52	0,83	0,38	2010	171	0,64	0,48
Germany	48	0,75	0,44	Healthcare	64	0,63	0,49	2011	212	0,73	0,45
Denmark	13	0,54	0,52	Technology	107	0,77	0,43	2012	188	0,80	0,40
Finland	22	0,68	0,48	Materials	41	0,61	0,49	2013	171	0,82	0,39
France	61	0,72	0,45	Media	25	0,40	0,50	All	1044	0,69	0,46
Great Britain	161	0,77	0,42	Mining	88	0,64	0,48				
				Ind. Goods & Services	207	0,67	0,47				
Hong Kong	6	0,83	0,41	Pers & Household Goods	81	0,68	0,47				
India	14	0,64	0,50	Retail	40	0,60	0,50				
Italy	10	0,90	0,32	Travel & Leisure	35	0,71	0,46				
Japan	162	0,77	0,43	Telecommunications	35	0,77	0,43				
Norway	12	0,83	0,39	Utilities	99	0,75	0,44				
Sweden	30	0,40	0,50	All	1044	0,69	0,46				
Taiwan	16	0,81	0,40								
U.S.	335	0,64	0,48								
South Africa	27	0,81	0,40								
All	1044	0,69	0,46								

Appendix C: Composition of the construct experience in monitoring environmental performance construct (*Monitor_Exp*)

Factor	Eigenvalue	Proportion	Cumulative
Factor 1	1.47	0.49	0.49
Factor 2	-0.11	-0.04	0.46
Factor 3	-0.19	-0.07	0.39

Variable	Factor loadings (Factor 1)	SMC
CO ₂ _Report_Exp	0.75	0.45
CO ₂ _Audit_Exp	0.64	0.32
ISO_Certificate_Exp	0.70	0.40

N = 1044

Note: The table reports the output a common factor analysis model with one unobserved variable called common factor (*Monitor_Exp*). The model is built such as the values of the indicators (observed) depend on their underlying common factor (unobserved) as well as measurement error. Sampling adequacy is acceptable as KMO is 0.68. Cronbach alpha for the four indicators is 0.76, which is above the minimum acceptable level of 0.60 (Nunnally, 1978).

The analysis reveals the existence of a single common factor (Factor 1) with an eigenvalue greater than one. Factor loadings on this main factor indicate the correlation coefficients between the unobserved common factor and each of observed indicators. Squared multiple correlations (SMC) indicate the percentage of variance of each indicator that is accounted for by the variance in the common factor.

Table 1: Sample Selection and Descriptive Characteristics

	Number of firm-years	Number of distinct firms
All firm-year observations in CDP database indicating the use of green incentives	6,976	1,709
Less:		
Observations from firms in financial sector	-1,447	-381
Observations not covered by Refinitiv ESG database + observations not covered by Datastream annual file + observations below the minimum firm-size parameters	-2,496	-481
Observations from countries with less than 5 distinct firms in the sample	-144	-41
Reductions due to model specifications	-1,845	-275
Final sample	1,044	531

Table 2, Panel A: Summary Statistics

Variable	Mean	SD	Min	P25	Median	P75	Max	Alpha [†]
Green_Incentives _t	0.69	0.46	0.00	0.00	1.00	1.00	1.00	
Green_to_Top	0.37	0.48	0.00	0.00	0.00	1.00	1.00	
Green_to_Mid	0.60	0.49	0.00	0.00	1.00	1.00	1.00	
Green_to_Other	0.49	0.50	0.00	0.00	0.00	1.00	1.00	
Green_Strategy _{t-1}	0.82	0.38	0.00	1.00	1.00	1.00	1.00	
Monitor_Exp _{t-1}	-0.01	0.84	-1.26	-0.65	-0.14	0.63	2.52	0.75
CO2_Report_Exp _{t-1}	4.95	2.62	1.00	3.00	5.00	7.00	11.00	
CO2_Audit_Exp _{t-1}	1.65	2.02	0.00	0.00	1.00	3.00	10.00	
ISO_Certificate_Exp _{t-1}	4.35	3.37	0.00	1.00	5.00	7.00	11.00	
Environ_Performance _{t-1}	-0.07	1.12	-2.74	-0.18	-0.05	0.00	5.65	
Industry_Use _t	0.62	0.16	0.10	0.53	0.64	0.75	0.92	
Mkt_Share _t	0.02	0.04	0.00	0.00	0.01	0.03	0.51	
Size _{t-1}	10.19	1.29	3.33	9.25	10.28	11.15	14.56	
R&D _{t-1}	0.03	0.05	0.00	0.00	0.01	0.03	0.30	
Mkt_to_Book _{t-1}	2.78	2.52	-1.95	1.50	2.14	3.35	18.51	
Environ_Noise _{t-1}	1.18	1.84	0.02	0.09	0.43	0.75	7.04	
CSR_Committee _{t-1}	0.86	0.35	0.00	1.00	1.00	1.00	1.00	
Volatility _{t-1}	25.96	8.58	9.98	19.49	25.38	30.76	61.32	
Distress _{t-1}	0.26	0.38	0.00	0.00	0.00	0.40	1.00	

[†]Alpha refers to Cronbach's alpha statistic. N = 1,044 (except for *Green_to_Top*, *Green_to_Mid* and *Green_to_Other* having N = 810 due to missing values)

Green_Incentives: indicator variable, one for the firm that uses green incentives, zero otherwise;

Green_to_Top/Mid/Other: indicator variable, one for the firm that provides green incentives to top managers/mid-level manager/Other employees, zero otherwise;

Green_Strategy: indicator variable, one for the firm that reports to have a policy to reduce emissions and discloses to have a business case for green management, one year prior to the proxy date, zero otherwise;

Monitor_Exp: factor score including the cumulated number of prior years the firm has made use of monitoring systems focused on environmental performance, such as (1) CO₂ and equivalent emissions reporting, (2) External auditing on the CSR report including CO₂ and equivalent emissions, and (3) ISO 14001 certification;

CO₂_Report_Exp: cumulated number of prior years the firm has produced and publicly disclosed CO₂ and equivalent emissions information in the annual report or in the CSR report;

CO₂_Audit_Exp: cumulated number of prior years the firm has assured his CSR report including the CO₂ and equivalent emission information through a specialized external auditor;

ISO_Certificate: cumulated number of prior years the firm has held an ISO 14001 certification;

Environ_Performance: firm's carbon emissions scaled over net sales minus the mean of carbon emissions scaled over net sales for CIGS parent sector, average of prior three years;

Industry_Use: proportion of other firms using green incentives for industry-year;

Mkt_Share: firm net sales/total net sales of the industry (GICS parent sector);

Size: natural logarithm of the number of employees;

R&D: research & development expenses divided by sales, average of prior 5 years;

Mkt_to_Book: market value of equity over book value of equity, average over prior 5 years;

Environ_Noise: standard deviation of firms' carbon emissions scaled by net sales, for GICS parent sector, average of prior three years;

CSR_Committee: indicator variable, one for the firm that reports to have appointed a dedicated CSR committee or team within the organization, one year prior to the proxy date, zero otherwise;

Volatility: stock's average annual price movement to a high and low from a mean price for each year; and

Distress: indicator variable, one for bankruptcy predicted by Altman model (1968) for year, zero otherwise, average over prior five years.

Table 2, Panel B: Correlations Table

	Green_ Incentives _t	Green_Str ategy _{t-1}	Monitor_ Exp _{t-1}	Environ_ Performance _t	Industry Use _t	Mkt_ Share _t	Size _{t-1}	R&D _{t-1}	Mkt_to_ Book _{t-1}	Environ_ Noise _{t-1}	CSR_ Committee _{t-1}	Volatility _{t-1}
Green_Strategy _{t-1}	0.14 ***											
Monitor_Exp _{t-1}	0.32 ***	0.31 ***										
Environ_Performance _{t-1}	0.06	-0.05	-0.11 ***									
Industry_Use _t	0.30 ***	0.26 ***	0.44 ***	0.00								
Mkt_Share _t	0.14 ***	-0.04	0.14 ***	-0.01	-0.15 ***							
Size _{t-1}	0.21 ***	0.05	0.28 ***	-0.07 **	0.03	0.53 ***						
R&D _{t-1}	0.03	-0.06	0.02	0.00	-0.01	0.04	0.05					
Mkt_to_Book _{t-1}	-0.01	0.08 **	-0.02	-0.01	-0.01	-0.01	0.08 **	0.08 **				
Environ_Noise _{t-1}	0.03	0.13 ***	0.18 ***	-0.13 ***	0.03	-0.08 **	-0.24 ***	-0.27 ***	-0.14 ***			
CSR_Committee _{t-1}	0.19 ***	0.29 ***	0.34 ***	-0.02	0.44 ***	-0.09 ***	-0.01	-0.01	0.04	0.07 **		
Volatility _{t-1}	-0.12 ***	-0.04	-0.12 ***	-0.08 **	-0.01	-0.15 ***	-0.08 **	0.14 ***	-0.13 ***	0.03	-0.02	
Distress _{t-1}	0.08 **	0.02	0.05	0.12 ***	0.09 ***	0.08 ***	0.00	-0.13 ***	-0.22 ***	0.14 ***	-0.01	0.01

, * Indicate significance at the 5 percent, and 1 percent levels, respectively.

Table 3: Antecedents of Green Incentives

	Dependent Variable: Green_Incentives _t							
	Model 1		Model 2		Model 3		Model 4	
	Coef- ficient	Std. error	Coef- ficient	Std. error	Coef- ficient	Std. error	Coef- ficient	Std. erro _l
<u>Strategic control</u>								
Green_Strategy _{t-1}	0.22	(0.28)	0.25	(0.28)	0.23	(0.27)	0.24	(0.27)
Monitor_Exp _{t-1}	0.46 ***	(0.19)	0.41 **	(0.19)	0.42 **	(0.20)	0.46 **	(0.19)
<u>Conformity</u>								
Environ_Performance _{t-1}	0.26 **	(0.13)	0.17	(0.12)	0.26 **	(0.13)	0.24 *	(0.13)
Industry_Use _t	4.11 ***	(1.58)	4.08 **	(1.59)	4.67 ***	(1.71)	4.17 ***	(1.58)
<u>Interaction terms</u>								
Monitor_Exp _{t-1} *			-0.28 ***	(0.10)				
Environ_Performance _{t-1}								
Monitor_Exp _{t-1} *					1.04	(0.94)		
Industry_Use _t								
Industry_Use _t *							-1.19 **	(0.57)
Environ_Performance _{t-1}								
<u>Control variables</u>								
Green_Incentives _{t-1}	2.92 ***	(0.25)	2.95 ***	(0.26)	2.91 ***	(0.26)	2.92 ***	(0.26)
Mkt_Share _t	9.09	(5.82)	9.26	(5.87)	9.25	(5.81)	8.99	(5.71)
Size _{t-1}	0.29 **	(0.13)	0.31 **	(0.14)	0.30 **	(0.13)	0.29 **	(0.13)
R&D _{t-1}	0.58	(2.74)	0.69	(2.76)	0.65	(2.72)	0.74	(2.75)
Mkt_to_Book _{t-1}	-0.03	(0.04)	-0.03	(0.04)	-0.02	(0.04)	-0.02	(0.04)
Environ_Noise _{t-1}	-0.04	(0.10)	-0.08	(0.11)	-0.04	(0.10)	-0.04	(0.10)
CSR_Committee _{t-1}	0.02	(0.31)	0.02	(0.31)	0.09	(0.32)	0.02	(0.31)
Volatility _{t-1}	-0.02	(0.01)	-0.01	(0.01)	-0.02	(0.01)	-0.02	(0.01)
Distress _{t-1}	-0.24	(0.31)	-0.27	(0.32)	-0.23	(0.31)	-0.23	(0.31)
Industry fixed effects	Yes		Yes		Yes		Yes	
Country fixed effects	Yes		Yes		Yes		Yes	
Year fixed effects	Yes		Yes		Yes		Yes	
Observations	1,044		1,044		1,044		1,044	
Number of distinct firms	531		531		531		531	
Pseudo R ²	0.39		0.40		0.39		0.39	
Log-likelihood	-393.5		-391.1		-393.0		-392.2	

*, **, *** Indicate significance at the 10 percent, 5 percent, and 1 percent levels, respectively.

Note: All models use logistic regressions. Model 1 tests strategic control and social conformity antecedents of green incentives adoption. Models 2 and 3 also examine the effects of the interactions between monitoring experience (*Monitor_Exp*) and the pressures to conform to, respectively, industry-level environmental performance (*Environ_Performance*) and industry peer behaviour (*Industry_Use*). Model 4 examines the effects of the interaction between the pressure to conform to industry-level environmental performance (*Environ_Performance*) and the pressure to conform to industry peer behaviour (*Industry_Use*). Robust standard errors are shown in parentheses. The dependent variable is an indicator variable that takes value of one if the firm provides green incentives; zero otherwise. All models include industry, country, and year fixed effects.

Table 4: Incentives Provided to Different Levels of the Organizational Hierarchy

Independent Variables	Green to Top _t		Green to Mid _t		Green to Other _t	
	dy/dx	Std. error	dy/dx	Std. error	dy/dx	Std. error
<u>Strategic control</u>						
Green_Strategy _{t-1}	0.04	(0.05)	-0.04	(0.05)	0.05	(0.05)
Monitor_Exp _{t-1}	0.06***	(0.02)	0.01	(0.02)	0.07***	(0.02)
<u>Conformity</u>						
Environ_Performance _{t-1}	0.02	(0.01)	0.00	(0.02)	-0.02	(0.02)
Green_to_Top_Peers _t	1.48**	(0.74)	0.45	(0.78)	-0.69	(0.82)
Green_to_Mid_Peers _t	-1.03	(0.73)	0.56	(0.77)	0.40	(0.81)
Green_to_Other_Peers _t	0.64	(0.72)	-0.03	(0.76)	0.03	(0.79)
<u>Control variables</u>		included		included		included
Industry fixed effects	Yes		Yes		Yes	
Country fixed effects	Yes		Yes		Yes	
Year fixed effects	Yes		Yes		Yes	
Observations	810		810		810	
R ²	0.43		0.38		0.36	

*, **, *** Indicate significance at the 10 percent, 5 percent, and 1 percent levels, respectively.

Models use seemingly unrelated regressions (SUR) with error terms correlated across the equations. Standard errors are in parentheses clustered by firm. The dependent variables are indicator variables taking value of one if the firm provides green incentives to, respectively, executive managers, mid-level managers, and employees; zero otherwise. All models include control variables (coefficients not reported), industry-, country-, and year fixed effects.

Table 5: Choice to Disclose Green Incentives Adoption

	Coefficient		Std. error
<u>Antecedents of Green Incentives</u>			
Green_Strategy _{t-1}	-0.01		(0.16)
Monitor_Exp _{t-1}	0.26	**	(0.10)
Environ_Performance _{t-1}	0.14	**	(0.07)
Industry_Use _t	2.15	***	(0.82)
Green_Incentives _{t-1}	1.64	***	(0.13)
Mkt_Share _t	4.54	*	(2.67)
Size _{t-1}	0.13	*	(0.07)
R&D _{t-1}	0.12		(1.52)
Mkt_to_Book _{t-1}	-0.01		(0.02)
Environ_Noise _{t-1}	-0.02		(0.06)
CSR_Committee _{t-1}	-0.01		(0.18)
Volatility _{t-1}	-0.01		(0.00)
Distress _{t-1}	-0.14		(0.17)
<u>Disclosure-Choice Model</u>			
Disclose_CDP _{t-1}	2.21	***	(0.08)
Industry_Disclosure _t	3.52	***	(0.98)
Green_Strategy _{t-1}	0.61	***	(0.08)
Environ_Performance _{t-1}	-0.03		(0.03)
Size _{t-1}	0.18	***	(0.03)
Mkt_to_Book _{t-1}	-0.01		(0.01)
Volatility _{t-1}	-0.01	*	(0.00)
Distress _{t-1}	-0.14		(0.11)
Observations	3,298		
Uncensored	1,044		
Likelihood Ratio χ^2	9.87	***	

*, **, *** Indicate significance at the 10 percent, 5 percent, and 1 percent levels.

Using a maximum likelihood probit method, we estimate the Heckman (1979) model to correct for selection bias; that is, we estimate Equation (1) model jointly with the disclosure choice model. We estimate the model on the full sample. Robust standard errors are shown in parentheses. All models include industry-, country-, and year fixed effects.

Antecedents of Green Incentives Model: $Green_Incentives_{it} = \alpha_0 + \alpha_1 Green_Strategy_{it-1} + \alpha_2 Monitor_Exp_{it-1} + \alpha_3 Environ_Performance_{it-1} + \alpha_4 Industry_Use_{it} + \alpha_5 Green_Incentives_{it-1} + \alpha_6 Mkt_Share_{it-1} + \alpha_7 Size_{it-1} + \alpha_8 R\&D_{it-1} + \alpha_9 Mkt_to_Book_{it-1} + \alpha_{10} Environ_Noise_{it-1} + \alpha_{11} CSR_Committee_{it-1} + \alpha_{12} Volatility_{it-1} + \alpha_{13} Distress_{it-1} + \alpha_{14} Industry_i + \alpha_{15} Country_i + \alpha_{16} Year_t + \varepsilon_{it}$

Disclosure-Choice Model: $Disclose_CDP_{it} = \delta_0 + \delta_1 Disclose_CDP_{it-1} + \delta_2 Industry_Disclosure_{it} + \delta_3 Green_Strategy_{it} + \delta_4 Environ_Performance_{it} + \delta_5 Size_{it-1} + \delta_6 Mkt_to_Book_{it-1} + \delta_7 CSR_Committee_{it-1} + \delta_8 Volatility_{it-1} + \delta_9 Distress_{it-1} + \delta_{10} Industry_i + \delta_{11} Country_i + \delta_{12} Year_t + \varepsilon_{it}$

Disclose_CDP is an indicator variable equal to one if the firm reports green incentives information to CDP, and zero otherwise. *Industry_Disclosure* measures the ratio of the number of firms in the industry disclosing green incentives information to the total number of firms in the industry in our sample. The likelihood ratio χ^2 statistic that tests for the null hypothesis that there is no self-selection. This test is significant ($p < 0.01$), thus highlighting the importance of correcting for self-selection bias in our empirical model.

Table 6: Simultaneous or Sequential Association between Monitoring Experience and Green Incentives

	Green_Incentives _t		Monitor_Exp _{t-1}	
	Coefficient	Std. error	Coefficient	Std. error
Green_Incentives _t			0.01	(0.30)
Green_Strategy _{t-1}	0.03	(0.04)	0.09 **	(0.04)
Monitor_Exp _{t-1}	0.10 ***	(0.03)		
Environ_Performance _{t-1}	0.03 ***	(0.01)	-0.01	(0.01)
Industry_Use _t	0.68 ***	(0.19)		
CSR_Report_Exp _{t-1}			0.14 ***	(0.01)
CSR_Audit_Exp _{t-1}			0.11 ***	(0.01)
Green_Incentives _{t-1}	0.45 ***	(0.03)	-0.01	(0.14)
Mkt_Share _t	0.79 *	(0.42)	0.98 *	(0.50)
Size _{t-1}	0.03 *	(0.01)	0.11 ***	(0.02)
R&D _{t-1}	-0.04	(0.37)	1.08 ***	(0.40)
Mkt_to_Book _{t-1}	-0.00	(0.00)	0.01	(0.01)
Environ_Noise _{t-1}	-0.01	(0.01)	0.00	(0.01)
CSR_Committee _{t-1}	0.02	(0.04)	0.09 *	(0.04)
Volatility _{t-1}	-0.00	(0.00)	-0.00	(0.00)
Distress _{t-1}	-0.02	(0.04)	-0.05	(0.04)
Industry fixed effects	Yes		Yes	
Country fixed effects	Yes		Yes	
Year fixed effects	Yes		Yes	
Observations	1,044		1,044	
R ²	0.41		0.81	

*, **, *** Indicate significance at the 10 percent, 5 percent, and 1 percent levels, respectively.

Note: Simultaneous equation model is used to perform these analyses. The dependent variable of the first equation is *Green_Incentives*, an indicator variable that takes value of one if the firm provides green incentives; zero otherwise. The dependent variable of the second equation is *Monitor_Exp*, that measures the firm's monitoring experience accumulated over the years by using different systems to monitor environmental performance (see variable description in Table 2 for a more detail explanation). *CSR_Report_Exp* and *CSR_Audit_Exp* indicate, respectively, the number of years a company has issued publicly a CSR report and the number of years CSR reports have been audited by an external party. All models include industry-, country-, and year fixed effects.

Table 7: Time-to-Adoption of Green Incentives

Independent Variables	Hazard ratio	Std. error
<u>Rational accounts</u>		
Green_Strategy _{t-1}	1.78 ***	(0.37)
Monitor_Exp _{t-1}	1.27 **	(0.16)
<u>Social accounts</u>		
Environ_Performance _{t-1}	1.02	(0.11)
Industry_Use _t	0.01 ***	(0.00)
<u>Control variables</u>		
Size _{t-1}	1.39 ***	(0.09)
R&D _{t-1}	12.28	(23.44)
Mkt_to_Book _{t-1}	1.01	(0.03)
Environ_Noise _{t-1}	0.84 **	(0.07)
CSR_Committee _{t-1}	1.22	(0.40)
Volatility _{t-1}	0.99	(0.01)
Distress _{t-1}	1.09	(0.25)
Industry fixed effects	Yes	
Country fixed effects	Yes	
Year fixed effects	Yes	
Number of observations	1,028	
Number of distinct firms	414	
Number of distinct failures	199	
Chi-square	1912.45 ***	

*, **, *** Indicate significance at the 10 percent, 5 percent, and 1 percent levels, respectively.

Note: This model uses Cox proportional hazard function to estimate the time-to-adoption. Standard errors are in parentheses clustered by firm. The model includes industry-, country-, and year fixed effects.

Figure 1: Effects on $\Delta Green_Incentives$ for different values of *Industry_Use* across Sample Firms

