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MANAGEMENT CONTROL FOR CORPORATE SUSTAINABILITY EXECUTION: THE ROLE OF EMPLOYEE COMPENSATION

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MANAGEMENT CONTROL FOR CORPORATE SUSTAINABILITY EXECUTION: THE ROLE OF EMPLOYEE COMPENSATION

THÈSE DE DOCTORAT

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Docteur en Science Economiques, mention «Managament»

par

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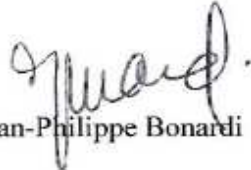
Sans se prononcer sur les opinions de l'auteur, la Faculté des Hautes Etudes Commerciales de l'Université de Lausanne autorise l'impression de la thèse de Monsieur Giovanni Battista DERCHI, titulaire d'un Master of Science in General Management de l'Université Bocconi, en vue de l'obtention du grade de docteur en Sciences Economiques, mention "Management".

La thèse est intitulée :

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Lausanne, le 15 septembre 2015

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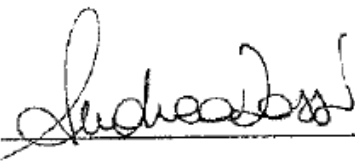I hereby certify that I have examined the doctoral thesis of

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SYNOPSYS

In 2012 "Our Global Impact" update, General Electric (GE) publicly disclosed to have invested approximately $2 billion in research and development (R&D) for sustainability innovation. In the same document, it reported $25 billion in revenues ($130 billion since 2005) from "ecoimagination", GE's program to develop products and services with significant environmental benefits. Additionally, GE informed on the following commitments through ecomagination: (1) doubling R&D expenditures in clean-technologies to achieve the company's goal of $10 billion cumulative investments by 2015; (2) increasing revenues from ecomagination products at twice the rate of total company revenue in five years; (3) reducing greenhouse gas (GHG) emissions and improving the energy intensity of operations by ,respectively, 25 percent and 50 percent by 2015; and (4) reducing freshwater use by 25 percent and improving water reuse. Hence, the report provided an update on GE's "healthymagination" involvement, which includes: investing in new business models; collaborating with customers, government, universities and industry leaders; and expanding employee relations and health efforts. In this regard, the report said that GE gave $219 million to community and educational organizations.

In the same year Fiat Group (now FCA Group) expanded the "Highlights" section of the Annual Report, which typically sums up main end-year financial results of the business. In the appendix of the section, the firm added a table reporting key nonfinancial sustainability outcomes[*] (page 14 of 2012 Annual report). Specifically, the sub-section discloses current year and prior two years performance, including the following information: percentage of woman employees; total hours of training provided to employees; frequency and severity rates of

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[*] Starting from 2013, Fiat Group explicitly titled this subsection "Sustainability Highlights" (see page 15 of 2013 Annual Report of Fiat Group). From 2013, the company has also reported the number of employees participating in a performance evaluation process.

accidents; energy consumption of plants; CO_2 emissions by plants; water consumption; and total amount of contributions to local communities.

Similarly to GE and FCA Group, in the last 15 years an increasing number of firms have declared to recognize the strategic need for socially responsible behavior and have formally disclosed their growing commitments towards corporate social responsibility (CSR). But what do generally companies mean when informing about CSR? Although the concept of CSR is not uncontested, in this dissertation I refer to the definition of Carroll (1979, 500) which is mostly widely accepted. His definition states as follows: "the social responsibility of a business (or CSR) encompasses the economic, legal, ethical and discretionary expectations that society has of organizations at a given point in time". Such a broad description is consistent with the stakeholder theory of firms arguing that organizations are accountable to a wide audience such as employees, customers, local communities, government, and suppliers in addition to shareholders (Freeman 1984). Aside from economic performance, primary areas of CSR that are acknowledged in research and by specialized rating agencies refer to environmental and social factors. Indicatively, (1) environmental performance typically includes categories such as resource reduction, emission reduction, and product innovation. (2) Social categories embrace employment quality, health and safety, training and development, diversity human rights, community, and product responsibility.

Traditionally, corporate demands for CSR practices are twofold. From an economic perspective, firms make socially responsible investments only when they maximize shareholder value. Accordingly, companies create a business case for sustainability and incorporate green and social aspects in their strategies and operations because of the potential financial benefits associated to CSR performance[†] (Porter and Kramer 2011; Bénabou and Tirole 2010; Porter and Linde 1995). In line with these conjectures, some empirical studies have concluded that there exists an overall positive relationship between CSR and corporate financial performance, and that this positive link exists after controlling for a variety of contingency factors involving measurement, mediation, and moderation (Cheng et al. 2014; Eccles et al. 2014; Matsumura et al. 2014; Servaes and Tamayo 2013; Henri and Journeault 2010; Orlitzky et al. 2003). From a sociopolitical perspective, firms make investments that benefit society to comply with regulations and to avoid the deterioration of their reputation, which in turn may affect both revenues and stock price (Marcus and Fremeth 2009). Such investments are attempts to conform to societal boundaries and behave legitimately by responding to non-shareholder constituents' demands,

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[†] See Porter and Kramer (2006; 2011) for insights and examples of companies that have developed deep linkages between their business strategies and CSR.

potentially, but not necessarily, to the detriment of the economic interest of shareholders. If managers decide to engage in CSR activities because of reputational considerations, then some of those activities may be undertaken at the expense of shareholders[‡] (Moser and Martin 2012; Bénabou and Tirole 2010). Accordingly, in the context of environmental sustainability, several empirical studies provided evidence of environmental management tools used by companies to address their exposure to social, legal, and political pressures. (Derchi and Oyon 2015; Cho, Freedman, et al. 2012; Cho, Guidry, et al. 2012; Marquis and Toffel 2012; O'Sullivan and O'Dwyer 2009; Cho and Patten 2007). These pressures, for example, stem from lobby groups pushing for environmental friendly disposal of unused assets, or from the current emphasis on the reduction of carbon emissions.

Independent of the origins of the demand for socially responsible behavior, today both academic scholars and management leaders agree on CSR concerns to constitute a corporate priority (CIMA 2011; Berns et al. 2009; Marcus and Fremeth 2009; Porter and Kramer 2006). So "it is no longer a discussion of why, what and whether to focus on sustainability, but how" (Epstein 2010, 4). An analysis of Thomson Reuters ASSET4[§] data over more than 4,500 global listed companies documents the increasing CSR engagement of firms. For instance, ASSET4 analysts note the growing popularity of CSR-specific managerial mechanisms implemented by firms to deal with the social and environmental aspects of the business.

In line with prior examples, Figure A displays the growing diffusion of CSR-focused governance structures across firms between 2005 and 2013. From a corporate governance perspective (Armstrong et al. 2010; Hill and Jones 1992), these practices are designed to align the decisions and actions of managers with the interest of shareholders, as well as of other constituencies who hold strategic resources.

[‡] By the expression "at the expense of shareholders", I refer to Moser and Martin's definition (2012, 798), meaning that "the costs of the socially responsible activity to the firm exceed the benefits to the firm".

[§] Founded in 2002, Thomson Reuters ASSET4 is a Swiss-based company that provides professional investors with Environmental, Social, and Governance (ESG) annual information from the largest listed firms to enable social responsible investment analysis. In 2014, ASSET4 database covers globally over 4,500 companies including MSCI World, MSCI Europe, STOXX 600, NASDAQ 100, Russell 1000, S&P 500, FTSE 100, ASX 300 and MSCI Emerging Markets. Recently, it has been estimated that investors representing more than €2.5 trillion in assets under management use the ASSET4 data, including prominent investment houses such as BlackRock, Goldman Sachs, and Merrill Lynch (Cheng et al. 2014).

FIGURE A. Diffusion of CSR governance practices in the period 2005-2013
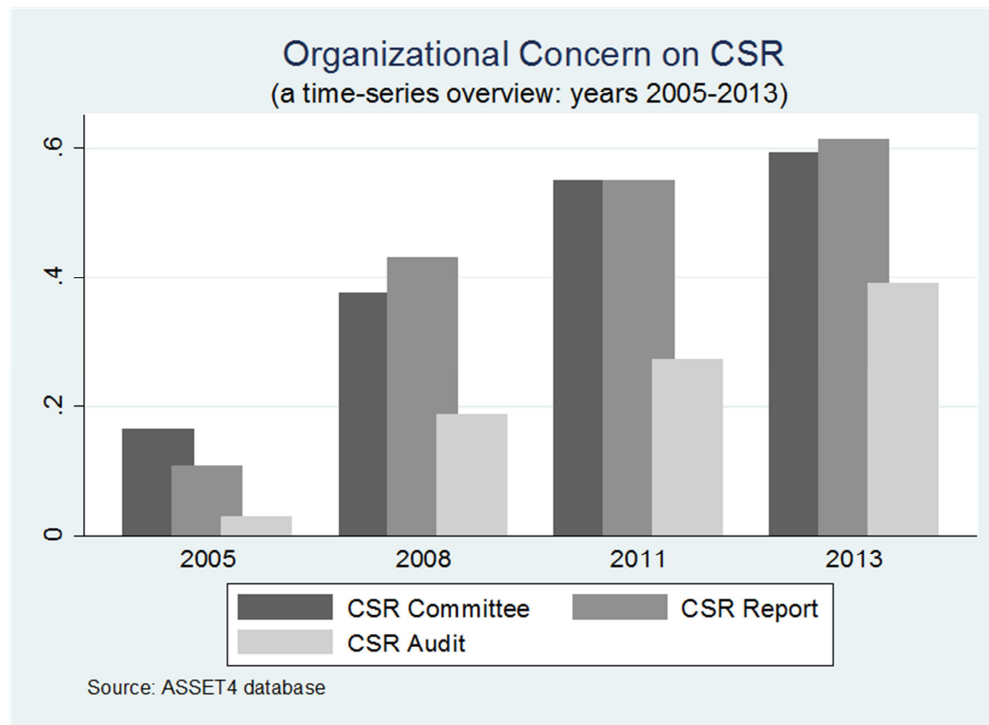
Based on Figure A, in 2013 nearly 60% of investigated companies have *ad-hoc* CSR committees or teams formally accountable for promoting and guiding CSR activities, with this proportion dramatically increased from around 10% in 2005. Similarly, the number of firms disclosing a CSR report and choosing to purchase a CSR external audit to assure the validity of the disclosed information sharply increases of, respectively, around 50 and 40 basis points.

Given this evidence of strong (at least declared) commitment towards socially responsible actions, one would expect to observe over time some clear marginal improvement in the CSR outcomes of the firms. However, a more detailed investigation reveals that, on average, companies are struggling to reach significant results.

Figure B shows the time series of mean environmental and social scores from KLD STATS[**] obtained by more than 3,000 US firms in the period 2005-2013.

[**] KLD is a product of RiskMetrics Group (formerly KLD Research and Analytics, Inc.) that specializes in assessing ESG performance of publicly traded US companies and cover more than 3,100 firms. Starting in 1991, KLD uses a combination of surveys, financial statements, articles in the popular press and academic journals, as well as government reports, to independently determine if a company is socially responsible along seven qualitative performance areas, including corporate governance, community relations, diversity, employee relations, environment, human rights and product. In addition, KLD provides information for involvement in the following exclusionary controversial business categories: alcohol,

FIGURE B. CSR performance in the period 2005-2013

CSR Performance
(a time-series overview: years 2005-2013)

Source: KLD dataase
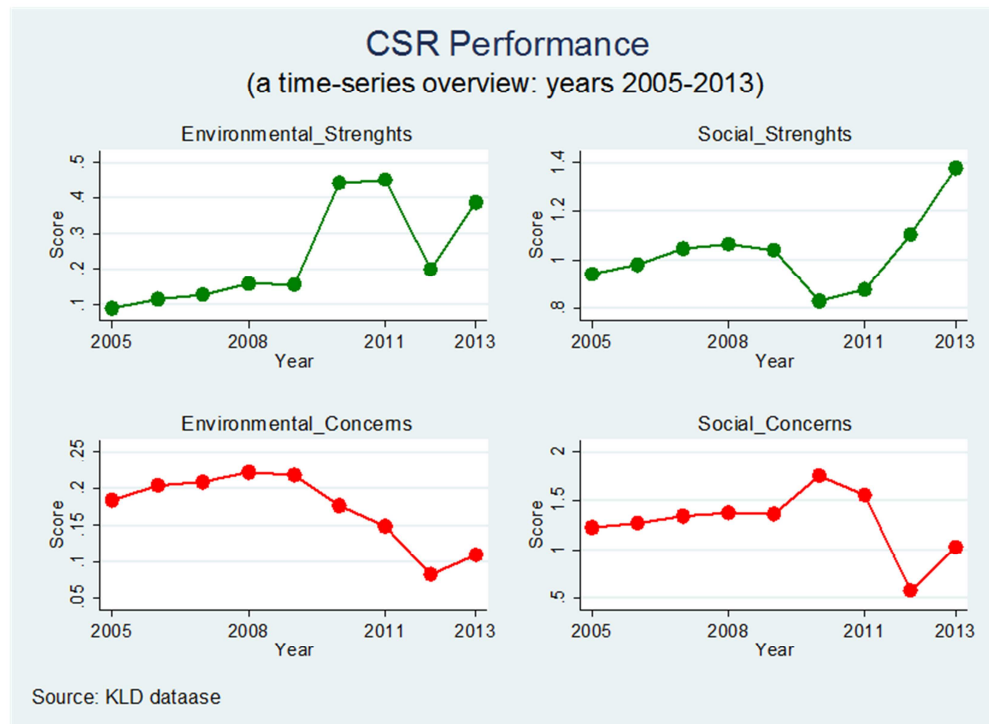
Every year, KLD independent raters assess socially responsible behavior of US listed companies and assign a number of positive (strengths) and negative (concerns) indicators along seven qualitative performance areas including corporate governance, community relations, diversity, employee relations, environment, human rights and product. For each performance dimension, if the company does have a strength or concern in that issue, this is indicated with a 1; and 0 otherwise. Between 2005 and 2013, the maximum number of environmental strengths is 5, as well as environmental concerns. Grouping the social categories, the maximum number of strengths ranges from 28 to 29 and total concerns vary from 21 to 22 depending on the year of assessment. At a first look, the average US firm reports over time a weak but significant increase in the total strengths of both environmental and social dimensions. On the other hand, the mean of concerns decreases across years at a lower but still significant marginal rate in both areas of performance. Overall, all graphs reveal weak positive trends in the CSR performance of the

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gambling, firearms, military contracting, nuclear power, and tobacco. Specifically, KLD STATS data is organized by year. Each year, KLD raters assign a number of positive indicators (strengths) and negative indicators (concerns) in each non-exclusionary dimension. If the company does not have a strength or concern in that issue, this is indicated with a 0.

investigated US firms, with companies exerting more efforts on improving their CSR strengths than reducing the weaknesses. At a first sight, these findings are consistent with institutional proponents of CSR, emphasizing the role of corporate reputation or "image" concerns driving socially responsible behavior of firms (Bénabou and Tirole 2010; Marcus and Fremeth 2009). In particular, some scholars argue that CSR actions are likely to take the form of window-dressing, "which represents a way to disseminate a misleading picture of social and environmental friendliness in some dimensions but serves to obscure less savory ones" (Bénabou and Tirole 2010, 11). More in detail, Figure B displays that companies begin to show significant changes in CSR scores between 2009 and 2010. Prior to that period, firm CSR involvement looks overall stable across years. Starting form 2009, then, corporate performance becomes scattered indicating a likely volatile execution and suggesting the presence of a variety of CSR patterns adopted by firms.

Similarly, Figure C reports ASSET4 data on the use of a CSR strategy by international companies between 2005 and 2013. In this regard, ASSET4 analysts collect information and document whether firms set explicit targets or objectives to be achieved through interlocking environmental, social, and governance (ESG) issues into their strategy and day-to-day decision making. Accordingly, in 2013 only 20% of firms have a strategy which integrates ESG elements and establishes formal goals. Figure C also displays the frequencies of two CSR-focused governance structures (CSR Committee and CSR Report) for comparison purposes. The contrast emphasizes the low character of the diffusion of CSR strategies across organizations.

Overall these primary findings indicate the existence of a gap in execution and suggest the presence of some obstacles preventing firms from elaborating clear, comprehensive and effective strategies to pursue CSR objectives.

Accordingly, both researchers and professionals have recently highlighted the difficulties that corporations face when incorporating social and environmental aspects into business processes and have particularly indicated the existence of a divide between good intentions and execution (Epstein 2010; Berns et al. 2009).

FIGURE C. CSR strategies in the period 2005-2013
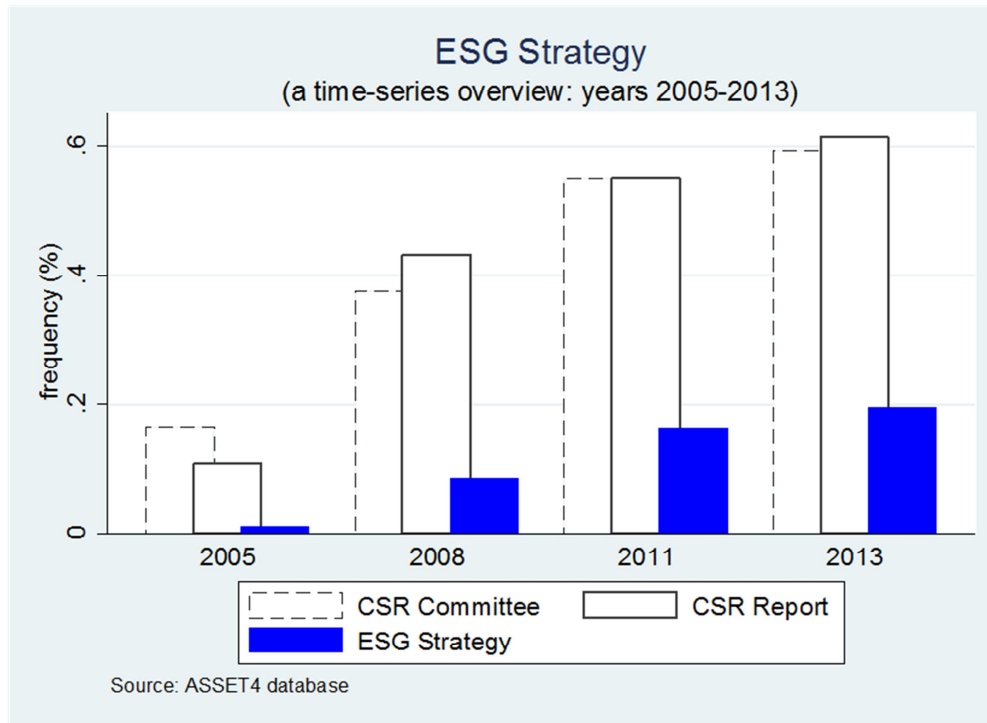
Some authors suggest that many of these challenges are associated with conceptual and practical problems with management control and performance measurement systems integrating social and environmental information and providing guidance and control on how to succeed in CSR actions (Epstein 2010; Berns et al. 2009).

For an accounting perspective, "as changes occur in corporate concepts and accountability for the environment and the society, the demands for different flows of information – accounting and otherwise – are also growing" (Hopwood 2009a, 433). While organizational concern about CSR is increasing, so is interest in accounting for the social and the environmental aspects of the business (Gray 2010). As a result, managerial professionals have widely requested management control and performance measurement systems to support organizations in managing environment- and social- related information and foster CSR execution. In the domain of environmental sustainability, for example, both the United Nations Division of Sustainable Development and the International Federation of Accountants have promoted environmental management accounting (EMA) systems by providing government agencies, industry management, accounting professionals and all others with detailed guidelines for effective application (IFAC 2005; UNDSD 2001).

Extended to a broader CSR context, management accounting mechanisms relate to the collation and communication of data – financial and nonfinancial, quantitative and qualitative - about an organization's interactions with the society. These systems are designed to facilitate internal management use in the form of social bookkeeping and information systems (Contrafatto and Burns 2013; Gray 2010; Henri and Journeault 2010). As CSR practices assume a more significant position in the strategic processes of firms, management accounting assumes a growing importance as a set of tools that supply information for both decision-making and control (Zimmerman 2000). Based on this information, firms are able to make strategic decisions to achieve social and environmental objectives and provide persuasive evidence supporting the benefits of such actions. This often includes: redesigning cost estimation systems with a social and an environmental focus; integrating CSR aspects into both capital and operating budgeting; adopting a balanced scorecard approach to manage and report CSR information; developing a variety of performance metrics to monitor the key social and environmental opportunities and risks facing the organization; and linking managers' performance incentives to CSR goals.

So far, major barriers to effective CSR actions have been attributed to traditional management control systems (Burritt 2004). For instance, social and environmental costs are assumed to be unimportant, and indirect expenses are usually aggregated with general business overheads. Performance evaluation techniques are dominated by short-term financial accounting rules, which contrast with the multidimensional and long-term nature of CSR performance (Carroll and Shabana 2010; Bénabou and Tirole 2010; Deckop 2006). Performance measurement and rewarding mechanisms often do not include measures and weights that congruently assess social and environmental impacts of individuals and organizational units (profit centers and cost objects), thereby resulting in poor motivation during planning, implementation and control. Finally, there is an absence of accounting for externalities and social cost issues. On this matter, Berns et al. (2009) illustrate three main roadblocks to successfully implement CSR management. Firstly, companies often do not understand what CSR is and what it means concretely, largely because of a lack of information for decision-making. Secondly, companies struggle to model the business case for sustainability because of difficulties identifying, measuring and controlling the tangible and intangible social and environmental aspects of their business. Thirdly, when companies do act, the execution of sustainable policies is often hampered by skepticism of how to institutionalize the eco- and social-agenda throughout the company. Lastly, Epstein (2010) highlights the significant role of organizational culture, leadership and people as informal controls to drive CSR execution. Managerial inertia, costs, lack of requisite skills, organizational

and cultural factors, and the reluctance to change may significantly influence the decision to adopt any application of social and eco-control tools.

In this dissertation, I dig into the role of management accounting systems for CSR execution. In particular, this dissertation aims to shed some light on the design and the efficacy of managerial control mechanisms in the context of CSR. More in detail, I start adopting a broader approach and I explore the characteristics and the role of management accounting in the context of environmental sustainability. Subsequently, I focus the lens of the investigation on the importance and the functioning of managerial rewarding systems used to motivate managers and employees and make them formally accountable for the achievement of CSR targets.

In the first chapter of this dissertation, I focus on environmental sustainability and examine the role of EMA systems for green management execution within firms. Specifically, I review the growing body of EMA research to inform the reader about the characteristics, the benefits and the challenges associated with the use of EMA mechanisms. This chapter is joint work with Michael Burkert and my supervisor Daniel Oyon. The review highlights the relevant aspects of EMA investigated in prior studies. In addition, I reveal unexplored facets that need to be investigated to complement existing literature and to provide useful knowledge for managers and policy makers to design effective green practices. More specifically, I emphasize the importance of developing new theoretical hypotheses to gain understanding on the use of these practices. For example, sociopolitical argumentations and psychological considerations may explain the case of applications of EMA practices not justified by rational profit-maximization theories. Similarly, a multiple theoretical approach which integrates organizational social psychology, information economics, and cognitive psychology might serve to investigate the extent to which EMA is required and explore the rationality of managers in green management decisions. On the other hand, I suggest appropriate research designs to empirically investigate new aspects of EMA. To give some example, unexplored facets of EMA include the multiple and complex dimensions of environmental performance, the role of informal control systems, the case of eco-controls practiced by non-accountants, and the characteristics of EMA across SMEs, non-manufacturing organizations and in developing countries.

Among the issues addressed in the review of the literature, I highlight the extant lack of understanding about the role played by environment- and, more in general, CSR-linked incentive systems assigned to managers and employees in form of compensation plans. Given their theoretical crucial function for strategy execution (Prendergast 1999), in the remaining two chapters of this dissertation I make an attempt to empirically examine the characteristics and the

functioning of compensation contracts linking managers' and employees' pay to the CSR performance of the firm.

The second chapter of this dissertation examines the determinants influencing corporate provision of incentives for the attainment of environmental targets. This chapter is a joint work with my supervisor Daniel Oyon. First, we draw on agency (Milgrom and Roberts 1992) and institutional theory (Ansari et al. 2010; DiMaggio and Powell 1983) and propose two sets of hypotheses that, alone or combined, clarify a firm's choice to insert environmental performance measures in compensation contracts of managers and employees. Second, we use theoretical predictions from the literature on the diffusion of management practices (Ansari et al. 2010; Rogers 1995; DiMaggio and Powell 1983) to explain a firm's decision about the timing of green incentive adoption. Empirically, we conduct our analyses over of cross-industry sample of 829 global listed firms that, in the years 2007-2013, responded to the Carbon Disclosure Project investor survey.

In line with agency theory (Milgrom and Roberts 1992), we find that the probability of adopting green incentives increases at the presence of a business policy for green management and higher corporate investment in monitoring environmental performance Consistent with "legitimacy" arguments (Ansari et al. 2010; Reid and Toffel 2009; Cho and Patten 2007; DiMaggio and Powell 1983), social influences, in the form of both country and industry peer pressures, significantly impact corporate provision of green incentives. Additionally, compared to US based companies, international firms are more likely to respond to higher environmental concern through the use of green incentives. The results are only in part consistent with rational and social accounts explaining the diffusion of managerial practices across organizations (DiMaggio and Powell 1983). Specifically, we find that an earlier establishment of an environmental policy is associated with earlier corporate use of green incentives, while industry-peer pressure impacts later adoption. However, country peers influence earlier provision. Finally, contrary to the expectations, companies investing more in monitoring the green aspects of the business are likely to be later adopters, suggesting the need to cumulate knowledge about the informativeness of environmental performance measures before inserting them in compensations contracts.

The third chapter, on the other hand, examines the performance consequences associated with the use of CSR-linked compensation for senior executive contracts across firms. Compared to the prior section, this chapter extends the length of the analysis to the broader CSR concept and focuses on senior managers, who lead the decision-making process and exert significant influence

on overall company performance. The aim of this study is to shed light on the effectiveness in contracting associated with the use of CSR-linked executive compensation. For this purpose, I develop two research questions based on agency theory and corporate governance literature (Armstrong et al. 2012; Milgrom and Roberts 1992). First, I test whether the firm's choice to tie top executives' pay to CSR targets exerts a positive effect on the firm's CSR performance. Second, I explore the CSR outcomes associated with the use of CSR-linked incentives for senior executives in combination with specific CSR-focused governance structures. Empirically, I analyze a cross-industry sample of 5,720 firm-year observations from 783 US listed companies in the period 2002-2013.

Consistent with agency theory predictions, I find that the provision of CSR-linked compensation contracts for senior executives significantly promotes the firm's CSR performance. Specifically, corporate choice to tie senior managers' pay to CSR targets produces positive effects already in the year subsequent to the date of adoption, and increases CSR results monotonically as firms accumulate experience in using this mechanism over the years. Furthermore, the use of CSR-focused advisory and monitoring systems is shown to increase the positive effects of a firm's experience in tying top managers' compensation to CSR targets. In accordance with agency theory and corporate governance research, it was found that companies with higher experience in using CSR-linked executive compensation are associated with even higher CSR outcomes when they have an *ad-hoc* CSR committee established within the board of directors, or when they have publicly disclosed their sustainability performance and actions in a CSR report. In contrast, CSR external audits do not improve CSR performance, suggesting that they are likely to play a merely symbolic role.

In the remainder of this synopsis, I present the abstracts of the three different chapters.

Chapter 1: Environmental Management Accounting Systems: A Review of the Evidence and Propositions for Future Research (Giovanni Battista Derchi, Michael Burkert and Daniel Oyon)

ABSTRACT: Organizations' increasing concern for the environment shows the interest in appropriate mechanisms that account for relevant flows of environment-related information. Today managers and researchers are promoting environmental management accounting (EMA) systems as a means to incorporate the full spectrum of ecological data into day-to-day business decisions and foster green management execution. However, implementation remains a challenge and many of the difficulties are associated with conceptual and practical problems in integrating "green" information and providing guidance on effective implementation. In this context academics might investigate on further explanations on how to achieve excellence in both environmental and financial performance. Hence, this paper substantiates the need for more theoretical and empirical studies on EMA practices and proposes avenues for future research. Specifically, we review the growing body of EMA research to inform the reader about the relevant aspects of EMA examined to date and to reveal unexplored areas that need to be investigated to complement existing knowledge. In particular, researchers might explore the concept of environmental performance and the application of different forms of EMA within organizations. Moreover academics have the opportunity to further examine the role of EMA mechanisms in companies that do not pursue environmental results for economic benefits. Finally, the paper emphasizes the opportunities that new theoretical developments and appropriate research designs offer in the investigation of the remaining gaps in the literature.

Chapter 2: Corporate Provision of Incentives for the Attainment of Environmental Targets (Giovanni Battista Derchi and Daniel Oyon)

ABSTRACT: This paper examines the determinants influencing corporate choice to provide managers and employees with incentives for the attainment of environmental targets. We analyze a cross-industry panel of 829 global listed firms from the 2007-2013 Carbon Disclosure Project investor survey. According to agency theory and social legitimacy, we find that the probability of adopting green incentives increases at the presence of a business policy for green management, with higher investment in monitoring environmental performance and with higher peer pressures. Also, non US firms are more likely to respond to environmental concern by means of assigning green rewards to their employees. Consistent with rational and social accounts explaining the diffusion of managerial practices in the field, an earlier establishment of an environmental policy is associated with earlier corporate use of green incentives, while industry-peer pressure impacts later adoption. However, country peers influence earlier provision. Finally, companies investing more in monitoring the green aspects of the business are likely to be later adopters, suggesting the need to cumulate knowledge about the informativeness of environmental performance measures before inserting them in compensations contracts.

Chapter 3: Does CSR-linked Executive Compensation Promote CSR performance? (Giovanni Battista Derchi)

ABSTRACT: The research described in this paper examines effectiveness of contracting associated with the use of CSR-linked executive compensation across firms. Empirical analysis of a cross-industry sample of 5,720 firm-year observations from 783 US listed companies for the period 2002-2013 revealed that, in accordance with agency theory predictions, the provision of CSR-linked incentives for senior executives promotes firms' CSR performance. Corporate choice to tie senior managers' pay to CSR targets produces positive effects already in the year subsequent to the date of adoption, and increases CSR results monotonically as firms accumulate experience in using this mechanism over the years. Results are robust after controlling for potential endogeneity by means of a 2SLS estimation procedure with instrumental variables. Furthermore, the use of CSR-focused advisory and monitoring systems is shown to increase the positive effects of a firm's experience in tying top managers' compensation to CSR targets. In accordance with agency theory and corporate governance research, it was found that a company's experience in using CSR-linked executive compensation is likely to promote even higher CSR outcomes when a CSR committee is established within the board of directors or a CSR report is publicly disclosed. In contrast, CSR external audits do not improve CSR performance, suggesting that they are likely to play a merely symbolic role.

CHAPTER I

Environmental Management Accounting Systems: A Review of the Evidence and Propositions for Future Research[*†]

Environmental Management Accounting Systems: A Review of the Evidence and Propositions for Future Research

ABSTRACT: Organizations' increasing concern for the environment shows the interest in appropriate mechanisms that account for relevant flows of environment-related information. Today managers and researchers are promoting environmental management accounting (EMA) systems as a means to incorporate the full spectrum of ecological data into day-to-day business decisions and foster green management execution. However, implementation remains a challenge and many of the difficulties are associated with conceptual and practical problems in integrating "green" information and providing guidance on effective implementation. In this context academics might investigate on further explanations on how to achieve excellence in both environmental and financial performance. Hence, this paper substantiates the need for more theoretical and empirical studies on EMA practices and proposes avenues for future research. Specifically, we review the growing body of EMA research to inform the reader about the relevant aspects of EMA examined to date and to reveal unexplored areas that need to be investigated to complement existing knowledge. In particular, researchers might explore the concept of environmental performance and the application of different forms of EMA within organizations. Moreover academics have the opportunity to further examine the role of EMA mechanisms in companies that do not pursue environmental results for economic benefits. Finally, the paper emphasizes the opportunities that new theoretical developments and appropriate research designs offer in the investigation of the remaining gaps in the literature.

1. INTRODUCTION

The organizational focus on environmental sustainability has changed considerably in the past thirty years – from a side topic in the early 1980s to a dominant theme today. Beyond the moral reasons for green development, demands for environmental management also originate from a variety of sources. From a managerial perspective, we can identify a combination of external social and internal business-related factors (Burritt and Schaltegger 2010).

On the one hand, calls for green management arise from social forces outside the organization. Corporations must show material commitment to environmental sustainability in order to comply with green regulations and avoid the deterioration of their reputation, which could potentially result in loss of sales (Marcus and Fremeth 2009). On the other hand managers are committed to environmental sustainability on the basis of an internally developed business strategy. Decisions aimed at solving environmental problems are business-related in nature because they are made to strengthen the competitive position of the company in the marketplace (Burritt and Schaltegger 2010; Carroll and Shabana 2010).

As a result, management leaders and academic researchers alike have generally accepted that corporate environmental aspects must be integrated into business strategy and thus into operational and capital-investment decisions to more effectively manage leading corporations (CIMA 2011; Berns et al. 2009; Epstein 2008). So "it is no longer a discussion of why, what or whether to focus on sustainability, but how" (Epstein 2010, 4). Nevertheless effective execution remains volatile (Epstein 2010), creating challenges for both managers and academics. Several studies indicate that organizations have difficulty integrating green management into day-to-day decision-making and ascribe this implementation gap to defects and breakdowns in planning and execution (CIMA 2011; Berns et al. 2009; Epstein 2010; Mankins and Steele 2005). Some authors suggest that many of these difficulties are associated with conceptual and practical problems of management control and performance measurement systems which seem to be unable to incorporate environment-related information and provide guidance on how to succeed in environmental sustainability (Epstein 2010; Burritt 2004). So far major barriers to effective corporate action have been attributed to conventional management accounting (Epstein 2010; Berns et al. 2009; Burritt 2004). Firstly, environmental costs are generally lumped in with business overheads and green externalities are not accounted for. As a result, companies fail to understand what green management means, largely because of a lack of information for decision-making. Secondly, "performance appraisal techniques are too narrow and short term in their focus" (Burritt 2004, 18), whereas environmental performance is multidimensional and long term

in nature. As such, companies find it difficult to model the business case for environmental sustainability because of difficulties in identifying, measuring and controlling green impacts. Thirdly, rewarding systems do not include the environmental impacts of individuals and organizational units. Poorly motivated organizations are unlikely to deliver targeted outcome. Finally, firms encounter many organizational obstacles in adapting existing control systems to environmental concerns. When companies act, the implementation of sustainable practices is constrained or even blocked by skepticism originating from managerial inertia, lack of requisite skills, organizational and cultural factors, and the reluctance to change.

It is in this context that academics have room to contribute to management accounting research and provide further explanations on how to successfully implement environmental sustainability (Epstein 2010; Henri and Journeault 2010; Burritt 2004).

This work focuses on environmental management accounting (EMA), which refers to the development and implementation of appropriate accounting practices that identify and measure the full spectrum of relevant environment-related information to support business decisions (IFAC 2005; UNDSD 2001). EMA is concerned with the entire set of formal and informal control systems that use financial and ecological information to establish patterns in corporate environmental activities (Henri and Journeault 2010; Burritt 2004). Several recent studies have shed light on the importance of these systems, arguing that EMA represents one of the tools adopted by firms to profit from the potential benefits of environmental performance (Burritt et al. 2002)

Our central aim is to substantiate the claim for more theoretical and empirical work in the field of EMA and to propose directions for future research.

As such we review existing literature on EMA and identify avenues for further investigation. Our analysis indicates that extant research has provided many relevant insights into the various aspects of green management control practices adopted by organizations. We also reveal interesting, unexplored facets of EMA that need to be investigated. We additionally elaborate on the increasing enthusiasm and consensus on green management (Marcus and Fremeth 2009), providing researchers with the opportunity to explore innovative theories and models to better explain the concept of EMA and its applications.

The remainder of this paper is organized as follows. The following section introduces the background of the study. The next section reviews literature on EMA substantiating the need for additional research. We then propose new theoretical developments and research designs that accounting scholars might consider when setting up and structuring future work concerning

innovative aspects of green management control. Finally we summarize the results of our investigation and conclude the study.

2. BACKGROUND

The managerial view of environmental sustainability provides various explanations about corporate needs for green management. We can distinguish two main theories in the related academic research.

Some authors adopt a sociopolitical approach to justify why managers are called for contributing to environmental development. As such, corporations engage with external green-oriented stakeholders to demonstrate that they operate within the bounds of society and behave with "legitimacy" to the extent that their activities are transparent and congruent with societal expectations and managers are fully accountable for their decisions (Mathews 1993; Parsons 1960). In this context, several empirical studies provide evidence of green management tools used by companies to address their exposure to social, legal and political pressures (Cho, Freedman, et al. 2012; Cho, Guidry, et al. 2012; Marquis and Toffel 2012; O'Sullivan and O'Dwyer 2009; Cho and Patten 2007).

In parallel, other academics agree on an economics-based paradigm to explain what drives corporate environmental behavior. According to this line of thought, companies incorporate green aspects into their internal business strategies because of the potential financial benefits related to environmental performance. These business-case arguments contend that firms engaging in environmental activities are rewarded by the market in monetary terms (Schaltegger et al. 2012; Carroll and Shabana 2010). More specifically, organizations allocate resources to responsible eco-efficient activities as they realize that it is possible to increase economic performance while simultaneously strengthening environmental performance. Ecological improvements such as waste reduction, energy conservation, material reutilization and a life-cycle perspective increase productive efficiency, thereby reducing costs (Porter and Linde 1995). Also, superior green performance provides a basis for enhancing corporate reputation and for increasing revenues by satisfying the needs of green consumers (Hart 1995). Finally, the positive association between environmental and economic performance can also be explained by the potential to reduce compliance and liability costs (i.e., by reducing emissions below the required level), as well as to diminish long-term risks associated with resource depletion, pollution, waste management and fluctuations in energy costs and product liabilities (Shrivastava 1995). Thus far, much of the literature has empirically shown that the more enlightened corporations recognize environmentally responsible activities as value-relevant. Firms engage with green-oriented

stakeholders to help improve corporate economic performance through cost reductions and ecological efficiencies, as well as new-market development, first-move advantage, better community relations and an improved image (Dhaliwal et al. 2012; Henri and Journeault 2010; CIMA 2011; Berns et al. 2009; Burnett and Hansen 2008; Epstein 2008; Clarkson et al. 2008; Clarkson et al. 2004; Hughes II 2000; Ditz et al. 1995).

"As changes occur in corporate concepts and accountability for the environment, the demands for different flows of information – accounting and otherwise – are also growing" (Hopwood 2009a, 433). While organizational concern about caring for the environment is increasing, so is interest in accounting for the environment (Gray 2010; Burnett and Hansen 2008). In this context, managerial professionals have widely requested management control and performance measurement systems that support organizations in managing environment-related information and allow firms to foster green management execution. At an institutional level, for example, the United Nations Division of Sustainable Development has promoted EMA systems by providing government agencies, industry management, accounting professionals and all others with detailed guidelines and frameworks for effective application (UNDSD 2001). Additionally, from a corporate perspective, practitioner studies have identified firms that are investing resources to develop new organizational capabilities, including a culture that stimulates and rewards long-term vision, and managerial tools to support performance measurement, business modeling and reporting (CIMA 2011; Berns et al. 2009). Similarly, one line of academic research has focused on defining the concept of EMA and has reported current issues related to ecologically oriented control systems (Epstein 2008; Burritt 2004; Schaltegger and Burritt 2000).

According to this research, EMA refers to the design and implementation of appropriate accounting techniques that identify and measure the full spectrum of physical and monetary, environment-related information to support day-to-day business decisions (IFAC 2005; UNDSD 2001). In particular, "as a specific application of management control systems, EMA has attracted growing attention in recent years as a means of driving firm-wide environmental strategy" (Henri and Journeault 2010, 63). EMA is concerned with the entire set of formal and informal control systems that use financial and ecological information to model environmental decisions (Henri and Journeault 2010; Burritt 2004). As pointed out by Henri and Journeault (2010, 64), ecological management accounting tools are "used to supply information for decision-making to ensure the attainment of environmental objectives and to provide persuasive evidence supporting the benefits of such actions".

"If the business case for environmental sustainability is valid, then companies are more likely to establish EMA systems aimed at quantifying costs and benefits of proactive green management" to support day-to-day business decisions (Burnett and Hansen 2008, 552). This often includes: redesigning cost estimation systems with an ecological focus; integrating environment-related information into both capital and operating budgeting; adopting a balanced scorecard approach to manage and report green sustainability information; developing a variety of green metrics related to ecologically-oriented internal and external value drivers for managerial use; and linking managers' performance incentives to environmental objectives. However, both researchers and professionals have recently highlighted the difficulty that corporations face when incorporating green aspects into business processes and have particularly indicated the existence of a divide between good intentions and execution (Epstein 2010; Berns et al. 2009). Some authors suggest that many of these challenges are associated with conceptual and practical problems with management control and performance measurement systems integrating environment-related information and providing guidance on how to succeed in environmental sustainability (Epstein 2010; Berns et al. 2009). So far major barriers to effective corporate action have been attributed to traditional management control tools. Burritt (2004) outlines several "environmental" criticisms to conventional management accounting. Environmental costs are assumed to be unimportant, and indirect expenses are usually aggregated with general business overheads. Performance evaluation techniques are dominated by short-term financial accounting rules, which contrast with the multidimensional and long-term nature of environmental performance. Performance measurement and rewarding mechanisms often do not include measures and weights that congruently assess environmental impacts of individuals and organizational units (profit centers and cost objects), thereby resulting in poor motivation during planning, implementation and control. Finally, there is an absence of accounting for externalities and social cost issues. On this matter, Berns et al. (2009) illustrate three main roadblocks to successfully implement environmental management. Firstly, companies often do not understand what green management is and what it means concretely, largely because of a lack of information for decision-making. Secondly, companies struggle to model the business case for environmental sustainability because of difficulties identifying, measuring and controlling the tangible and intangible green aspects of their business. Thirdly, when companies do act, the execution of sustainable policies is often hampered by skepticism of how to institutionalize the eco-agenda throughout the company. Finally, Epstein (2010) highlights the significant role of organizational culture, leadership and people as informal controls to drive green management execution.

Managerial inertia, costs, lack of requisite skills, organizational and cultural factors, and the reluctance to change may significantly influence the decision to adopt any application of formal eco-control tools.

As a result, academics have the opportunity to invest more in EMA research to complement existing knowledge and provide further explanations on how to successfully implement green management (Epstein 2010; Henri and Journeault 2010; Burritt 2004).

3. LITERATURE REVIEW

As demands for green management have prompted businesses to adopt EMA systems that facilitate environmental decision-making, academics and managerial professionals have focused their attention on the design of tools and their application. In this review article we analyze the literature with the aim to summarize the key contributions and highlight interesting areas that need to be further explored to complement existing knowledge. For this, we assess both extant theoretical research and empirical work on EMA practices published between 1992 and 2015 in leading accounting journals and academic book series including: The Accounting Review; Journal of Management Accounting Research; Accounting, Organizations and Society; Journal of Accounting and Public Policy; the European Accounting Review; The British Accounting Review; Management Accounting Research; Accounting Forum; Accounting, Auditing and Accountability Journal; Abacus; Australian Accounting Review. In addition, given the continuous publication of new research, we extend our investigation to related scientific manuscripts and professional reports and articles published in the main practitioner journals in order to capture a more comprehensive picture of this novel domain. Despite practical limits on the number of studies included, we believe that the selected sample contains a broad diversity of EMA research published in English and properly covers the relevant literature. Indeed we structure our analysis around the following three main issues:

A. studies analyzing the design of EMA practices and their diffusion across firms;
B. studies analyzing the antecedents influencing the decision to adopt EMA systems; and
C. studies examining the effects of EMA systems on organizational performance.

3.1. Overview of the Literature

3.1.1. Studies Analyzing the Design of EMA Practices and their Diffusion across Firms

TABLE 1.
Articles published from 1992 to 2012 on the design and level of diffusion of EMA systems

Author(s)	Year	Type of study	Methodology	Main analyzed issues
Gray	1992	Conceptual	Commentary	Environmental accounting
Milne	1996	Conceptual	Literature review	EMA systems
Mathews	1997	Conceptual	Literature review	EMA
Parker	2000a	Empirical	Multiple case study	Environmental costing
Parker	2000b	Normative	Multiple case study	Environmental costing
Bartolomeo et al.	2000	Empirical	Survey	EMA systems
Burritt et al.	2002	Normative	Commentary	EMA framework
Epstein	2004	Conceptual	Literature review	EMA systems
Antheaume	2004	Empirical	Single case study	Environmental costing
Lamberton	2005	Normative	Commentary	Sustainability accounting
Lockhart and Taylor	2007	Normative	Single case study	Environmental activity-based-costing
Beiman	2008	Normative	Commentary	Enrivonmental balanced scorecard
Adams and Frost	2008	Empirical	Multiple case study	Sustainability management control systems
Durden	2008	Empirical	Single case study	Sustainability management control systems
Deegan	2008	Empirical	Single case study	Environmental capital budgeting
Dutta and Lawson	2009	Normative	Commentary	Environmental managerial rewarding
Jones	2010	Conceptual	Commentary	EMA and environmental reporting
Joshi and Krishnan	2010	Normative	Commentary	Sustainability management control systems
Schaltegger	2011	Normative	Commentary	Sustainability balanced scorecard
O'Rourke	2011	Normative	Commentary	Sustainability balanced scorecard
Butler et al.	2011	Normative	Commentary	Sustainability balanced scorecard
Cooper and Pearce	2011	Empirical	Multiple case study	Environmental perf. measurement systems
Bowen and Wittneben	2011	Empirical	Literature review + Opinion workshop	Carbon accounting
Burritt et al.	2011	Empirical	Multiple case study	Carbon management control systems
Horváth and Berlin	2012	Normative	Single case study	Environmental target costing
Gond et al.	2012	Conceptual	Commentary	Sustainability management control systems
Deegan and Islam	2012	Empirical	Content analysis	Environmental managerial rewarding
Hartmann et al.	2013	Conceptual	Literature review	Carbon management control systems
Passetti et al.	2014	Empirical	Survey	Sustainability management control systems
Bebbington and Larrinaga	2014	Conceptual	Commentary	Sustainability accounting
Burritt and Schaltegger	2014	Conceptual	Literature review	Sustainability accounting in the supply chain
Dillard and Layzell	2014	Normative	Single case study	Sustainability accounting
Burritt and Schaltegger	2014	Conceptual	Literature review	Sustainability accounting in the supply chain

Main contributions

As outlined in the introduction, in the last 24 years research linking accounting to the concept of environmental sustainability has received growing attention in both academic and professional accounting literature. Table I reports a series of articles analyzing the design of EMA practices and the diffusion of these systems across firms. The majority of these works were published after 2000, indicating the newness of the field. In particular approximately 70% of these publications

were published post-2005, indicating the even stronger attention given to ecologically oriented control in the last ten years under investigation. Empirical, conceptual and normative papers have been equally distributed throughout the entire period, showing that environmental managerial control is likely to be still considered at an embryonic stage among both scholars and practitioners. Prescriptive commentaries and case studies have been the most used methodologies, equally adopted throughout the time span analyzed.

One sustained group of studies adopts a broader approach examining the diffusion of the concept of EMA across firms and addressing some of the main conceptual and practical problems encountered while designing and implementing green management-control systems. More specifically, the first publications linking accounting with sustainability focus on the deficiencies of conventional accounting in measuring and managing sustainability related information (Schaltegger and Burritt 2000; Mathews 1993; Milne 1996; Gray 1992). The studies also highlight the limits of the underlying philosophy of accounting, which conventionally focuses on financial measures of corporate economic activities (Mathews 1993; Milne 1996; Gray 1992). Some authors report current practices and provide guidance on how to model effective EMA tools. For instance, Bartolomeo et al. (2000) report and analyze the results of a trans-European project to investigate actual and future links between environmental management and management accounting functions of a company. Later Burritt et al. (2002) propose a comprehensive framework providing a structure for managers to understand and assess the variety of EMA tools that have been developed, with the intention of encouraging their adoption. Epstein (2004) provides a review of the progress made in both academic literature and corporate practice starting from 1970, finding little evidence of advances in the integration of social and environmental impacts into management decisions. More generally, Lamberton (2005) consolidates the various approaches taken by researchers to link accounting to sustainability, proposing a broad sustainability accounting framework aimed at measuring performance and producing consistent information for potential internal and external users. Adams and Frost (2008) interview managers from four British and three Australian companies in different industries and describe high variation in how firms develop and use key performance indicators for decision-making, planning and performance management. Durden (2008) analyzes the case of a small, privately owned New Zealand manufacturing business that explicitly subscribes to social responsibility and stakeholder principles. In this organizational context, the author finds that formal management control systems of the observed organization do not measure or monitor social responsibility. By elaborating on the case evidence, he proposes a framework aimed at

integrating both formal and informal control mechanisms with social responsibility. Jones (2010) develops a multilayered theoretical model to conceptually argue about the inadequacy of current accounting systems and call for a corporate innovation and experimentation of novel measurement mechanisms to assess industry's environmental impact. Gond et al. (2012) have adopted a configuration approach to develop different organizational patterns that reflect the various roles and uses of management control tools for the integration of sustainability within organizational strategy. The integration encompasses three specific dimensions: technical, organizational and cognitive. The authors elaborate on eight configurations to show how management accounting systems and sustainability control mechanisms can be linked, and how these tools can prevent or facilitate the emergence of sustainability at a strategic level. Recently, Passetti et al. (2014) run an extensive survey among Italian organizations and document the diffusion of specific mechanisms for sustainability accounting in decision making (e.g.: environmental budget, environmental cost accounting, environmental life cycle assessment, environmental performance indicators, eco-efficiency analysis). The results show that only a small set of firms implement these mechanisms while the majority of companies being more conservative. Further, sustainability accounting tools are mainly used for monitoring internal compliance and operating efficiency. After 30 years of research on social and environmental accounting, Bebbington and Larrinaga focus on "the frustrations expressed in the literature over the perceived lack of progress made by social and environmental accounting towards addressing sustainable development" (2014, 395). Subsequently, they explore the possibilities emerging for accounting based on sustainability science perspective. Dillard and Layzell (2014) adopt a normative framework to examine the case study of Intel Corporation and describe the meaning and operationalization of corporate responsibility in various dimensions. Overall, they highlight how corporate responsibility has been integrated over time into organizational processes by means of establishing various responsibility centers. Also, they document that in Intel Corporation corporate responsibility is mainly viewed through a financial viability lens. That is, a potential for a business case dominates the representation ad operationalization of corporate responsibility.

Another stream of research investigates issues related to EMA by focusing on the current diffusion and appropriate design of specific eco-practices such as cost accounting (Horvath and Berlin 2012; Deegan 2008; Lockhart and Taylor 2007; Antheaume 2004; Bebbington et al. 2001; Joshi et al. 2001; Parker 2000a; Parker 2000b; Ditz et al. 1995), performance measurement (Cooper and Pearce 2011) and management incentives (Deegan and Islam 2012; Dutta and

Lawson 2009). By taking a broader view, some studies call for an expanded role of management control and speculate on a more structured concept of sustainability management control on the basis of the balanced scorecard approach that accounts for business-relevant market and non-market factors (Joshi and Krishnan 2010; Schaltegger 2011; Rourke 2011). This leads in particular to the use of balanced scorecard and strategy mapping practices to address green challenges (Butler et al. 2011; Beiman 2008). Other scholars focus on sustainability concerns in specific organization's activities. Burritt and Schaltegger (2014, 327) describe "the potential function of accounting as catalysts moving organizations towards sustainability in production and supply chains". In particular, they explore what accounting systems for sustainability in production and supply chains would look like. Accordingly, they highlight three main ongoing problems: (1) lack of consensus on scope and terminology; (2) lack of broad sustainability focus from decision makers, partly because of the legal boundaries of firms and technical complexities associated with open-book computations; and (3) the need for trans-disciplinary teams to facilitate a process orientation consistent with the supply chain.

Other contributions focus on management control approaches dealing with specific environmental concerns. Carbon management control is maybe the most prominent theme. Burritt et al.(2011), through field work, elaborate on the practices of ten leading German companies to create a dedicated framework, while Bowen and Wittneben (2011) highlight the tensions between accuracy, consistency and certainty in carbon emission computation both within and across distinct organizational fields. Hartmann et al. (2013) review the extant literature on carbon accounting and identify key theoretical and empirical challenges potentially to be addressed by future research on management control and performance measurement.

Open issues

Four relevant areas for research can be identified with this literature review. Firstly, while contributing to the development of tools, this literature is mostly prescriptive or based on case studies. Hence there is room to complement existing knowledge by examining large-scale empirical evidence. Recent studies have addressed this gap by exploring the empirical aspects of EMA practices in extensive cross-sectional settings. Some initial surveys have examined the characteristics and level of diffusion of EMA systems in a number of countries and cultures (CIMA 2011; Gates and Germain 2010; Berns et al. 2009). Nevertheless, accounting scholars have recently reported that there is still not a great deal of extensive and longitudinal empirical evidence published in scientific journals examining the applicability of these ecological practices recommended by professionals and researchers (Henri and Journeault 2010). Additionally, most studies have focused their investigations primarily on materially sensitive environmental industries, while the demand for green management originates from all organization types (Berns et al. 2009; Sinkin et al. 2008). Thus there is a need for large-scale studies to test whether and to what extent green control patterns and propositions developed for single-organizational or industrial case studies could be generalized and applied to different samples.

Secondly, much of the work on management control and performance measurement in the field of environmental sustainability has focused on the role and design of formal systems rather than informal ones, despite the widely recognized reliance on soft or informal mechanisms such as organizational culture, leadership, learning and people (CIMA 2011; Epstein 2010; Berns et al. 2009; Durden 2008; Hart 1995). Empirical evidence from leading corporations suggests that informal controls may be more important than formal systems and processes in driving sustainability implementation. Additionally, results demonstrate that soft controls are probably more important than previously thought (Epstein 2010; Norris and O'Dwyer 2004).

Thirdly, recent surveys have indicated that environmental accounting is now practiced by more than just accountants (CIMA 2011; Berns et al. 2009). Some authors have suggested that, as environmental decisions are distributed throughout organizations, managers at all levels are being asked to simultaneously manage environmental and financial performance (Epstein 2010; Burritt et al. 2002). Indeed the forms of economic calculation that green accounting creates are now a part of most managerial functions. However, as mentioned by Hopwood (2007, 1370), "we still lack understanding of the processes and pressures underlying the shifting locations of economic calculation and control in the wider management accounting area". Also, both theoretical contributions and empirical evidence indicate that accountants are "equipped with tools and

techniques that ensure businesses understand the scale of environment-related problems, create viable solutions and implement these solutions properly" (CIMA 2011, 2; Hopwood 2009a). Some studies have suggested that management accountants have a "pivotal role in providing business intelligence to support strategic decision-making" (CIMA 2011, 2; Henri and Journeault 2010; IFAC 2005; UNDSD 2001). Indeed "without the rigor and business acumen of the accounting and control function, it may result impossible to embed environmental sustainability into day-by-day business life" (CIMA 2011, 2). Burritt and Schaltegger (2010) in particular have indicated that the failure of management accountants to provide necessary guidance to other departments or to get involved in key decisions on ecological initiatives and climate-change compliance could result in higher costs, lost opportunities and, thereby, poor execution.

Finally while environmental sustainability is viewed as a growing priority for businesses of all sizes at a global level, only a few empirical studies have focused on how small and medium-sized enterprises (SMEs) can implement sustainable business practices to benefit the environment, their communities, their customers and their bottom lines (CIMA 2011; Durden 2008; Burritt 2004). Moreover relevant topics such as the design and level of diffusion of EMA practices across organizations operating in developing countries remain largely unexplored. As such, there is an opportunity to complement the existing EMA knowledge by investigating the role and different applications of eco-control tools used by SMEs and firms in developing countries.

3.1.2. Studies Analyzing the Antecedents Influencing the Decision to Adopt EMA Systems

Main contributions

Another group of studies focuses on the antecedents that explain the decision to adopt EMA tools for managing environment-related information appropriately. As can be seen in Table II, all studies are conducted post-2000, with the majority post-2010. Approximately 30% are elaborate on survey methodology, while the remaining 70% are case study-based.

TABLE 2.

Articles published from 1992 to 2012 on antecedents of EMA systems

Author(s)	Year	Type of study	Methodology	Main analyzed issues
Frost and Wilmshurst	2000	Empirical	Survey	EMA systems
Bouma and Kamp-Roelands	2000	Empirical	Single case study	Environmental management information systems
Gago	2002	Empirical	Multiple case study	Environment-related make or buy decision
Ball	2005	Empirical	Single case study	Environmental accounting
Perego and Hartmann	2009	Empirical	Survey	Environmental perf. measurement systems
Gates and Germain	2010	Empirical	Survey	Sustainability perf. measurement systems
Quian et al.	2011	Empirical	Multiple case study	Waste management control systems
Figge and Hahn	2013	Normative	Commentary	Environmental performance evaluation
Rodrigue et al.	2013	Empirical	Single case study	Environmental perf. measurement systems
Pondeville et al.	2013	Empirical	Survey	EMA systems
Bouten and Hoozée	2013	Empirical	Multiple case study	EMA and environmental reporting
Virtanen	2013	Empirical	Single case study	Environmental perf. measurement systems
Moore	2013	Empirical	Single case study	Water management accounting
Contraffato and Burns	2013	Empirical	Single case study	Sustainability management control systems
Spence and Rinaldi	2014	Empirical	Single case study	Sustainability accounting in the supply chain
Parcker	2014	Empirical	Multiple case study	Corporate social accountability
Christ	2014	Empirical	Survey	Water management accounting

More specifically some studies adopt a contingency approach to identifying and testing significant factors that fit corporate uses of different EMA systems in a variety of contexts. For instance, Frost and Wilmshurst (2006) report and analyze survey data from CFOs of Australian companies to examine the environmental sensibility of the industry as a factor associated with the adoption of environmental cost accounting and management control practices. Their findings indicate that, although environmental practices are more likely to occur in environmentally sensitive firms, the adoption of EMA procedures does not appear to be driven solely by the environmental sensitivity of the industry. Hence the two authors conclude that further research is needed to identify what other determinants cause organizations to adopt eco-control practices. In the context of a single production site of a Dutch multinational chemical company, Bouma and Kamp-Roelands (2000) report that expectations of different stakeholders influence the content of the set of green information that managers choose to collect and measure while designing and implementing a structured environmental management system. Gago (2002) examines an ecologically-oriented make-or-buy decision taken in 11 Spanish environment-sensitive companies and finds financial considerations are the main determinants of structured use of cost and benefit analysis. Similarly Gates and Germain (2010) use survey data from financial controllers of 79 big firms operating in France and find that industry type and stock-market listings influence the choice of integrating sustainability metrics into strategic performance measurement systems. However, the authors do not find any association between the presence of sustainability measures and organizational strategy or nationality of the company. Pistoni and

Songini (2009) adopt a case-study approach focusing on one of the largest Italian enterprises in the energy sector, to analyze why and how the firm decides to align its performance measurement and evaluation systems to its formulated environmental strategy within a broader corporate social responsibility approach. Finally Perego and Hartmann (2009) combine contingency theory with an agency perspective and examine a sample of manufacturing firms in the Netherlands. In particular, they observe that the relationship between environmental strategy and the use of performance measurement systems is mediated by some attributes of EMA tools and specific properties of the measures adopted. Contrafatto and Burns (2013) document the development of social and environmental accounting practices (SEAR) as cumulative processes across the evolution of an Italian multinational organization over 8 years. They highlight the "processes of change through which SEAR practices become elevated to strategizing status" but also show "how institutionalized assumptions of profit seeking limit the extent to which broader sustainability concerns become infused into day-to-day business practices" (2013, 349). Overall, the authors shed some light on the role of management control systems in facilitating the cumulative path of SEAR practices, but highlight the need for firms to be caution against an uncritical reliance upon conventional management accounting mechanisms. Virtanen et al. (2013) focus on energy efficiency measurement systems in a single case study plant at Borealis Polymers, in Finland. The authors shed light on the technical complexities associated with the measurement and management of energy efficiency. So, they note how these complexities constraint an effective use of management control systems. Consistent with agency theory predictions (Milgrom and Roberts 1992), technical complexities impact the ability and motivation of employees to work towards corporate sustainability goals. As a performance indicator does not technically allow accurate measurement of the plant's energy efficiency, setting individual targets based on this parameter results particularly problematic. Based on data gathered through 15 interviews with finance and environmental manages of four Belgian companies, Bouten and Hoozée (2013) investigate the interplay between environmental reporting and EMA systems as response mechanisms to changes in environmental pressures - in the form of environmental regulation, green consumerisms, and, more generally, societal expectations. Overall, they find that the intensity of the environmental pressures, top management commitment, and the presence of an environmental champion are important contingent conditions in explaining the development of this interplay. Using survey data from 256 French manufacturing companies, Pondeville et al. (2013) find that perceived ecological uncertainty, and, on the other, market, community and organizational stakeholders are, respectively, negatively and positively associated with the firms'

development of a proactive environmental strategy as well as the use of environmental information systems and formal EMA systems. Rodrigue et al. (2013) note that managers of a large multinational firm operating in an environmentally sensitive industry make decisions on how to use environmental performance indicators based on the perceived impact on specific stakeholders and the company's need for legitimization. Figge and Hahn (2013) disaggregate the concept of corporate eco-efficiency and identify the drivers of an efficient use of environmental resources. Specifically, they develop an example of this decomposition by examining the carbon-efficiency of major car manufacturers worldwide and show that the drivers of economic capital efficiency and eco-efficiency are not fully congruent. Lastly, Parker (2014) conducts an historical analysis of four leading British industrialists of the 19th and early 20th centuries. Interestingly, he finds that corporate orientation towards social accountability reflects the moral responsibility of the leaders and their intention to concretely connect their personal beliefs with actions for the common good.

Other contributions focus on the public sector and adopt an institutional perspective to shed some light on company motivations that drive the decision to introduce EMA tools. For instance, Ball (2005) finds that environmental accounting is used by UK local officers to measure relevant eco-aspects of their activities and externally report on the basis of gradual political, functional and social pressures. More recently, Qian et al. (2011) have conducted a field analysis over 12 local councils in New South Wales (Australia) investigating the main motivations that drive the use of EMA information for waste management in local government. The authors combine an institutional and contingency-based approach and find that social structural pressures (regulatory pressures from different environmental regulatory bodies, green expectations from local communities and influences from peer councils) and organizational contextual factors (uncertainty in waste and recycling management facing the council, and the council's strategic position for waste management) contribute to explain the development of EMA practices in a complementary manner. In a different field, Moore (2013) conduct a longitudinal case study of an Australian public sector water business and investigate how and to what extent the institutionalization of internal sustainable and environmental management practices occur over the period 2001 to the beginning of 2011. The results show the intended/unintended consequences of the political context on the development of management accounting practices and routines with regard to water conservation.

Finally, a group of studies focus on sustainability control practices in production and supply chains. Specifically, Spence and Rinaldi (2014) use a governmentability lens and four analytics of

government to explore whether and how a company manages social, environmental and economic issues relating to suppliers, as a means to exercise power and authority. In the context of a single supply chain within a major grocery chain in the UK, the authors find that managers embed the social and environmental impact of the firm's actions into decision-making as the latter are instrumental to economic results. Drawing on contingency and new institutional sociology, Christ (2014) notes that organizational size, regulatory pressure and corporate environmental strategy are consistent drivers of water management accounting use among organizations in the Australian wine industry. Moreover, the achievement of a certified environmental management system and the involvement of managers with industry associations affect independently the use of sustainability-linked monetary and physical information in management control and decision making.

Open issues

Much of this literature has adopted an economic perspective and identified relevant drivers that influence the decisions to implement and design EMA tools that facilitate and maximize economic value creation. However, previous management accounting research has indicated that economic models do not themselves constitute a valuable assessment instrument to explain phenomena in case of departures from their implied assumptions (Hopwood 2007; Ball and Brown 1968). For instance, "some capital budgeting literature has suggested that accounting information may be used more to justify decisions that have already been taken rather than being an aid to decision-making" (Drury and Tayles 1995, 272). If environmental cost information is used mainly for legitimizing/rationalizing purposes, then organizational participants should perceive it as accurate or reliable rather than simply meeting the accuracy requirements specified by rational economic theory (Drury and Tayles 1995). Furthermore, some companies may have chosen not to make fundamental changes in their control processes by means of integrating environmental data into their managerial control practices, even when facing substantial changes in their competitive environment. Notably, academics have suggested that "there are many barriers to adopting or changing accounting systems, including management inertia, high costs, lack of requisite skills, organizational and cultural factors, and reluctance to abandon existing systems" (Drury and Tayles 1995, 278). "Hence it is dangerous to conclude, in the absence of further empirical testing, that a lack of substantive meaning implies a lack of utility" (Ball and Brown 1968, 160). Therefore, explanations for variations in the role and different applications of the observed eco-control practices must be explored also by using other theories that are beyond

the win-win economic perspective. Indeed as we argue about these remaining gaps in the literature, we can also appreciate the importance of having in managerial accounting a tradition of research that focuses on the organizational, social and political facets of the subject (Hopwood 2007). In fact, previous research in the area of management control has illustrated "the need for an understanding of how the wider political context, organizational structure and culture, and individual psychological factors mediate the use of accounting data and thereby its consequences" (Hopwood 2007, 1368). Indeed as mentioned by Hopwood (Hopwood 2009b, 890), "a diversity of understanding is fundamental in a complex and changing world where knowledge is an emergent process rather than a more static straightforward endeavour".

3.1.3. Studies Examining the Effects of EMA Systems on Organizational Performance

Author(s)	Year	Type of study	Methodology	Main analyzed issues
TABLE 3. Articles published from 1992 to 2012 on consequences of EMA systems				
Lanen	1999	Empirical	Archival research	Environmental perf. measurement systems
Norris and O'Dwyer	2004	Empirical	Single case study	Formal and informal environmental controls
Epstein and Wisner	2005	Empirical	Survey + Interviews	EMA systems
Dunk	2005	Empirical	Survey	EMA systems
Wisner et al.	2006	Empirical	Survey	Environmental planning
Campbell et al.	2007	Empirical	Survey + Archival research	Environmental managerial rewarding
Perez et al.	2007	Empirical	Multiple case study	EMA systems
Wisner et al.	2009	Empirical	Survey	EMA systems
Henri and Journeault	2010	Empirical	Survey	EMA systems
Ferreira et al.	2010	Empirical	Survey	Environmental costing
Neumann et al.	2012	Conceptual	Commentary	Sustainability perf. measurement systems
Eccles et al.	2013	Empirical	Archival research	Environmental managerial rewarding
Dutta et al.	2013	Conceptual	Analytical	Sustainability managerial rewarding
Arjaliès and Mundy	2013	Empirical	Survey	Sustainability management control systems
Tang and Luo	2014	Empirical	Archival research	Carbon accounting
Thomson et al.	2014	Empirical	Single case study	Sustainability accounting
Henri et al.	2014	Empirical	Survey	Environmental costing
Chan et al.	2014	Conceptual	Simulation	EMA
Lee and Wu	2014	Conceptual	Single case study + simulation	Environmental perf. measurement systems
Thomson et al.	2014	Empirical	Multiple case study	Sustainability accounting

Main contributions

The last group of studies (Table III) examines the role of EMA tools by focusing on the most relevant implications related to the design and adoption of the observed green control practices. More specifically, this part of the literature has examined the relevance of EMA practices to helping organizations achieve excellence in terms of both environmental and financial

performance. Except for Lanen (1999), all articles were written post-2000 and are highly concentrated post-2007. The majority adopted a survey-based methodology.

Consistent with the rationale behind the managerial case for green sustainability, several normative statements and professional studies provide prescriptive indications of the three central functions performed by ecologically oriented control tools when embedded in an organization, its strategy and operations (CIMA 2011; IFAC 2005; German Federal Ministry 2003; UNDSD 2001). Firstly, EMA mechanisms safeguard and stimulate corporate strategy by taking into account capital environmental expenses and by supporting the marketing of green products, services and reputation-reinforcing initiatives. Secondly, they promote eco-efficiency by controlling operating practices for material and energy flows. Finally they support environmental protection by helping to ensure the cost-effective implementation of ecological initiatives and monitoring to avoid safety and environmental incidents. Other lines of research empirically test the effectiveness of EMA mechanisms and their impact on environmental and economic performance.

Some authors focus on specific EMA mechanisms. For instance, Lanen (1999) finds that the adoption of non-financial, environment-related performance metrics at 3M Corporation is positively linked to the successful results of a five-year project on waste minimization in 55 plants. However, Lanen does not detect any association between explicit incentives to monitor plant performance and waste ratio. Similarly, other scholars examine the role of environment-related information on top management compensation. Campbell et al. (2007) find a positive relationship between environmental performance and the green components of CEOs' compensation plans implemented in a sample of US-based corporations. More specifically, the authors note the existence of a risk premium in compensating CEOs for incremental personal, environmental and economic risks in more environmentally sensitive industries. Also, using archival data from a sample of 207 S&P 500 firms in the United States, Cordeiro and Sarkis (2008) find a significant impact of firm-level environmental performance on CEO remuneration levels in firms that explicitly report the presence of a contractual link between green performance metrics and executive compensation. Alternatively, Wisner et al. (2006) examine the role of environmental planning using survey data from a sample of 215 large-base firms. The authors find a positive relationship between environmental strategic planning and green economic performance. Moreover, they identify a number of techniques, systems and managerial attitudes that form a package of formal and informal EMA mechanisms. Ferreira et al. (2010) examine a sample of large Australian businesses in various industries and report a positive association

between the extent of use of environmental cost accounting systems and process innovation level. However, they do not find any link with product innovation intensity. Additionally strategy does not seem to affect green costing use and innovation. Dutta et al. (2013) focus on performance measurement systems and develop an analytical model to demonstrate three different environmental benefits of inserting green sustainability objectives into employees' incentive schemes: (1) positive natural outcome congruent with pursuing economic efficiency through waste minimization; (2) societal gains, potentially incongruent with short-term economic goals; and (3) positive changes in optimal output level. In particular, the authors highlight the need for companies to design formal compensation systems that reward employees' efforts towards those environmental benefits that would not occur as an indirect, unintended effect of profit maximization behavior. Henri et al. (2013) analyze the consequences of environmental cost accounting systems using survey data from a large sample of Canadian manufacturing firms. They find that the tracking of environmental costs mediates the relationship between corporate environmental performance and economic performance. Second, they find this indirect effect to be moderated by the firm's environmental motivations, with business-oriented firms showing greater effect as compared to sustainability-oriented ones. In the context of the design of eco-friendly product, Chan et al. (2014) develop a simulation analysis to integrate Life-Cycle Assessment (LCA), fuzzy Analytical Hierarchical Process (AHP) and EMA concepts and create a higher efficient measurement model. This would permit to assess the environmental and organizational performance of different product designs and help designers diminishing their reliance on LCA. This novel measurement approach could support companies in reducing development lead time by screening out undesirable design options. Lastly, Lee and Wu illustrate the benefits associated with the use of a multi-methodological approach while integrating sustainability performance measurement in the field of logistics and supply networks. In particular, they develop a single illustrative case study of Westgate Ports, in Australia, to validate the applicability and usefulness of the proposed approach. As a result, the authors demonstrate the greater effectiveness of simultaneously using performance indicators from different perspectives and integrating them into one single measurement model to improve sustainability performance.

In contrast other academics adopt a broader approach to investigate the concept of eco-control. Norris and O'Dwyer (2004) examine a case study in a UK retail company and indicate the dominant influence of informal controls such as organizational culture and personal values in driving socially responsive decision-making in managers. Epstein and Wisner (2005) study a

random sample of 236 Mexican manufacturing plants and find that environmental compliance is positively influenced by various eco-controls, such as plans and procedures, belief systems, measurement systems and reward systems. In addition, using a sample of 119 area managers from manufacturing companies across Australia, Dunk (2005) indicates that, at organizational level, the integration of environmental information into management control mechanisms is positively linked to non-financial performance. Perez et al. (2007) elaborate on evidence from managers of 10 Eco-Management and Audit Scheme (EMAS) registered production sites in Spain and illustrate how the use of green data in strategic planning and other management accounting practices drives environmental performance improvement. Henri and Journeault (2010) investigate a large sample of Canadian manufacturing firms and observe the manner in which formal eco-control tools contribute to organizational performance. Their results indicate that, in a context of high environmental exposure, high public visibility, high environmental concern, and larger size, eco-control practices have no direct impact on financial outcomes but there appears to be a mediating effect of environmental performance on the link between eco-control and economic performance. Wisner et al. (2009) examine data from a cross-section of US-based industrial firms and demonstrate a positive indirect relation between the use of green information in capital equipment decisions and firms' environmental performance, mediated by the level of corporate environmental proactivity. Neumann et al. (2012) speculate on prior experimental literature and argue that adding environmental and societal information into managerial reports contributes to managers' information overload and bias the interpretation and the use of performance measures. Eccles et al. (2013) examine a large cross-industry sample of multinational organizations between 2007 and 2010, and analyze the effectiveness of monetary and non-monetary incentives provided by companies to their employees to reduce carbon emissions. Specifically, consistent with monetary crowding-out motivation theory, their findings report that the use of financial incentives is associated with higher carbon emissions, while the provision of non-monetary rewards is related to lower carbon emissions. Arjaliès and Mundy (2013) shed light on the role of management control systems in managing corporate social responsibility (CSR) strategy within a sample of 36 French companies, members of the CAC 40. The authors provide evidence of management control systems used by firms as effective "levers of control" (Simons 1995), enabling managers to identify and manage risks and opportunities associated with the firm's CSR strategy, thereby constituting powerful risk management processes able to foster the achievement of strategic objectives. Tang and Luo (2014) explore the consequences of the implementation of carbon management systems (CMS) among a sample of

large Australian firms. Specifically, they find that, on average, firms with an overall higher quality of CMS are associated with better carbon mitigation. More in detail, adequate assessment of risks and opportunities related to carbon emissions, the use of absolute or intensity reduction targets, a higher number of carbon programs and enhanced external reporting appear the most effective factors.

Finally, Thomson et al. (2014) empirically explore the role of accounting systems in shaping sustainability practices in the UK public sector. Specifically, they document the mediating role of "accounting-sustainability hybrids" (otherwise known as social and environmental management accounting practices) in positively affecting the organizations' eco-efficiency, eco-effectiveness, but limited social justice. Also, they find that the implementation of "accounting-sustainability hybrids" create capacity for wider sustainability transformations though their mediating role.

Open issues

We distinguish two sets of interesting open areas when examining this body of research. Firstly, much of the work examining EMA as antecedents of organizational characteristics has analyzed EMA practices primarily at a corporate level. Additionally, the studies have focused on testing exclusively for the presence of linear, explanatory relations between the design and adoption of these tools and companies' performances. On the one hand, few empirical studies have investigated the role of individuals' attitudes and organizational culture in the link between green management control and organizational performance, as well as the conditions under which EMA practices drive managers' behavior within firms (Campbell et al. 2007; Wisner et al. 2006; Norris and O'Dwyer 2004). As a result, we still only have partial understanding of how managers' personal characteristics influence how firms use EMA systems and moderate the extent to which these mechanisms contribute to organizational performance. On the other hand, the existing empirical literature provides little information on how ecologically oriented control tools create value. Few empirical studies have examined how EMA simultaneously contributes to environmental and economic performance (Henri and Journeault 2010). Moreover, other than causal linear form, explanatory links between green control practices and organizational performance remain unexplored. As such, we still do not know whether particular EMA tools improve performance only up to a certain point and then make it worse, conditional on certain contextual factors and specific individual characteristics of the managers using them. As stated in prior research, businesses do not merely want to know that more or less EMA is better, but how

much EMA is optimal (Luft and Shields 2003). Therefore there seems to be opportunity to further investigate these questions.

Secondly, prior research has emphasized the lack of consensus on the definition and operationalization of environmental performance (Henri and Journeault 2010; Xie and Hayase 2007; Ilinitch et al. 1998). More specifically, academic researchers have recognized the complexity and multidimensional nature of the concept. In particular, Ilinitch et al. (1998) have mentioned that green performance appraisal requires measurement of non-financial performance, evaluation under significant levels of uncertainty, assessment over a long-term time frame and aggregation of multiple types of metrics. Accordingly, Burritt (2004) and Burritt et al. (2002) highlighted the long-term time dimensions of environmental performance. Burritt and Schaltegger (2010) have mentioned the corporate need for identifying and measuring environmental externalities that may influence organizational behavior. Other authors have suggested that "the notion of green performance covers various dimensions, analogous to the broad concept of performance that is not limited only to financial aspects but also integrates other aspects such as customer satisfaction, productivity, quality and innovation" (Henri and Journeault 2010, 65). Moreover, the accounting profession appears to be a natural candidate to establish such metrics because its domain typically includes measuring, communicating and regulating information about company performance. However, few studies in the EMA literature have developed comprehensive green performance measurement models (Henri and Journeault 2010; Xie and Hayase 2007; Ilinitch et al. 1998; Epstein 1996). Specifically, much of the empirical work on EMA has continued to examine green performance mainly in terms of the environmental impact of business or environmental compliance (Burnett and Hansen 2008; Sinkin et al. 2008; Cordeiro and Sarkis 2008; Wisner et al. 2006; Campbell et al. 2007; Joshi et al. 2001). A notable exception is the work of Epstein (2008), who has conducted a field project to explore four successful companies operating in different industries and developed a broader model that provides details on the various drivers and the multiple measures used to successfully manage corporate sustainability. Another exception is the work of Henri and Journeault (2010), who has examined a sample of Canadian manufacturing firms and adopted different effectiveness models to define environmental performance. For this purpose, they have identified four key dimensions that collectively constitute the concept of green performance: (i) environmental impact and corporate image; (ii) stakeholder relations; (iii) financial impact; and (iv) process and product improvements. Both theoretical and empirical studies have collectively indicated that green sustainability is still subject to a general lack of understanding and thereby inaccurate

measurability (CIMA 2011; Burritt and Schaltegger 2010; Berns et al. 2009). Hence, accounting scholars have the opportunity to develop more congruent and inclusive environmental performance metrics aimed at defining, measuring and controlling this broad corporate domain.

3.2. Summary of the Findings

All told, this emerging stream of literature has provided many relevant insights into the various aspects of EMA practices implemented within firms. This literature review reveals interesting unexplored facets of environment-related control systems that need to be further investigated. In particular, we have built on the increasing managerial enthusiasm and consensus on green management (Marcus and Fremeth 2009) to provide researchers with the opportunity to complement existing EMA knowledge. Similarly, researchers have the opportunity to explore innovative theories and models that further explain the concept of ecological control, its role and applications. Academics could cumulate knowledge by improving and testing new frameworks, examining novel aspects of the tools, and investigating different applications of these practices. This phase of knowledge development shares some characteristics with the concept of "normal science" as mentioned by Sims (Sims 1996, 112): "textbooks are written and frameworks developed; researchers pose and solve puzzles; and there is a general sense of powerful theories and methods being extended to cover unexplored areas of application". Hence more research is needed in order to accumulate a stock of solutions for green management implementation and to contribute to management accounting and EMA literature.

4. RECOMMENDATIONS FOR FUTURE RESEARCH

As discussed in the preceding section, the extant research on EMA has produced partial explanations about the role and design of ecologically oriented control systems adopted by firms for green management implementation. As such, further research is needed to accumulate the stock of solutions necessary to provide the right guidance and clarification on how to successfully execute green management.

In this section we derive propositions for future explanatory studies and address some recommendations about research design.

4.1. Theoretical Developments

4.1.1. Exploring Alternative Theoretical Propositions

Causal-model forms, used to predict and test organizational causes and effects of EMA tools within firms, are mainly based on economic theories and are linear in nature. As such a

multiplicity of approaches, rather than pure, neoclassical economics, would be required to complement existing knowledge.

On the one hand researchers could adopt alternative perspectives or combine different approaches to increase theories' explanatory and predictive ability as to how the broader political context, organizational cultural, and managers' psychological characteristics mediate the use made of environmental and accounting data and thereby its consequences.

From an organizational point of view, two relevant questions arise: (1) whether EMA is a voluntary management tool designed to help managers, or a tool of social policy by which governments impose their will; and (2) under which conditions it can perform both functions simultaneously. Several studies on the corporate role of environmental disclosure have adopted legitimacy considerations to explain companies' use of external reporting as a tool to reduce exposure to the social and political environment as opposed to a means for signaling an unobservable proactive strategy toward green objectives (Cho, Freedman, et al. 2012; Cho, Guidry, et al. 2012; Cho and Patten 2007). Sociopolitical arguments might similarly shed some light on why some firms do not introduce fundamental changes in their control processes by integrating environmental data into their accounting practices, even amid significant change in their competitive environment. Additionally, a mix of economic and societal interpretations could contribute to explaining green control implementation as a means of obtaining environmental and economic gains simultaneously.

From an individual perspective, EMA is considered to have at its disposal "the right tools to motivate managers' commitment to implement and stimulate positive attitudes towards green initiatives, but it might not produce the expected results due to behavioral problems" (Burritt 2004, 13). People today "expect managers to use resources wisely and responsibly, protect the environment, eliminate harmful toxins in the workplace and communities, and reduce greenhouse gas emissions" (Marcus and Fremeth 2009, 17). Accordingly the moral obligations for green management and environmental social incentives might influence the manner in which managers make effort-level and effort-allocation choices (Norris and O'Dwyer 2004). Moreover, as pointed out by Perego and Hartmann (2009, 406) "managerial effort towards environmental sustainability can only be inferred indirectly and imperfectly through some measures of green performance". The high uncertainty in measuring pollution or any harmful ecological effect as well as stochastic green events risk placing environmental performance outside of the direct control of management (Perego and Hartmann 2009). In this context, environmental psychology could provide innovative insights explaining the interrelationships between the environment and human behavior. In

particular individual ecological knowledge and green conservation attitudes might shed some light on how managers subjectively use environmental information to make judgments and decisions.

On the other hand, accounting scholars could investigate explanatory links other than linear relations in order to explore how ecologically oriented control creates value and to what extent EMA is required for green management execution. Additional theories must to be considered to predict and test non-linear relations. Indeed much of the theory underlying empirical management accounting research assumes curvilinear relations. With this regard, Luft and Shields (2003) mentioned that economic perspectives predict curvilinear functions for individual utility and for organizational costs and profits, while cognitive psychology assumptions predict U-shaped or inverted-U response curves. Accordingly, reward designers would be practically interested in the shape of the curve and try to identify the point at which the expected costs of further environmental incentives outweigh the diminishing expected benefits. Moreover individual attitudes and values towards green sustainability might affect how corporate use of specific environmental performance measures influences managers' learning curves and, in turn, the effectiveness of green business decisions.

4.1.2. Looking at Different Levels of Analysis

So far most explanatory links examined in scientific journals have analyzed antecedents and effects of EMA practices across companies, firms' subunits and other organization entities. As a result, accounting scholars could complement existing EMA knowledge by investigating how managers individually use environmental and accounting information to make green decisions (Norris and O'Dwyer 2004). Researchers might also analyze how the design and use of different green management control practices could be associated with different characteristics of the managers who use them (i.e., values, skills, knowledge and abilities). Hence researchers could focus on examining EMA systems at the individual level of analysis to further understand how to design and use control tools that shape managers' decisions for green management execution. According to extant research in managerial accounting (Luft and Shields 2003), theories from social psychology of organizations and predictions based on information economics and cognitive psychology would be appropriate to examine various aspects of EMA practices at the managerial level. Moreover these perspectives could help academics further explore the debate about individual rationality for environmental management implementation.

4.2. Research Designs

4.2.1. Potential of Case-based and Field Study Design

Researchers have the opportunity to focus on innovative aspects of the role and design of green management control tools within organizations. They would ideally opt for qualitative case or field study designs to allow for the investigation of relevant unexplored facets of EMA. Indeed managerial scholars need to define new constructs and operationalize new variables in order to draw a more complete picture of the concept of ecologically oriented control. For this purpose, academics could start spending time "performing systematic observation, description and classification, which lie at the foundation of knowledge creation" (Kaplan 2011, 371). A more informed basis for these aspects would lead to stronger modeling, theory-building and hypothesis-testing activities (Kaplan 2011).

We identify three specific new areas for investigation. Firstly, accounting researchers should further examine the role of informal control systems, such as organizational culture, leadership, learning and people, to drive green management execution. For instance, as suggested in the literature (Epstein 2010), soft factors such as managerial inertia, lack of requisite skills, corporate culture and the reluctance to change might be associated with different applications of eco-control tools and success in performing green initiatives. As such, field-based explorations would be conducted with the purpose of understanding environmental management implementation approaches beyond formal incentives.

Secondly, research scholars need to know more about the practical aspects of EMA when green management control is practiced by business professionals other than accountants. Indeed non-accountants could be equipped with different knowledge, skills and abilities that could influence how EMA mechanisms are used and thereby the effects related to their application. Additionally, prior studies have indicated that management accountants are shifting toward the top of the organization, as business partners in top level decision-making (Sorensen 2008). Therefore, researchers are required to examine whether the changing role of management accountants fits with the pivotal function they are required to perform for green management (Henri and Journeault 2010).

Finally, accounting researchers could develop metrics to accurately measure green costs and benefits, in line with the holistic concept of environmental performance. To do so, they need to overcome the several limitations potentially hindering the informativeness and contractibility associated with the measures, and the goal congruence between the environmental and organizational objectives (Burritt and Schaltegger 2010; Henri and Journeault 2010; Burritt 2004;

Ilinitch et al. 1998). Keeping this in mind, as suggested by Kaplan (1986; 2011) managerial scholars could start by observing, documenting and describing leading practices and innovations. They could next identify where a specific set of green performance metrics seems to be effective and where the measures fail in execution. They would finally be able to formulate general principles that drive the choice for the "right" environment-related performance measures. As a result new convincing variables reflecting the multiple dimensions of corporate environmental performance (financial/non-financial, internal/external, direct/indirect, tangible/intangible, process/results) could be operationalized, tested and proposed.

4.2.2. Relevance of Large-scale Empirical Evidence

Conclusive empirical evidence on the design and level of diffusion of EMA mechanisms should be large scale in nature and consider businesses of all sizes in all industries. Consequently, extensive survey designs represent an appropriate method to investigate EMA systems in broader settings. In particular, more cross-country and cross-industry studies would validate the correlation paths and causal associations examined to date in single organizational or industrial case analyses, allowing for better generalization of the findings (Henri and Journeault 2010). Moreover, a more complete understanding of the diffusion level of green control mechanisms within firms requires both academic researchers and managerial professionals to consider implementation characteristics across SMEs and within organizations operating in developing countries (Burritt 2004).

Additionally, a longitudinal research design should be selected to allow for investigating changes in EMA practices over time. However, given the high costs and difficulties associated with longitudinal studies, cross-sectional surveys also constitute an appropriate method (Burkert et al. 2010).

5. CONCLUSIONS

The aim of this study was to substantiate the need for more theoretical and empirical research on innovative aspects of EMA practices adopted by firms to foster green management execution. The point of departure for our reasoning in Section 2 was that today both corporate leaders and academic researchers agree upon the relevance of green management in leading organizations. Indeed managerial scholars and professionals call for the integration of corporate environmental considerations into business strategy, thus into operational and capital investment decisions. Accordingly, EMA represents one of the mechanisms used by firms to incorporate environment-related information into day-to-day decision-making and take advantage of the potential benefits

of environmental performance. Hence, as stated by Schaltegger & Burritt (2000) ecologically oriented management control tools serve as a means of executing environmental strategy throughout the organization. However, successful implementation remains challenging and defined targets are hardly fully reached (CIMA 2011; Epstein 2008). Several lines of evidence have indicated that many of these difficulties are associated with conceptual and practical problems with management control systems in integrating environmental information into decision-making and providing guidance on how to effectively implement green management (Epstein 2010; Berns et al. 2009; Burritt 2004).

In Section 3 we therefore reviewed extant literature on EMA practices published in both scientific and practitioner journals, exposing the important findings and shedding some light on interesting, unexplored issues that need to be further investigated in order to complement existing knowledge. Firstly, in relation to the diffusion of the concept of EMA, academics have the opportunity to examine whether and to what extent green control mechanisms can be generalized to all types of businesses in cross-cultural settings. Additionally, researchers might invest more in analyzing the role of informal control systems to drive green management implementation, as well as cases where environmental accounting is practiced by various business professionals other than management accountants. Secondly, while investigating significant antecedents influencing the decision to adopt and how to design effective EMA mechanisms, accounting scholars should attempt to further explain variations in the role and different applications of the observed green control practices in cases of departure from the win-win economic prediction. Finally, when examining the potential effects produced by the use of ecologically oriented control tools, researchers have the opportunity to investigate more how EMA systems contribute to organizational performance. Moreover, academics have the opportunity to further explore the concept of environmental performance and develop more inclusive metrics to define, measure and control this broad corporate domain.

In Section 4 we identified avenues for future explanatory studies and addressed recommendations for research design. On the one hand, we suggested innovative theoretical developments to establish and investigate new causal links. Researchers could accordingly use sociopolitical argumentation and psychological considerations to explain applications of corporate EMA practices either only partially or entirely not justified by profit-maximization theories. Similarly, a multiple theoretical approach might serve to investigate the extent to which EMA is required for effective green management. We also proposed the adoption of theories from organizational social psychology, information economics and cognitive psychology to

investigate the various aspects of EMA at an individual level and examine the debate about managers' individual rationality in green management implementation. On the other hand, we derived recommendations for appropriate research designs to address specific open issues outlined in the review. In particular, we proposed the qualitative case/field study approach as appropriate for the further examination of those relevant facets of EMA practices that today remain partly unexplored. For this purpose, researchers could start with the systematic observation, description and classification of practical aspects of EMA, possibly defining appropriate constructs and new convincing variables to further explore the role of informal green control mechanisms, the case of environment-related control systems practiced by non-accountants and the multiple dimensions of corporate environmental performance. We finally indicated large-scale, cross-sectional surveys and longitudinal studies for the empirical investigation of the design of EMA mechanisms and the level of diffusion of these tools across SMEs, non-manufacturing organizations and firms operating in developing countries.

In conclusion, we think that academics should play an important role in investigating challenging aspects of EMA practices that today remain partly unexplored. More research is therefore required in order to accumulate a stock of solutions to better explain the design and role of effective green control tools adopted by organizations for green management execution. There is a need for new theoretical developments as well as empirical evidence with regard to eco-control and we hope that this paper stimulates the debate on innovative approaches to the appropriate design of such research.

CHAPTER II

Corporate Provision of Incentives for the Attainment of Environmental Targets[*]

Corporate Provision of Incentives for the Attainment of Environmental Targets

ABSTRACT: This paper examines the determinants influencing corporate choice to provide managers and employees with incentives for the attainment of environmental targets. We analyze a cross-industry panel of 829 global listed firms from the 2007-2013 Carbon Disclosure Project investor survey. According to agency theory and social legitimacy, we find that the probability of adopting green incentives increases at the presence of a business policy for green management, with higher investment in monitoring environmental performance and with higher peer pressures. Also, non US firms are more likely to respond to environmental concern by means of assigning green rewards to their employees. Consistent with rational and social accounts explaining the diffusion of managerial practices in the field, an earlier establishment of an environmental policy is associated with earlier corporate use of green incentives, while industry-peer pressure impacts later adoption. However, country peers influence earlier provision. Finally, companies investing more in monitoring the green aspects of the business are likely to be later adopters, suggesting the need to cumulate knowledge about the informativeness of environmental performance measures before inserting them in compensations contracts.

1. INTRODUCTION

Organizational concern about environmental sustainability has grown dramatically in the last thirty years to become a dominant theme today. Explanations about corporate need for green management come from two main perspectives. The economic approach states that companies engage in environmentally responsible activities for strategic reasons with the goal to maximize shareholder value (Porter and Linde 1995). By contrasts, the sociopolitical perspective argues that firms commit to environmental sustainability to comply with green regulations and avoid the deterioration of their reputation, potentially, but not necessarily, to the detriment of the economic interest of shareholders (Moser and Martin 2012; Marcus and Fremeth 2009).

As changes occur in corporate concepts and accountability for the environment, accountants are called to put major effort on designing accounting and control systems that provide managers with environment-related information, foster green management execution, and facilitate the disclosure of corporate environmental performance (Hopwood 2009a, 433). In particular, it is now widely accepted that, if green sustainability has become a corporate priority, then strong incentive systems need to be associated with it (PRI 2012). Accordingly, survey results document a growing number of firms adopting sustainability-related compensation plans to motivate managers and employees and make them formally accountable for the attainment of environmental targets (Glass Lewis &Co 2013; TCB 2012; Berns et al. 2009). For instance, an analysis of Thomson Reuters ASSET4 data over more than 4500 public world companies[1] unveils that, in 2013, approximately 33.6% of listed firms has at least one of their senior executives' compensation linked to sustainability targets.

However, many researchers and professionals highlight the difficulty for companies to incorporate green aspects into management processes and, particularly, underline the existence of a divide between good intention and execution (Derchi et al. 2013). Major barriers to effective green corporate action could be associated with conceptual and practical problems with management control and performance measurement mechanisms integrating environmental information and influencing ecological decisions (Derchi et al. 2013; Burritt 2004; Epstein and Roy 2001). For instance, some authors claim that it is difficult for companies to come up with reliable measures regarding environmental performance dimension affecting their choice to tie compensation contracts to green objectives (Eccles et al. 2014). As standards for environmental performance measurement are developed, it will be easier to make ecological performance a

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[1] Thomson Reuters' ASSET4 collects ESG public information from more than 4500 global listed firms. Figure A in Appendix shows the yearly distribution of corporate use of senior manager compensation plans.

factor in the compensation plans of employees. Other scholars note that economic models alone are not sufficient to explain the observed heterogeneity in firms' use of managerial control systems in case of departures from their implied assumptions (Hopwood 2007; Ball and Brown 1968). So far, there is little knowledge on why and how firms choose to insert environmental elements in incentive mechanisms (Derchi et al. 2013; Henri and Journeault 2010). Most research focuses on CEO compensation linked to sustainability issues, analyzes total compensation instead of concentrating on specific environmental components, and investigates performance effects of green rewarding. No empirical evidence exists yet on the reasons why firms choose to include environmental aspects in incentive plans or how they make this decision. The aim of this work is to make a first step in this direction and to better understand corporate provision of green incentives. More specifically, we explore some relevant determinants influencing the choice of using and the time of adoption of environmental performance measures in compensation contracts. With the term environmental performance measure we refer to any type of environment-related criteria or metrics used to evaluate agent's effort to achieve an assigned green target. For instance, environmental goals take the form of carbon emission reductions, energy efficiency achievements, sales of environment-friendly products and services, completion of climate change risk mitigation plans, ideation and development of new operating processes or product design that mitigate the environmental impact, individual behavioral changes at the benefit of the climate. Environmental performance indicators linked to these targets could be objective, easily quantifiable measures or more subjective, judgmental measures (i.e. flexibility in assigning weights to measures, use of qualitative performance evaluations, and/or discretion to incorporate other environmental performance criteria) (Ittner et al. 2003).

In line with the literature on corporate demands for green management, we initially examine two sets of hypotheses that, alone or combined, clarify a firm's decision to implement environmental performance-based incentive schemes at the individual level. First, based on agency theory, we argue that the inclusion of green performance measures in compensation contracts increases the alignment of the agent with the principal by means of making the contracting more effective (Milgrom and Roberts 1992; Holmstrom 1979). Second, based on institutional theory (Ansari et al. 2010; DiMaggio and Powell 1983), we argue that firms choose to insert environmental elements in compensation contracts as a symbolic "legitimacy" response to external and internal social influences or pressures. Subsequently, we use theoretical predictions from the literature on the diffusion of practices among organizations (Ansari et al. 2010; Rogers 1995; DiMaggio and Powell 1983) and develop two sets of hypotheses to explain a

firm's choice about the timing of green incentive adoption. Accordingly, economic rational accounts are expected to be associated with an earlier corporate use of green incentives, while social accounts lead firms to choose to adopt this mechanism at a later stage.

To test our predictions, we conduct our analyses over of cross-industry sample of 829 global listed firms that, in the years 2007-2013, responded to the Carbon Disclosure Project investor survey and provided information about the use of incentives at the individual level for the attainment of climate change targets. In the period of analysis, 68.8 % of sample firms provide incentives to managers and employees for the management of climate change issues including the achievement of environmental targets.

In accordance with agency theory predictions (Milgrom and Roberts 1992), we find that firms that integrate environmental issues into their business model through an *ad-hoc* corporate policy are more likely to provide green incentives. Further, corporate investment in monitoring environmental performance is positively associated with the likelihood that a firm decides to insert green performance metrics in compensation plans. From an institutional perspective, social influences have a significant impact on corporate choice to use green incentives in the forms of peer pressures, both at the country and industry level. In addition, these primary results shed some light on other characteristics of these relationships. Overall, environment-oriented monitoring effort and peer pressures are not linearly associated with the probability of using green incentives but show decreasing marginal effects for higher values of the variables. Further, our results demonstrate that, compared to US based companies, firms not domiciled in the US are more likely to respond to higher environmental concern through the provision of green incentives designed to motivate managers and employees and make them accountable for environmental goals. The latter findings are in line with Ioannou et Serafeim (2012) showing that countries whose laws and regulations promote market competition and shareholder protection (i.e.: US) are associated with lower corporate environmental performance.

In addition, our results are partially consistent with theoretical predictions from practice diffusion research (Ansari et al. 2010; Rogers 1995; DiMaggio and Powell 1983). In line with rational accounts, we provide robust empirical evidence that firms with an explicitly business policy for environmental sustainability established at an earlier stage are more likely to be earlier adopters of green incentive schemes. On the contrary, firms investing more in monitoring the environmental aspects of the business are more likely to adopt green incentives at a later stage, suggesting the need for the principal to cumulate knowledge and experience about the information content provided by environmental performance measures before deciding to include

them in compensations contracts. Finally, consistent with social accounts predictions, we find that industry peer pressure is positively associated with a firm's later decision to introduce green incentives for managers and employees. However, country neighbors exercise a more immediate effect and influence a firm's choice to use green incentives at an earlier time.

Our work contributes to the literature in three ways. First, we complement extant environmental accounting research by providing some explanations about the reasons why and when companies decide to adopt "eco-friendly" control systems (Burritt 2004; Henri and Journeault 2010). Second, we enrich the empirical management accounting literature by exploring corporate provision of incentive schemes used to motivate green management execution. In particular, we extend the body of knowledge on performance evaluation by detecting the role of environmental performance measures inserted in compensation plans. Finally, we contribute to environmental management diffusion research by documenting why and how the use of green incentives spreads among firms.

This research has also important implications for practice as well. From a regulatory perspective, we offer policy makers a better understanding of how firms respond to green management demand and we provide them with robust and useful information to determine the best design and mix of environmental rules for society. From an investor point of view, socially responsible asset managers need to select good and successful firms to allocate their scarce resources and diversify their portfolio. Understanding the reasons driving firms to adopt green incentives might significantly help socially responsible investors to interpret corporate environmental performance. Hence, this would support them in predicting more precisely which companies are more likely to significantly increase their engagement towards environmental sustainability. Finally, from an organizational perspective, we shed some light on the role of incentives for green strategy and corporate responsibility execution.

The remainder of the paper is divided into five sections. In Section II we discuss the theory and develop our research hypotheses. Section III describes the sample selection process. Section IV illustrates the variables measurement processes used in our empirical analysis. Research methods and results are provided in Section V. Section VI concludes with a summary of the findings.

2. THEORY AND RESEARCH HYPOTHESES

From an economic perspective, it is well known that incentives influence the behavior of individuals (Baker et al. 1988). In this respect, compensation schemes are designed to incentivize people to pursue the strategic interests of firms (Prendergast 1999). Thus, if sustainability has

become a corporate strategic priority, then firms need to put in place strong incentives. Unfortunately, existing compensation plans do not necessarily promote sustainable value creation. As a result, professionals and scholars alike start exploring different ways of integrating Environmental, Societal and Governance (ESG) factors in incentive contracts.

For example, as documented by Thomson Reuters' ASSET4 database, corporate use of sustainability-linked rewards for senior managers is becoming quite popular. More specifically, ASSET4 reports that the number of firms adopting sustainability compensation plans has significantly increased, from a 3.9% in 2002 to a 33.6% in 2013. The character of this diffusion is confirmed by survey results from practitioners showing that firms increasingly invest resources to develop new organizational capabilities, including a culture that stimulates and reward green vision, and managerial tools to support environmental performance measurement, business modeling and internal reporting (CIMA 2011; Berns et al. 2009). In line with this evidence, Eccles et al. (2014) indicate that companies known as sustainability leaders are more likely to introduce environmental and social metrics in senior executive incentive schemes. At the institutional level, we also assist to a flourishing body of guidance literature for investors and companies on how to integrate ESG issues in executive management goals and incentive schemes (PRI 2012).

As Henri & Journeault (2010) suggest, green performance-based compensation refers to the integration of environmental criteria in the evaluation and rewards process of employees to direct their efforts towards the achievement of environmental goals. Prior environmental management literature has only partly addressed the design of incentive systems and the characteristics of environmental performance measures used in compensation plans. A first group of studies, mainly prescriptive in nature, describes how firms should design compensation systems to improve environmental performance (Dutta and Lawson 2009; Lothe et al. 1999). In parallel, an embryonic stream of research in environmental economics draws analogies from mainstream agency theory and analytically investigates how incentive systems should be modified to implement environmental strategy (Zabel and Roe 2009). Related evidence indicates that measuring green performance has several limitations that potentially hinder the informativeness and the contractibility associated with these metrics, and the goal congruence between environmental and organizational objectives. Another set of studies empirically focuses on the association between environmental performance and CEO compensation. In particular, Stanwick and Stanwick (2001) study a sample of 190 firms in the years 1990 and 1991 and demonstrate that there is a strong relationship between CEO compensation and firm's environmental

reputation, size and financial performance. Berrone & Gomez-Mejia (2009) analyze longitudinal data of 469 US firms and find that good environmental performance increases CEO pay, that pollution preventing strategies affect executive compensation more than end-of-pipe pollution control, and that an explicit use of green governance mechanisms (specifically, environmental pay policy and environmental committee) does not strengthen this link. More directly, Campbell et al. (2007) document the existence of a positive relationship between environmental performance and the environment-related component of CEO's compensation plans in US-based companies. In particular, the authors indicate that there exists a risk premium compensating CEOs for incremental environment-related personal and economic risks in more environmentally sensitive industries. Similarly, Cordeiro & Sarkis (2008) using data from a sample of 207 S&P500 firms report a significant impact of firm-level environmental performance on CEO compensation levels, but only for firms declaring to have established an explicit link between environmental performance and executive contracts. Finally, other authors examine empirically the organizational effects associated with the use of green compensation contracts. Testing green performance effectiveness of specific organizational arrangements over a large sample of US electronics facilities, Russo and Harrison (2005) find that only the presence of a formal link between plant manager compensation structure and environmental performance contributes to reduce plant-level toxic emissions. Berrone & Gomez-Mejia (2009) find that CEO long-term pay increases pollution prevention success. Referring to a broader concept of corporate sustainability, Deckop et al. (2006) document that short-term CEO pay is negatively related to corporate social performance whereas a long-term focus is positively related to corporate social performance. However, neither of these two papers investigates the direct effects of sustainability elements used in incentive contracts. Differently, Eccles et al. (2013) examine a global cross-industry sample of large organizations between 2007 and 2010, and analyze the effectiveness of monetary and non-monetary incentives provided by companies to their managers and employees for the achievement of climate-change targets. In line with monetary crowding-out motivation theory, they find that the use of financial incentives is associated with higher carbon emissions compared to the provision of non-monetary rewards.

Overall though, empirical evidence on the role of green incentive schemes remained limited. Most of research focuses on CEO level, analyzes total compensation instead of disentangling organizational causes and consequences of specific environmental components, and mainly investigates performance effects associated with the use of environmental rewards. In addition, there is little knowledge on the use of green incentives for organizational levels other than the

CEO. In particular, there is no empirical evidence on the reasons and the way companies choose to insert green performance measures in compensations contracts. A notable exception is the work of Eccles et al. (2013), where the authors regress corporate use of green monetary and non-monetary incentives on various economic, reputational and ethical antecedents, as a first instrumental stage for the main econometric analysis.

Our study complements existing knowledge by empirically exploring a set of determinants for firms to adopt green incentive schemes.

2.1. Determinants of Corporate Adoption of Green Incentives

As briefly mentioned in the introduction, corporate needs for environmental management practices are seen through two lenses.

Based on an economic perspective, a group of scholars argue that firms make environmental-friendly investments only when they maximize shareholder value. According to this line of thought, companies create a business case for environmental sustainability and incorporate green aspects in their strategies because of the potential financial benefits associated to environmental performance (Bénabou and Tirole 2010; Porter and Linde 1995). First, pro-environmental activities such as waste reduction, energy conservation and material reutilization positively affect productivity and, thereby, reduce operating costs (Porter and Linde 1995). Second, superior green performance enhances corporate reputation and may generate additional revenues by satisfying the needs of green consumers (Hart 1995). Finally, good environmental performance reduces compliance and liability costs, and the long-term risks associated to resource depletion, pollution, and fluctuations in energy costs and product liabilities (Shrivastava 1995).

Other scholars use a sociopolitical approach and argue that firms engage in environmentally responsible initiatives to conform to societal boundaries and behave with "legitimacy" (Mathews 1993; Parsons 1960). Companies focus on "eco-friendly" customer needs and invest in eco-efficient processes in an attempt to respond to non-shareholder constituents' demands, potentially, but not necessarily, to the detriment of the economic interest of shareholders. If managers decide to engage in environmentally responsible activities because of reputational considerations, then some of these green activities may be undertaken at the expense of shareholders[2].

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[2] By the expression "at the expense of shareholders", we refer to Moser and Martin's definition (2012, 798), meaning that "the costs of the environmental responsible activity to the firm exceed the benefits to the firm".

Based on this literature, we propose two sets of hypotheses that, alone or in combination, explain corporate provision of environmental performance-based incentive schemes. First, based on an agency theory perspective, we argue that the use of green performance measures in compensation plans the efficacy in contracting between the principal and the agent given the informativeness of the metrics related to efforts. In addition, we argue that corporate investments in environmental performance monitoring influence the quality of the measurement model and, thereby, the efficacy in contracting when principal needs to align the agent's efforts to strategic environmental targets. Second, from an institutional perspective, we claim that companies may choose to include environmental performance measures into compensation plans as a symbolic response to societal and political external pressures. According to this line of thought, firms try to demonstrate that they operate with "legitimacy" within the societal boundaries and that their managers are accountable for their actions.

2.1.1. Economic Efficacy in Contracting

Based on principal-agency theory, the design of an incentive contract addresses the general problem of motivating the agent to act on behalf of principal's desires (Milgrom and Roberts 1992). Prior work on performance evaluation investigates the design of optimal compensation contracts and focuses on the importance of inserting adequate performance parameters to make agents' pay depending on their performance (Milgrom and Roberts 1992; Holmstrom 1979). For instance, the selection and "the relative weight placed on a performance measure should be related to the measure's level of informativeness regarding the manager's action choice" (Ittner et al. 1997, 233; Feltham and Xie 1994; Banker and Datar 1989; Holmstrom 1979). In turn, the level of informativeness of a specific measure may also be a function of the overall effectiveness of the measurement process implemented by the firm (Milgrom and Roberts 1992). Principals may decide to improve measurement by investing in monitoring systems to increase the overall quality of the measures used to evaluate and reward agents. These decisions are costly but improve principal's information on agents' performance (Milgrom and Roberts 1992). As a result, the ability to incorporate this information in compensation decisions depends also on principal's monitoring effort (Höppe and Moers 2011).

In this study, we assume that there exists an optimal design of compensation contracts for a firm and we hypothesize that firms choose to adopt green incentives to adjust to the optimal level. Accordingly, we propose an agency framework to test important antecedents explaining a firm's decision to incorporate green performance measures in compensation plans, as a means to

increase the efficacy in contracting with agents. As we discuss in the following subsections, various factors can potentially impact the informativeness of green performance measures.

Environmental Policy

One potential determinant of the information content of green performance measures is the company's business strategy. Based on principal-agent models, organizations tend to make greater use of, or place more weight on, a specific type of measure when pursuing a specific business strategy. Accordingly, prior research confirms that firms following a prospector strategy or having implemented strategic quality initiatives rely more extensively on specific nonfinancial performance measures in bonus plans, such as customer satisfaction, specific nonfinancial strategic objectives and product or service quality (Ittner et al. 1997). Also, other empirical contributions demonstrate the use of certain nonfinancial measures as function of their level of informativeness under given strategic directions (Abernethy et al. 2004; Ittner and Larcker 1995). In the field of corporate sustainability management, Eccles et al. (2014) investigated the impact of the integration of ESG issues into a company's strategy on organizational processes and performance. In particular, the authors identified in the US market a group of 90 High Sustainability companies as entities that at an early stage, by 1993, voluntarily adopted a set of managerial policies aimed at improving the social and the environmental aspects of the business such as an emission reduction policy. Subsequently, they tracked over years the organizational arrangements and performance of these companies and compared them to a matched sample of US firms that adopted almost none of these policies, termed Low Sustainability companies. As a result, they found that High Sustainability firms significantly exhibit distinct organizational processes compared to Low Sustainability companies. Specifically, the authors noted that the board of directors of these firms is more likely to be formally responsible for sustainability and top executive compensation is more likely to be a function of sustainability performance metrics.

Further, the business paradigm for environmental sustainability requires firms to follow a green innovation strategy aimed at finding creative and effective solutions to reduce pollution and, thereby, increase the productivity of their operations (Porter and Linde 1995). In addition, their innovation offsets should encourage them to develop new business opportunities, to create first-mover advantage in new eco-friendly markets, to strengthen community relations and to improve their reputation (Porter and Linde 1995). In the field of corporate sustainability research, Nidumolu et al. (2009) studied a wide breath of sustainability initiatives from 30 large companies and discovered that the pursuit of sustainability constitutes an opportunity to seek out new bottom-line and top-line returns from organizational and technological innovations. Similarly,

Eccles et Serafeim (2013) analyzed more than 3,000 organizations from 2002 to 2010 and found that if companies innovate they can simultaneously improve ESG and financial performance. As claimed by the two authors, many improvements, such as reducing manufacturing waste or energy consumption, involve minor or moderate innovations that can enhance efficiency and, therefore, financial performance. However, those innovations are necessary but not sufficient to ensure competitiveness. Addressing the most significant ESG performance requires major, organization-wide innovations: new products, new processes, and innovative business models aimed at improving the firm's "material" ESG performance[3]. To do this, some organizational barriers to change need to be overcome. For instance, the compensation contracts of the employees – typically linked to short-term performance - should be tied to ESG measures to ensure agents' efforts to be associated with the firm's most critical long-term sustainability performance.

As a result, it is reasonable to expect companies which have formally started "to recognize the environment as a competitive opportunity – and not as annoying cost or a postponable threat" (Porter and Linde 1995, 114), to improve their measurement and assessment methods to control for the firm's environmental performance. In particular, firms that have integrated environmental issues into their business strategy through the adoption of a corporate policy would be more likely to insert green performance measures in the incentive plans of their employees to make them accountable for the attainment of environmental objectives.

Accordingly, our study aims to explore whether and to what extent a firm's environmental policy influences the choice to provide green incentives. This premise motivates the following hypothesis.

H1: Firms are more likely to adopt green incentive schemes as they have adopted a business policy for environmental sustainability.

Investment in Monitoring

As mentioned before, the monitoring intensity of the principal on the agent is another potential determinant of the extent to which environmental performance measures are informative about agent's effort. Given that the informational value of a performance measure is affected by its noise, firms may decide to invest resources to design information systems that increase the

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[3] Based on the Sustainability Accounting Standard Board (SASB) definition, the materiality of an ESG issue refers to the economic impact associated with the management of the same issue. That is, higher is the probability that the management of a certain ESG issue affects the firms' valuation parameters - such as revenue growth and return on capital -, higher is its materiality (Eccles and Serafeim 2013).

level of precision and, thereby, the quality of the information provided by the metrics used to evaluate and reward agent's behavior (Milgrom and Roberts 1992). As argued by Hunton et al. (2008), "examples of information systems that are used for monitoring purposes include budgeting systems, reporting procedures, direct supervision and internal audit". For instance, internal audit research indicates that increased monitoring intensity alleviates information asymmetry between the agent and the principal and reduces misappropriate behavior (Hunton et al. 2008; Anderson and Young 1988). In particular, in this paper we focus on different types of managerial mechanisms used at various levels within an organization to monitor the environmental performance achieved by any agent specifically accountable for it (i.e., from senior executives to employees).

With this regards, Thomson Reuters' ASSET4 database documents a growing number of companies investing in ad-hoc governance mechanisms and monitoring-like tools to manage sustainability issues. For instance, the number of firms, voluntarily disclosing a separate sustainability report or publishing a sustainability related section in their annual report, sharply increased, from a proportion of 5.5% in 2002 to 62.4% in 2013 (see Figure A in Appendix). In line with these figures, a KPMG survey conducted in 2011 indicates that 95% of the Fortune largest global 250 companies (G250) issue sustainability reports, up from 80% in 2008 (KPMG 2011). Also, ASSET4 data unveil firms have increasingly used other monitoring-type mechanisms, such as sustainability committees or teams (with diffusion rate from 9.7% in 2002 to 61.2% in 2013 – see Graph C in Appendix), external audit on their sustainability reports (from 17.1% in 2002 to 82.5% diffusion in 2013 – see Figure A in Appendix), and ISO 14000 certifications (with usage rate spreading from 27.5% in 2002 to 45.5% in 2013 – see Figure A in Appendix).

Overall, corporate adoption of sustainability governance mechanisms reached a level of diffusion higher than 40% already in the period 2007-2009. By contrast, the diffusion of sustainability-linked senior management compensation plans remains lower than 40% in 2013 despite an increasing trend. At a first sight, these descriptive figures suggest the existence of an anticipatory role of these governance mechanisms on corporate choice to integrate sustainability-related incentives into compensation contracts.

Our study explores whether and to what extent a firm's investment in green sustainability monitoring systems influences the choice of incorporating environmental performance measures in compensation plans. These premises motivate the following hypothesis.

H2: Firms are more likely to use green incentive schemes when they invest more in environment-oriented performance monitoring systems.

2.1.2. Social Influences

Prior work on the diffusion of voluntary corporate practices state that "whereas economic models draw on informational arguments about the value of an innovative managerial practice, social accounts tend to emphasize growing levels of pressure toward social conformity" (Ansari et al. 2010, 67). Based on these socio-political theories, understanding the patterns by which an innovative organizational practice spreads in the field also requires "framing the mechanism in relation to its adoption environment" (Fiss et al. 2012, 1082). Specifically, Ansari et al. (2010) argue that practice adoption is likely to be affected by processes occurring both outside and inside the borders of an organization. For instance, because of cultural factors and normative expectations of outside stakeholders (Abrahamson 1991; DiMaggio and Powell 1983), "organizations may find advisable to adopt a specific managerial practice to increase or maintain their standing in the eyes of their constituencies" (Ansari et al. 2010, 70).

Accordingly, in the context of green management, companies must show a material commitment to environmental sustainability to comply with green regulations and societal expectations, and to avoid the deterioration of their reputation, which could potentially result in loss of sales and higher costs (Marcus and Fremeth 2009; Mathews 1993; Parsons 1960). In line with this theoretical ground, many empirical studies focus on specific company-, industry- and country-related factors and provide evidence of green management practices used by companies to address their exposure to social, legal and political influences (Cho, Guidry, et al. 2012; Marquis and Toffel 2012; Reid and Toffel 2009; Simnett et al. 2009; Cho and Patten 2007; Bouma and Kamp-Roelands 2000). The majority of these works explore issues related to environmental disclosure and explain a firm's decision to use external reporting, as a tool to reduce exposure to social and political pressures as opposed to a means for signaling an unobservable strategy toward green targets (Cho, Guidry, et al. 2012; Clarkson et al. 2008; Cho and Patten 2007; Al-Tuwaijri et al. 2004). On the other, a smaller group of studies focus on internal control systems and find that expectations of different stakeholders influence the set of green information that managers choose to measure in an environmental management system (Gates and Germain 2010; Bouma and Kamp-Roelands 2000).

Therefore, we argue that corporate provision of green incentive schemes is a function of specific social influences. In the following subsections we discuss two sets of antecedents that are expected to influence a firm's decision to adopt environmental incentives as a "legitimacy" tool.

Environmental Performance Concern

One potential set of measures relates to the internal and external pressures companies face because of environment-related concerns. More specifically, corporate exposure or visibility with respect to stakeholders demanding socially responsible behavior incentivizes firms to engage in such behavior (Bénabou and Tirole 2010). For instance, in voluntary disclosure literature predictions from socio-political theories argue that companies, whose social legitimacy is threatened, have incentives to increase environmental disclosure to inform relevant publics about changes in their performance and to seek to changes in public expectations (Patten 2002; Lindblom 1994). In some cases, these corporate reputation or "image concerns could take the form of "greenwash", which represents a way to disseminate a misleading picture of environmental friendliness in some dimensions but serves to obscure less savory ones" (Bénabou and Tirole 2010, 11). Accordingly, many empirical studies find a negative association between corporate environmental performance and the level of discretional environmental disclosure (Cho, Guidry, et al. 2012; Marquis and Toffel 2012; Cho and Patten 2007). Similarly, Reid and Toffel (2009) use the theory of social movements and demonstrate that activist groups and government actors can spur changes in organizational disclosure of climate change strategies. Also, Simnett et al. (2009) extend their investigation to corporate voluntary assurance on sustainability reports and unveil the existence of a strong positive link between companies with a higher need to enhance credibility and those ones choosing to purchase assurance on the content of their reports.

We extend prior research on corporate environmental disclosure to explore how firms respond to specific social influences through the adoption of internally-focused managerial mechanisms. More specifically, we test whether and to what extent the firm's environmental performance concerns influence its choice to incorporate green measures in compensation contracts, to motivate managers and employees and make them accountable for the attainment of green targets. This reasoning motivates the following hypothesis.

H3: Firms are more likely to use green incentive schemes when they face higher environmental concerns.

Peer Pressures

Peer pressure is another potential determinant of the extent to which environmental measures are used by firms in compensation contracts. Institutional tensions for legitimacy tend to emphasize the growing pressures toward social conformity. In particular, "social accounts tend to assume that organizations frequently imitate other organizations in order to appear legitimate and that, with increasing institutionalization, the adoption of practices is therefore often driven by a desire to appear in conformance with norms" (Ansari et al. 2010). As a result, "organizations tend to imitate the models promoted by fashion setters or those used by their peers" (Ansari et al. 2010). In the context of environmental sustainability, Bansal and Roth (2000) noted that institutional pressures from industry peers make it difficult to deviate from the norm. Industry members are strongly motivated by concerns of legitimacy and mimicked the initiatives of their peers. Moreover, the authors documented the pressures to conform that managers receive from local community members. The frequency and the intensity of interactions place firms operating in that field under greater scrutiny in case of deviations from the norm and push them to conform.

Empirical research on peer-related factors influencing corporate choice to implement environmental accounting mechanisms is scarce. A notable exception is the work of Eccles et al. (2013), showing a positive link between peer pressure (measured in terms of percentage of other firms in any given country-year pair that adopt monetary or non-monetary incentives) and corporate use of green incentives.

In line with this evidence, we explore whether and to what extent both country- and industry-specific peer pressures may affect a company's decision to incorporate environmental performance measures in compensation contracts. Therefore, we extend extant research by testing the following hypothesis.

H4: Firms are more likely to use green incentive schemes when they face higher pressure from their peers, at both the country and industry level.

2.2. Determinants of the Time of Green Incentives Adoption

Prior literature on diffusion of innovations has significantly contributed to our understanding of practices adoption and diffusion across organizations. In particular, an extensive body of research examines how progressive innovations spread faster in an economy and how resilient firms could be convinced to adopt them, thus accelerating the diffusion process (Rogers 1995; Abrahamson 1991). As a result, many studies have focused on the diffusion speed of various management practices among companies (Davis and Marquis 2005). Diffusion speed (or rate of

adoption) is defined as the relative speed at which an actor adopts a managerial practice. More specifically, this group of works investigates the characteristics of early adopters as opposed to late adopters, including identifying determinants of the time of adoption and measuring the rate of diffusion[4].

Based on this theoretical ground, early adopters of organizational practices are commonly driven by a desire to improve performance through the expected economic benefits resulting from the use of a novel practice (DiMaggio and Powell 1983). For example, cost effectiveness is generally associated with earlier diffusion in most of this stream of research (Rogers 1995). Ansari et al. (2010) refers to these explanations as *rational accounts*. However, as an innovation spreads, economic concerns become more and more irrelevant because the adoption process is increasingly driven by social conformity pressures and legitimacy concerns. Hence, once a critical mass is reached, efficiency concerns are replaced by social pressures from outside stakeholders, leading companies to adopt practices even with less consideration about their economic value relevance (Ansari et al. 2010). Ansari et al. (2010) refer to this second set of explanations as *social accounts*. As such, "strategies that are rational for individual organizations may not be rational if adopted by large numbers" (DiMaggio and Powell 1983).

In line with this literature, we propose two sets of hypotheses that, alone or in combination, explain a firm's decision about the timing of adoption of green incentives. First, we argue that economic efficacy in contracting belongs, by nature, to economic rational accounts, influencing the early diffusion of a managerial practice. As such, we test whether and to what extent factors explaining the economic efficacy in contracting are associated to a firms' decision to adopt green incentive systems at an earlier stage. Second, we consider social influences as social accounts that may lead later diffusion of a management tool. Accordingly, we test whether and to what extent factors used to proxy for social influences drive corporate provision of green incentives at a later time. More specifically, these premises motivate the following hypotheses.

H5: Firms are more likely to adopt green incentive schemes at an earlier (later) time when: (1) they are earlier (later) adopters of a business policy for environmental sustainability; and (2) they invest more (less) in sustainability-oriented performance monitoring systems.

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[4] Rogers (1995) distinguishes between the terms adoption and diffusion. Accordingly, adoption is a process detailing the series of stages an organization undergoes from first hearing about a practice to finally adopting it. On the other, diffusion refers to a group of phenomena indicating how an innovation spreads. In our work, we focus on the concept of diffusion. However, both terms are used interchangeably along the paper.

H6: Firms are more likely to adopt green incentive schemes at a later (earlier) time when: (1) they face higher (less) environmental concerns; and (2) they face higher (less) pressure from their peers, at both the country and industry level.

3. SAMPLE

We develop our sample using information on firms' incentive contracts related to green management through the investor survey of the Carbon Disclosure Project (CDP). CDP is an international, not-for-profit organization working to drive climate change protection in business. Starting in 2002, CDP has been collected data on carbon and climate change from the world's largest companies on behalf of institutional investor signatories[5]. The main goal of this survey is to provide investors with tools to assess and manage firm's risks and opportunities related to environmental aspects. Today, 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 companies in carbon management. For instance, CDP elaborates scores calculated according to a standardized methodology which measures the overall quality of company environmental reporting.

Up to 2014, over 4,000 organizations have reported data to CDP, accounting for 54% percent of the market capitalization of the world's largest 30 stock exchanges. As a result, CDP database has become a relevant source of data for practitioners and academics. For example, since April 2010, CDP ratings are publicly available on Google Finance. Also, starting in 2013, RobecoSAM, the company behind the Dow Jones Sustainability Indices (DJSI), agreed to use CDP climate change questions as part of its annual corporate sustainability ranking process. On the other side, a number of prominent empirical studies in the fields of management and accounting elaborate on CDP data to provide robust evidence of the phenomena under observation (Matsumura et al. 2014; Lewis et al. 2013; Eccles et al. 2013; Reid and Toffel 2009).

Since 2007, the CDP investor survey asks questions on the provision of ad-hoc incentives used by firms at individual level to stimulate the achievement of climate change targets. More specifically, the focal question of this study is a "YES or No" inquiry formulated as follows: "Do you provide incentive for the management of climate change issues, including the attainment of targets?"[6] In addition, companies are asked to provide details regarding the design of the incentives. Based on CDP questions, assigned incentives could be monetary and nonmonetary,

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[5] In 2014, CDP has been worked for more than 767 investor signatories representing an excess of US\$92 trillion in managed assets (see CDP website).

[6] This statement refers to question number 1.2 of 2013 CDP investor survey. Question formulation remained substantially unchanged from 2007 to 2013 (see CDP website).

while targets refer to any type of activities that mitigate the environmental impact of the business (i.e., carbon emission reductions, energy efficiency, low carbon energy installation and purchase, sales of environment-friendly products and services, climate change risk mitigation plans, ideation and development of less pollutant operating processes and products design, use of sustainable transportation fleet, and individual behavioral changes at the benefit of the climate). Typically, monetary incentives are included in the annual bonus and are cash-based by nature. On the other, nonmonetary incentives involve intangible rewards based on public recognition, taking forms of medals, prizes and public decorations. Alternatively, nonmonetary incentive take the forms of tangible awards, such as company products and services, external gifts and services, training programs, free hours for volunteering and grants for donations (Table A in Appendix reports some examples of green incentive schemes from company answers to the 2013 CDR investor survey).

Annual CDP investor surveys are the first to provide direct, large-scale, cross-sectional data regarding environment-linked aspects of individual incentive schemes. From 2007 to 2013, respondents to these particular questions increased substantially from approximately 400 to 1,350 firms with response rate of around 80.0% stable over the years.

In particular, as displayed in Panel A of Table 1, we initially identify a panel containing 6,976 firm-year observations and corresponding to 1,709 unique companies that, in the period 2007 – 2013, report their choice regarding the use of green incentives schemes. Then, we exclude data from companies in the Financial sector (selected on the basis of CIGS Parent Sectors classification) to reduce materiality concerns related to sample firms' environmental issues[7]. So, we obtain a panel sample containing 5,529 firm-year observations, corresponding to 1,328 unique firms, with number of respondents dramatically increasing over the years, from 284 in 2007 to 1,063 in 2013.

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[7] Eccles et al. (2011) argue that the problem with banks, insurance and other financial institutions that show their commitment to sustainability by focusing on energy and water in their sustainability reporting, is that these issues are simply not material to the sustainability of the institution itself.

TABLE 1. Sample Selection and Main Characteristics

Panel A.

	Number of firm-years	Number of distinct firms
All firm_year observations in CDP database indicating green incentive adoption choice	6,976	1,709
Less:		
Observations from firms in Financials Sectors	-1,447	-381
Observations not covered by ASSET4 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 firms in the sample	-55	-18
Final Sample	**2,978**	**829**

We hence combine the remaining CDP observations with ASSET4 database, a product of Thomson Reuters that provides public information on general firms' sustainability governance structures and climate change policies and that it is extensively used in sustainability research. Specifically, ASSET4 employs about 180 research analysts that collect data from publicly available sources. In a systematic and standardized data screening process, specific firm information is derived from public disclosures such as annual reports, company websites, sustainability reports, newspapers, NGO reports and commentaries. Next, we retrieve annual corporate financial information from Thomson Reuters' Datastream. To alleviate the noise caused by smaller company size, we remove observations from 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 5 distinct firms per country to reduce potential measurement bias linked to country misrepresentation.

After subtracting observations with missing data, our final sample consists of a panel set containing 2,978 firm-year observations, corresponding to 829 unique companies with approximately the same increasing trend in responding over the years as previously noted. As reported in Panel B of Table 1, the sample exhibits considerable variation in size, with assets ranging from $275 million and $795,000 million (mean = $32,900 million, median = $13,900 million), annual sales from $106 million and $478,000 million (mean = $23,900, median = $10,700 million), and employees from 19 to 2,200,000 (mean = 53,800, median = 27,000). We acknowledge that our final sample size is biased towards larger companies, by construction. However, as noted by Ioannou et al. (2014), in the context of climate change, public policy and civil society pressures are predominantly placed on the world's largest companies given that

carbon emissions to be proportional to firm size. Consequently, largest companies represent a strong relevant sample to investigate our research question.

TABLE 1. Sample Selection and Main Characteristics								
Panel B.								
Variable	N	Mean	SD	Min	P25	Median	P75	Max
Total Assets ($/000)	2978	32,900,000	58,600,000	275,000	5,330,000	13,900,000	33,900,000	795,000,000
Net Sales ($/000)	2978	23,900,000	44,800,000	106,000	4,200,000	10,700,000	22,800,000	478,000,000
Employees	2978	53,800	97,500	19	10,100	27,000	64,600	2,200,000

In addition, final sample shows a diverse representation both in terms of countries and industries. Panel C of Table 1 indicates that final sample firms are domiciled in 20 countries with United States (238 firms), Japan (128 firms) and Great Britain (115 firms) jointly covering more than 50 percent of the sample. Also, sample firms operate in 15 CIGS Industry Groups with some concentration in Industrial Goods and Services (160 firms), Technology (89 firms), Utilities (70 firms), Oil & Gas (59), Personal and Household Goods (59 firms), Healthcare (58), and Basic Resources (55).

TABLE 1. Sample Selection and Main Characteristics (continued)

Panel C.

	Final Sample		CDP database (no Financials firms)	
	Freq.	Percent	Freq.	Percent
Industry distribution				
Automobiles & Parts	25	3.02	89	2.77
Basic Resources	55	6.63	345	10.74
Chemicals	46	5.55	124	3.86
Construct. & Material	43	5.19	156	4.86
Food & Beverage	34	4.10	162	5.04
Healthcare	58	7.00	195	6.07
Ind. Goods & Services	160	19.30	589	18.34
Media	18	2.17	121	3.77
Oil & Gas	59	7.12	290	9.03
Pers & Househld Goods	59	7.12	185	5.76
Retail	46	5.55	247	7.69
Technology	89	10.74	267	8.31
Telecommunications	24	2.90	108	3.36
Travel & Leisure	43	5.19	154	4.79
Utilities	70	8.44	180	5.60
Total	**829**	**100**	**3212**	**100**
Country distribution				
Australia	30	3.62	255	7.94
Brazil	13	1.57	63	1.96
Canada	40	4.83	228	7.10
Switzerland	22	2.65	49	1.53
Germany	32	3.86	71	2.21
Denmark	14	1.69	21	0.65
Spain	10	1.21	32	1.00
Finland	16	1.93	25	0.78
France	39	4.70	79	2.46
Great Bretain	115	13.87	260	8.09
Hong Kong	6	0.72	17	0.53
India	15	1.81	63	1.96
Italy	10	1.21	31	0.97
Japan	128	15.44	345	10.74
The Netherlands	9	1.09	32	1.00
Norway	9	1.09	19	0.59
Sweden	21	2.53	35	1.09
Taiwan	23	2.77	108	3.36
U.S.	238	28.71	827	25.75
South Africa	39	4.70	97	3.02
Total	**829**	**100**	**3212**	**100**

To check for possible selection biases related to our sampling procedure, we verify size, industry and country distributions of the final sample as compared to the entire CDP database (excluding companies in Financials sector). Panel C of Table 1 reports the comparison between the two groups. In particular, CDP database includes 3,212 firms, whose aggregated end-year market capitalization accounts for approximately $47,000 billion in 2013. In the same period, our 829 final distinct firms amount to $13,700 billion in terms of market value. Moreover, at a first sight, industry and country distributions of sample firms show similar proportions as compared to CDP database.

4. MEASURES

4.1. Dependent Variables

Adoption of Green Incentive Schemes

The main dependent variable of our analysis, denoted GRINC, is a binary outcome indicator, taking a value equal to 1 each year the firm reports to have incorporated green incentives into compensation plans and 0 otherwise. In Panel A of Table 2, we notice that, over the period 2007-2013, firms are increasingly including climate-change related measures in incentive schemes[8]. The diffusion of green rewards for managers and employees across organizations increases of 30.3 basis points, from 54.3% in 2007 to 83% in 2013. Overall, CDP data confirm the growing relevance of this organizational practice. In addition, sample data (not tabulated) show high time consistency in the use of green incentives from our sample firms. Indeed, 98.03% of companies using environment-related rewards in a certain year t, continue to implement them in the following year t+1, while only the remaining 1.97% decides to drop it from period t to t+1. On the other, 73.94% of firms, not using green incentives in a year t, keep the same path in t+1, while the remaining 26.06% make the choice to adopt this mechanism from t to t+1. Overall, these distribution characteristics strengthen our confidence with the quality of our main dependent variable.

Time of Green Incentive Schemes Adoption

To test for our hypotheses explaining the timing of corporate adoption of green incentives, we initially identify all firms, in the first year they inserted environment-related elements in compensation plans. As such, we select a restricted sample only composed by first year adopting firms (denoted FST_ADOPT).

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[8] Panel A of Table 2 shows a drop in the total number of observations covered by our sample in the year 2013. This drop is essentially caused by the coverage of ASSET4 database at the time of the extraction of the data for the sampling procedure.

TABLE 2. Corporate Use of Green Incentive Schemes - Time Distribution Dynamics								
Panel A.				year				
Green Incentive Schemes	2007	2008	2009	2010	2011	2012	2013	Total
0 (= "No")	69	113	170	192	168	134	83	929
1 (= "Yes")	82	141	209	340	427	445	405	2,049
Total	151	254	379	532	595	579	488	2,978
Panel B.								
				year				
	2007	2008	2009	2010	2011	2012	2013	Total
Number of Adopting Firms (TADOPT)	82	61	58	108	86	57	40	492

Based on diffusion innovation research, the rate of diffusion or time of adoption is usually measured by the length of time required for the actors of a social system to adopt a managerial practice (Rogers 1995). Similarly, we distinguish earlier adopting firms from later ones by referring to the year of first adoption. By construction, 2007 sample users are the earliest users and 2013 adopters are the latest to have chosen to introduce this mechanism. As such, we create a new dependent variable, named "Time of Adoption" or TADOPT, that ranks sample firms in an increasing order, based on the first year they chose to insert green incentives in compensation contracts. More specifically, the indicator ranges from 1 to 7 and assumes unit values, starting from 1, for 2007 users and ending up with 7, for 2013 adopters. Panel B of Table 2 reports the distribution of adopting firms per year. In particular, 492 distinct firms compose this restricted sample. At first sight, TADOPT data are approximately normally distributed. Except for 2007 and 2013[9], companies are overall equally distributed across years, with bigger concentrations in 2010 and 2011. TADOPT sample mean is 3.8 and median equals 4, suggesting that the average firm starts providing green incentives between 2009 and 2010, with the majority of companies choose to adopt this mechanism almost in the same period, from the beginning of 2010.

4.2. Independent Variables

As discussed in the research hypotheses development section, we assume five constructs to potentially influence corporate decision to incorporate environment-related performance

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[9] On the one side, 2007 TADOPT observations might be overestimated since CDP database, by construction, collects data on corporate use of green incentives starting from 2007 and does not track the case of firms that already adopted them before that year. On the other, 2013 TADOPT observations may suffer from a drop in the total number of observations covered by our sample in the year 2013, as stated in the above note (number 8).

measures into compensation contracts. These constructs are: (1) environmental policy; (2) investment in sustainability-oriented monitoring; (3) environmental performance concern; and (4) peer pressures on using green management practices.

Environmental Policy

The construct "environmental policy" measures the integration of environmental issues into the company's business strategy through the adoption of a dedicated corporate policy. To proxy this construct, we interact two different variables from ASSET4 information. (1) Similarly to Eccles et al. (2014), we use the item "Emission Reduction Policy Elements/Emissions", a binary indicator taking value of 1 for each year a firm discusses in its public reports to adopt corporate policies to reduce carbon emissions, and 0 otherwise. Specifically, ASSET4 analysts answer to the question "Does the company have a policy to reduce emissions?" Based on ASSET4 methodology, the presence of the policy is assigned to firms fulfilling the following three conditions: only direct statement by the company matters to assess the attribution; inferences through legal obligations are not taken into account; the company shows a commitment towards tackling climate change or reducing its environmental emissions in general. Specifically, we include this variable to capture those firms that publicly committed on reducing environmental emissions, whatever the motives associated with the adoption of this policy. (2) Based on Eccles et al. (2013), we adopt the item "Commercial Risks and/or Opportunities Due to Climate Change", a binary indicator equal to 1 for each year a firm describes in its public disclosures the commercial risks and opportunities that climate change represents, and 0 otherwise. Specifically, we use this variable to capture those firms that specifically explored commercial risks and opportunities associated with green management as indicated by their public disclosures. In this respect, ASSET4 has elaborated a corporate measure for climate impact business attention based on the question: "Does the company make a clear statement that it believes that climate change can represent commercial risks and/or opportunities?" - over years modified as "Is the company aware that climate change can represent commercial risks and/or opportunities?"

Hence, we multiply the two terms to compute the variable environmental policy, denoted GRPOLICY. The obtained indicator is in turn a binary variable assuming the value of 1 when companies both declare to have an emission reduction policy and publicly recognize the environment as a competitive risk and/or opportunity, and 0 otherwise. In accordance with prior sustainability research (Eccles et al. 2014; Eccles et al. 2013), we argue that firms that integrated environmental issues in their business strategy through the adoption of a green policy are more

likely to provide employees with green incentives to make them accountable for green management execution.

Investment in Monitoring

The construct "investment in monitoring" measures the firm's level of investment on monitoring the environmental sustainability aspects of the business. In this work, we propose to use the concept of monitoring experience (MONITEXP) to proxy for corporate investment on monitoring. In particular, monitoring experience refers to overall corporate experience matured by the firm over the years by means of investing in controlling the environmental aspects of the business. In particular, from ASSET4 information we create four variables to assess the firm's experience - or "tenure" - in using different types of monitoring-type mechanisms that, at various levels within the organization, focus on the green aspects or, more in general, on the sustainability facets of the business. As previously mentioned (and displayed in Appendix, Figure A), the importance of using management practices focused on controlling corporate sustainability issues (such as ISO 14000 certifications, sustainability reports, external sustainability audits, and sustainability committees) is increasing over time.

More specifically, ISO 14000 certifications are voluntary process-based frameworks for facilities to manage environmental issues. ISO 14000 is expected to induce corporate environmental responsiveness because it establishes appropriate internal organizational structures. Based on ISO 14000, firms must identify general environmental goals and develop an environmental policy. Consequently, companies need to set up management and operational control, as well as monitoring and measurement procedures for their environmental impacts[10]. Meanwhile, employee and manager training programs are also necessary to ensure that all individuals are aware of any established environmental policy and objectives, along with all environmental aspects of their own activities. In addition, ISO 14000 often involves auditing, either of the system or of the firm's environmental performance (Jiang and Bansal 2003). Sustainability reports are publicly disclosed non-financial reports, produced on a voluntary basis and intended to meet the information needs of all general stakeholders. Based on an agency approach, sustainability reports are produced to reduce the information asymmetry between the company and the market/public (Simnett et al. 2009). Sustainability committees are subgroups or team of knowledgeable board members, senior executives or other lower level managers to whom corporate environment- or, more in general, sustainability-related tasks and responsibilities are formally delegated on a daily basis (Berrone and Gomez-Mejia 2009). This type of composition

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[10] See ISO website (www.iso.org).

would put the board and the management group in a better position to more accurately assess corporate performance on the environmental dimension. Evidence from case studies indicates such a committee or team as a powerful tool to source appropriate knowledge and expertise, and to drive corporate accountability towards sustainable issues (Paine 2014). Finally, sustainability audits are voluntary purchases of external assurance on sustainability reports. As stated in Simnett at al. (2009, 941) "assurance serves as a useful control mechanism to enhance the credibility of disclosed information and facilitate greater user confidence".

Hence, we create the following four indicators to measure a firm's monitoring experience on sustainability issues: (1) ISOEXP, that counts for how many years prior to the proxy date a firm has hold an ISO 14000 certification; (2) SREPEXP, that measures the number of years prior to the proxy date that a company has published a sustainability report; (3) SCOMEXP, that counts for the number of years prior to the proxy date a firm has established a sustainability committee or team; and (4) SAUDEXP, that computes how many years prior to the proxy date the sustainability report has been audited by an external party[11]. Finally, we measure MONITEXP by computing a factor score including the four indicators. So, we explore sample data to capture those common patterns that emerge in all the variance generated by the different corporate maturities in using the proposed monitoring mechanisms (Tabachnick and Fidell 2007). Common patters measure overall firm's level of experience gained over years by continuously investing in monitoring the green aspects of the business.

Principal component analysis reveals the existence of a single factor with an eigenvalue greater than unity. All estimated loadings are strong, with coefficients greater than 0.45[12]. Then, we check for measurement internal consistency by computing Cronbach alpha and we obtain a reliability coefficient equal to 0.8292, indicating a high level of reliability.

As monitoring experience increases with these measures, higher value of MONITEXP implies more experience and, thereby, more investment in monitoring activities across time. Following Milgrom and Roberts (1992), investments in monitoring are made to increase the quality of the information provided by the metrics used to evaluate and reward the agent's behavior. Similarly, we assume that higher experience in green monitoring should reduce information asymmetry between the principal and the agent, and, thereby, be positively linked to

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[11] Variables ISOEXP, SREPEXP, SAUDEXP, and SCOMEXP assess corporate experience in using different types of sustainability-focused monitoring-like mechanisms. All indicators are measured in terms of number of years of continuous adoption prior to the proxy date.

[12] Kline (2002) indicates that with sample sizes of minimum 100 participants, factor loadings of .30 or higher can be considered significant. Comrey and Lee (1992) suggest that loadings of 0.45 can be considered "fair".

the likelihood of providing green incentives to motivate managers and employees and make them accountable for the attainment of environmental targets.

Environmental Performance Concern

The construct "environmental performance concern" (ENVCON) refers to the firm's prior environmental performance. According to extant research, a firm's level of environmental performance is significantly associated with corporate decision to use strategically green management information (Cho, Guidry, et al. 2012; Reid and Toffel 2009; Clarkson et al. 2008; Cho and Patten 2007). More specifically, we use total tons of annual carbon emissions scaled by net sales to measure a company's environmental performance[13]. Hence, we compute ENVCON on a yearly basis as the difference between a firm's environmental performance and the mean of corporate carbon emissions calculated at the GICS parent sector level. We obtain carbon emissions data from ASSET4 database. To increase the time consistency of this parameter, we compute ENVCON as the average over the three years preceding the proxy date. Also, we stretch the sample coverage of this measure by calculating the average of the prior two years or by using prior year data, for firms having missing information relatively to, respectively, the preceding 3rd and 2nd year. Finally, we winsorize this variable at its 1st and 99th percentiles to mitigate the effects of outliers.

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

Peer Pressures

The construct "peer pressures" measures the mimetic pressures that a firm may receive. We proxy this construct by two indicators: (1) we compute IMIMIC as the percentage of other firms in any given industry-year pair that implement green incentive schemes; (2) similarly to Eccles et al. (2013), we compute CMIMIC as the percentage of neighbors or other firms in any given country-year pair that use green incentives.

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[13] We compute carbon emissions by using firm's total CO_2 end CO_2 equivalent emissions in tons as reported by ASSET4 database. Because companies generally disclose CO_2 and CO_2 equivalent emissions according to various protocols (ex: GHG Protocol, Kyoto Protocol, EU Trading Scheme), ASSET4 reports the value from the GHG Protocol in case of multiple disclosures.

4.3. Control Variables

According to extant research on performance evaluation (Ittner et al. 1997), additional factors may affect corporate decisions to place more weight on nonfinancial performance measures while designing compensation contracts. In our investigation, we focus on firm size (SIZE), firm innovation propensity (R&D) and growth and investment opportunities (MTB), exogenous noise in the firm's environmental performance measures (CYCLICAL), company's level of financial distress (DISTRESS), firm risk (PVOL), industry (IND), country (CNT) and year (T) as main confounding variables.

We include firm size (SIZE) as previous studies have found a significant relationship between company dimension and the use of environment-focused governance mechanisms such as green information corporate disclosure (Marquis and Toffel 2012; Reid and Toffel 2009; Patten 2002). We measure SIZE by the natural logarithm of the company's number of employees obtained from Thomson Reuter's Datastream. Then, to reduce the potential bias for outliers, we winsorize this variable at its 1st and 99th percentiles. In particular, we make no directional predictions with regard to the effects of firm size on the decision to use green incentives.

As suggested by Ittner et al. (1997), we control for the ratio of research and development expenditures to net sales as a measure of a firm's orientation to search for new products and processes[14]. Similarly to Ittner et al. (1997), R&D ratio is computed as the averages of the respective yearly ratios over the five years preceding the proxy date. In addition, we stretch the sample coverage of the measure by calculating the average of the prior four or three years for firms having missing information relatively to, respectively, the preceding fifth and fourth year. Finally, we winsorize the indicator at its 1st and 99th percentiles, to control for potential effects of outliers[15]. Following prior studies on performance evaluation (Abernethy et al. 2004; Ittner et al. 1997; Ittner and Larcker 1995), we expect a firm's innovation strategy to positively influence the adoption of nonfinancial performance measures, such as environmental performance indicators, in formal performance assessments.

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[14] Based on Ittner et al. (1997), we initially consider an organization's propensity to innovate as a latent construct and we attempt to measure it as a factor score of two observable indicators: the ratio of research and development to net sales (R&D), and the market-to-book ratio (MTB). However, different from the authors, we find a very low Cronbach alpha reliability score from the measurement of this latent variable. So, we keep the two indicators separately in our models to capture, respectively: the firm's propensity to innovate (R&D); and, on the other hand, the firm's propensity to grow (MTB).

[15] To raise our confidence level up about the reliability of this extended indicator, we check for potential measurement biases related to the different time windows used in computation. Specifically, pairwise correlation between the five-year time span parameter and the mixed-year measure is extremely high and strongly significant for R&D ratios ($r = 0.99$, $p < .0005$). Moreover, results from our analyses remain unchanged for models using only five-year or mixed multiple-year average measures.

Further, we include corporate growth and investment opportunities (MTB) to control for market-based improvement expectations not explained by the firm's innovation propensity and potentially correlated with the firm's decision to provide green incentives. Specifically, we measure MTB as the ratio of market value to book value which is assumed to be a proxy for a firm's growth and investment opportunities (Lev and Sougiannis 1999). Similarly to Ittner et al. (1997), MTB ratio is computed as the averages of the respective yearly ratios over the five years preceding the proxy date. In addition, we stretch the sample coverage of the measure by calculating the average of the prior four or three years for firms having missing information relatively to, respectively, the preceding fifth and fourth year. Finally, we winsorize the indicator at its 1st and 99th percentiles, to control for potential effects of outliers[16].

As discussed in prior studies (Feltham and Xie 1994; Banker and Datar 1989; Holmstrom 1979), "the informational value of a performance measure is affected by its noise, or the level of precision with which the performance metrics provide information about manager's actions" (Ittner et al. 1997, 235). According to agency prescriptions, the use of performance measures should be inversely related to their conditional variance, or noise. Consistent with these theories, many empirical studies find positive relations between the noise in accounting measures and the relative importance of market and individual performance measures in bonus plans (Bushman et al. 1996; Lambert and Larcker 1987). In line with these arguments, we insert the construct "exogenous noise" to control for the exogenous noise in a firm's environmental performance measures. Specifically, we use one indicator, denoted CYCLICAL, to proxy this construct. In particular, we use total tons of annual carbon emissions scaled by net sales to measure a company's environmental performance[17]. We obtain carbon emissions data from ASSET4 database. Hence, we create the variable CYCLICAL as the standard deviation in corporate carbon emissions for companies in the same industry (based on GICS parent sector classification). In addition, to increase the time consistency of the indicator, we compute the measure as the average of the yearly standard deviations over the three years preceding the proxy date. Finally, we winsorize the measure at its 1st and 99th percentiles to control for potential effects of outliers.

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[16] To raise our confidence level up about the reliability of this extended indicators, we check for potential measurement biases related to the different time windows used in computation. Specifically, pairwise correlation between the five-year time span parameter and the mixed-year measure is extremely high and strongly significant for MTB ratios (r = 0.96, p < .0005). Moreover, results from our analyses remain unchanged for models using only five-year or mixed multiple-year average measures.

[17] We compute carbon emissions by using firm's total CO2 end CO2 equivalent emissions in tons as reported by ASSET4 database. Because companies generally disclose CO2 and CO2 equivalent emissions according to various protocols (ex: GHG Protocol, Kyoto Protocol, EU Trading Scheme), ASSET4 reports the value from the GHG Protocol in case of multiple disclosures.

Like Ittner et al. (1997), we consider the use of this performance indicator at the industry level, as representative of the noise in environmental performance measure that is beyond firm's control (e.g., cyclicality or other exogenous shocks related to climate change events). In particular, we assume that the exogenous noise in corporate green performance measures is an increasing function of the variance in industry environmental performance (Ittner et al. 1997).

Like Hoppe and Moers (2011) and Ittner et al. (1997), we include the variable DISTRESS to assess the extent to which a firm has faced financial adversity. From Thomson Reuter's Datastream data, we compute firm's DISTRESS by using Altman's bankruptcy prediction model (1968) for each of the five years preceding the proxy date. In particular, we assign to each company a score of 1 in those years if the estimated probability of bankruptcy is lower than Altman's cutoff of 1.81, and 0 otherwise. Finally, like Ittner et al. (1997), we average the firm's dichotomous bankruptcy indicators over the prior five-year period.

Because prior research has revealed significant differences among industries in how firms respond to green management demand (Simnett et al. 2009; Cho and Patten 2007), we also include industry dummies (IND) based on GICS Parent Sector classification. Furthermore, following Marquis and Toffel (2012), we use country dummies to control for country influences driving firms to insert green elements in compensation plans. Finally, we include the variable time (T) as a year dummy to account for unobserved changes in norms and expectations that occurred between 2007 and 2013.

4.4. Descriptive Statistics

Descriptive statistics and correlations for all independent and main control indicators are provided in Table 3 and Table 4. Firms in the sample vary substantially in strategic orientation, both in terms of level of research and development expenditures (R&D) and in terms of market-to-book ratio (MTB). The mean (median) level of research and development expenditures is 3% (0.8%) of net sales and the mean (median) market-to-book ratio is 2.845 (2.166). Also, the Altman (1968) bankruptcy model predicts that the mean (median) firm in the sample was in financial distress in 26.6% (0%) of the five years prior to the proxy date.

Then, 79.9% of firms report to have a business policy for environmental sustainability (GRPOLICY). Interestingly, a more detailed (not tabulated) analysis reveals that companies with an environmental strategy report a lower level of R&D expenditures over net sales (mean = 2.9%) than companies without an explicit recognition of the economic opportunities and risks linked to the environment (mean = 3.5%). Concerning the use of sustainability-focused monitoring mechanisms, the average (median) firm held an ISO 14000 certification for 4.2 years (4 years),

had publicly disclosed sustainability report for 3.1 years (3 years), had a sustainability committee or team established since 3.4 years (3 years), and had paid to have its own sustainability report assured by an external auditing party since 2.1 years (1 years). In addition, in any given country-year pair, the mean (median) proportion of peers that have used green incentive schemes was 62.7% (64.7%), while in any given industry-year pair, the average (median) percentage of peer green incentive users was 62.2% (63.9%).

TABLE 3. - Summary statistics									
Variable	N	Mean	SD	Min	P25	Median	P75	Max	Alpha[†]
GRINC	2978	0.688	0.463	0.000	0.000	1.000	1.000	1.000	
GRPOLICY	2978	0.799	0.365	0.000	1.000	1.000	1.000	1.000	
MONITEXP	2978	1.892	2.043	-1.141	0.218	1.574	3.213	8.829	0.829
ISOEXP	2978	4.209	3.323	0.000	1.000	4.000	7.000	11.000	
SREPEXP	2978	3.110	2.323	0.000	1.000	3.000	5.000	11.000	
SCOMEXP	2978	3.415	2.560	0.000	1.000	3.000	5.000	11.000	
SAUDEXP	2978	2.094	2.713	0.000	0.000	1.000	4.000	11.000	
ENVCON	2978	-0.106	1.001	-2.739	-0.190	-0.062	0.002	5.648	
IMIMIC	2978	0.622	0.159	0.095	0.533	0.639	0.741	0.923	
CMIMIC	2978	0.627	0.162	0.000	0.512	0.647	0.762	0.923	
SIZE	2978	10.105	1.349	2.944	9.220	10.204	11.077	14.604	
R&D	2978	0.030	0.052	0.000	0.000	0.008	0.033	0.296	
MTB	2978	2.845	2.556	-1.947	1.488	2.166	3.366	18.506	
CYCLICAL	2978	1.166	1.788	0.021	0.094	0.440	0.786	7.040	
DISTRESS	2978	0.266	0.388	0.000	0.000	0.000	0.600	1.000	

[†]Alpha refers to Cronbach's alpha statistic.

Variable Definitions:

GRINC : indicator variable, 1 = the firm uses green incentive schemes, 0 otherwise;

GRPOLICY: indicator variable, 1 = the firm reports to have a policy to reduce emissions and discloses to have a business case for environmental sustainability, 1 year prior to the proxy date, 0 otherwise;

MONITEXP : factor score including the number of prior continuous years the firm has implemented sustainability-focused monitoring-like mechanisms among (1) ISO 14000 certification, (2) Sustainability report, (3) Sustainability committee or team, and (4) External sustainability audit;

ISOEXP : number of prior continuous years the firm has obtained ISO 14000 certification

SREPEXP : number of prior continuous years the firm has produced and publicly disclosed a dedicated sustainability report

SCOMEXP : number of prior continuous years the firm has named a dedicated sustainability committee within the board

SAUDEXP : number of prior continuous years the firm has assured his sustainability report through a specialized external auditor

ENVCON : firm's carbon emissions scaled over sales - mean of carbon emissions scaled over sales for CIGS parent sector, average of prior 3 years;

IMIMIC : % other firms using green incentive schemes for industry-year;

CMIMIC : % other firms using green incentive schemes for country-year;

SIZE: natural logarithm of the number of employees; and

R&D : research & development/sales, average of prior 5 years;

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

CYCLICAL : standard deviation of firms' carbon emissions scaled by net sales, for GICS parent sector, average of prior 3 years;

DISTRESS : indicator variable, 1 = bankruptcy predicted by Altman model (1968) for year, 0 otherwise, average over prior 5 years.

TABLE 4. Table of Correlations

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1. GRINC	1									
2. GRPOLICY	0.1865***	1								
3. MONITEXP	0.3249***	0.3185***	1							
4. ENVCON	0.0108	-0.0088	-0.1055***	1						
5. IMIMIC	0.2928***	0.2391***	0.4296***	0.0014	1					
6. CMIMIC	0.3058***	0.1461***	0.4740***	-0.0460**	0.6122***	1				
7. SIZE	0.1982***	0.0991***	0.2564***	-0.0663***	0.0093	0.0969***	1			
8. R&D	0.0494***	-0.0235	0.0062	0.0198	0.0215	0.0371**	0.0074	1		
9. MTB	-0.0296	-0.0081	-0.0889***	0.0045	-0.0436**	-0.1046***	0.0353*	0.1230***	1	
10 CYCLICAL	0.0317*	0.1152***	0.1556***	-0.1582***	0.0244	0.0549***	-0.2364***	-0.2592***	-0.1505***	1
11 DISTRESS	0.0887***	0.0498***	0.0735***	0.0422**	0.0948***	0.1141***	-0.0013	-0.1662***	-0.2586***	0.1797***

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

Lastly, companies vary considerably with regard to environmental performance and experience different level of exogenous noise potentially influencing their green outcome. Indeed, the mean (median) firm reports environmental performance equal to -0.106 (-0.062) tons of CO^2 emissions per millions of dollars of net sales relatively to the average level of its industry. On the other, the volatility (measured in terms of standard deviation) of corporate carbon emissions produced by firms in the same industry (our proxy for CYCLICAL variable) presents a distribution with mean (median) equal to 1.166 (0.440) tons of CO^2 per millions of dollars of net sales and standard deviation equal to 1.788.

Pearson correlation coefficients observed among our variables gives little cause for multicollinearity concern. Overall, these statistics reveal that adopting organizations are on average larger, invest more on research and development initiatives and experience more financial distress relatively to non-adopters ones. More specifically, they are more likely to have an environmental policy and they have higher experience in using green- and, more in general, sustainability-focused monitoring tools. Finally, they are exposed to higher exogenous noise in terms of carbon emissions measured at industry level.

5. EMPIRICAL TESTS AND RESULTS

5.1. Determinants of Corporate Adoption of Green Incentives

To examine the choice of inserting green incentives in compensation plans, we estimate the following equation:

$$
\begin{aligned}
P(GRINC_{it}=1) = F(\alpha_0 &+ \alpha_1 GRPOLICY_{it} + \alpha_2 MONITEXP_{it} + \alpha_3 ENVCON_{it} + \alpha_4 IMIMIC_{it} \\
&+ \alpha_5 CMIMIC_{it} + \alpha_6 SIZE_{it} + \alpha_7 R\&D_{it} + \alpha_8 MTB_{it} + \alpha_9 CYCLICAL_{it} + \alpha_{10}DISTRESS_{it} \\
&+ \alpha_{11}IND_i + \alpha_{12}CNT_i + \alpha_{13}T_t + \varepsilon_{it}),
\end{aligned}
\tag{1}
$$

where ε represents the residual, or that portion of the endogenous variable that is not explained by the exogenous regressors, i represents firm i, and t represents year t. Because GRINC is a binomial outcome variable, we use a logit model to estimate equation (1). Table 5 presents the results of our analyses.

TABLE 5. Determinants of Corporate Use of "Green" Incentive Schemes						
		Entire sample			Restricted sample	
		(1.)	**(2.)**	**(3.)**	**(4.)**	**(5.)**
Independent Variables	*Predicted Sign*	logistic				OLS
Economic Efficacy in Contracting						
GRPOLICY	+	0.0709***		0.0628**	0.0754*	0.0686*
		(0.0253)		(0.025)	(0.0425)	(0.0381)
MONITEXP	+	0.0485***		0.0474***	0.0252**	0.0280**
		(0.01)		(0.0097)	(0.0117)	(0.0129)
Social Influences						
ENVCON	+		0.0256	0.0211	0.0105	0.0071
			(0.0181)	(0.0167)	(0.017)	(0.022)
IMIMIC	+		0.5615***	0.5075***	0.9682***	0.9147***
			(0.1451)	(0.1421)	(0.3373)	(0.3454)
CMIMIC	+		0.6041***	0.6214***	1.0615***	0.9427***
			(0.1636)	(0.1714)	(0.3352)	(0.2804)
Control Variables						
SIZE		0.0554***	0.0868***	0.0561***	0.0554***	0.0474***
		(0.0122)	(0.0107)	(0.012)	(0.0154)	(0.0134)
R&D		0.5641	0.7801**	0.5492	0.1524	0.1541
		(0.3676)	(0.3796)	(0.3667)	(0.4366)	(0.5067)
MTB		-0.0010	-0.0009	-0.0007	0.0082	0.0084
		(0.0048)	(0.0049)	(0.0047)	(0.0065)	(0.0067)
CYCLICAL		-0.0101	0.0019	0.0001	0.0186	0.0179
		(0.0089)	(0.0093)	(0.0092)	(0.0161)	(0.0173)
DISTRESS		0.0402	0.0245	0.0292	0.0352	0.0479
		(0.0407)	(0.0408)	(0.0397)	(0.0529)	(0.0629)
Industry effects		Yes	Yes	Yes	Yes	Yes
Country effects		Yes	Yes	Yes	Yes	Yes
Year effects		Yes	Yes	Yes	Yes	Yes
Number of observations		2978	2978	2978	808	808
Number of distinct firms		829	829	829	379	379
Pseudo R-Squared		0.179	0.167	0.190	0.120	0.126
Log-likelihood		-1517.476	-1540.498	-1497.968	-410.8423	

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

Note: Models (1)-(4) use logistic regression with average marginal effects (dy/dx). Model (5) uses OLS regression. Robust standard errors are shown in parentheses. Models (1)-(3) refer to the entire sample. Models (4) and (5) refer to a restricted sample including only those firms that from year t to year t+1 choose to adopt green incentives, and the ones that in the same period keep not adopting this mechanism. The dependent variable is an indicator variable assuming value of 1 if the firm has used green incentive, schemes, 0 otherwise. All models include industry (CIGS parent sector) effects, country effects, and year effects.

More specifically, we execute 4 different logistic regression models. Models 1-3 refer to the entire sample composed by 2,989 firm-year observations (838 unique companies). In particular, models 1-2 elaborate on equation (1) to test separately for the impact of economic efficiency in

contracting determinants and social influences on corporate use of green incentive schemes, while model 3 tests equation (1) in its complete specification. Models 4 tests equation (1) on a restricted sample of 808 firm-year observations (379 unique companies) with the aim to control for potential endogeneity concerns associated with firms' state dependence. Based on Heckman (1981), the conditional probability that a firm experiences the use of green incentive schemes in time t is a function of company's past experience in having already implemented the same mechanism. As a consequence, results from models 1-3 could be influenced by latent effects associated with firm's previous use of green incentives, not explicitly specified in the model. Omitting to control for this factor could significantly bias our results. To limit this issue, for each firm we attempt to identify the year of effective adoption as unbiased focus of our investigation. So, we select a subsample of companies including only those firms that from year t to t+1 start using green incentive systems and the ones that in the same period choose to keep not implementing the mechanism[18]. As a result, firms composing this restricted sample show the following characteristics: they are tracked at minimum twice, in two subsequent years; they enter in the subsample as non-adopting companies (GRINC = 0); they are excluded from the subsample the year after they have adopted green incentives.

Finally, in model 5 we re-estimate equation (1) using ordinary least squares (OLS) regression as a robustness check for our logistic specifications.

To prevent simultaneity constraints, independent variables in all models are one year lagged, except IMIMIC and CMIMIC, which are measured, respectively, at the country and industry level. Also, we cluster standard errors by firm to account for heteroskedasticity and nonindependence among observations from firms included in various years.

We interpret the magnitude of our coefficient estimates using average marginal effects (dy/dx) calculated at the mean of all other variables.

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[18] As a result, this re-sampling procedure has excluded those companies that from year t to t+1 answer to keep on using green incentive schemes for employees and those ones which stop implementing the mechanisms.

Controls

Starting with our control variables, we find greater use of green incentive schemes among larger organizations. This result is in line with prior literature reporting greater implementation of environmental management practices by larger companies (Marquis and Toffel 2012; Reid and Toffel 2009; Patten 2002). Moreover, similarly to Ittner et al. (1997), we find no evidence that the choice to insert environmental elements in compensation plans is influenced by a firm's financial distress. However, a difference between these studies is that Ittner et al. (1997) focus on firm's choice of general non-financial performance measures in CEO annual bonus contracts, while our emphasis is specifically on the use of environment-related incentives for both managers and employees. Finally, we do not find corporate choice to use green incentives to be affected by the firm's innovation (R&D) and grow (MTB) propensity or the exogenous noise in environmental performance (CYCLICAL).

Hypothesized relationships

The squared multiple correlation coefficients for the logistic model (pseudo-R^2) equal to 17.9% for the entire sample (model 3) and 12% for the restricted sample (model 4), indicating that the independent regressors explain a discrete portion of the variance in a firm' choice to use green incentives in compensation plans. Following our hypothesized relationships, we expect in equation (1) the coefficients (average marginal effects) $\alpha 1$, $\alpha 2$, $\alpha 3$, $\alpha 4$, and $\alpha 5$ to be positive.

Consistent with agency theory (Milgrom and Roberts 1992) and corporate sustainability research (Eccles et al. 2014), we find that the presence of a corporate environmental policy (GRPOLICY) is positively linked to the firm's provision of green performance metrics in the compensation contracts of employees. Further, we discover that monitoring experience (MONITEXP) exhibits a positive and significant relationship with the likelihood of using green incentives. For instance, firms with higher knowledge and experience in monitoring the environmental aspects of the business are more likely to insert green elements in compensations plans to reward managers and employees. This result is in line with agency arguments describing the role of corporate monitoring in influencing optimal contract design in a principal-agent setting (Milgrom and Roberts 1992).

In line with Eccles et al. (2013), we find positive and significant average marginal effects for the variables IMIMIC and CMIMIC, indicating that increases in peer pressures, at both the industry and country level, have a positive impact on the probability that firm adopts green incentives. These findings are consistent with institutional reasons explaining the diffusion of

management practices across organizations (Ansari et al. 2010; Rogers 1995; DiMaggio and Powell 1983).

Environmental performance concern (ENVCON) reports no significant effect on corporate choice to adopt green incentive mechanisms. Results from the restricted sample (model 4) are in line with those ones for the entire sample (models 1-3). Finally, OLS specification yields coefficients on the hypothesized variables with sign, magnitude and significance level nearly identical to those ones produced by model 4 logistic regression.

In terms of economic significance, model 4 results show that, holding all other variables at their means, companies with an environmental policy has 7.09% higher probability of adopting green incentives than firms that did not establish a formal business policy for environmental sustainability. Also, a one-standard deviation increase in firm's monitoring experience is associated with a 5.1% increase in the likelihood of adopting green incentive schemes, calculated as the average marginal effect (AME) of 0.0252 x SD of 2.0427. This represents a 7.5% increase beyond the mean of green incentive corporate use of 0.688. Finally, a one-standard deviation increase in the proportion of peers using green incentives rises the probability that a firm chooses to use environmental rewards of 15.4% for industry peers (calculated as AME of 0.9682 x SD of 0.1589), and 17.2% for country peers (obtained as AME of 1.0615 x SD of 0.1620). These are respectively a 22.4% and a 25.0% increase beyond the sample mean of green incentive corporate use.

5.2. Extra Analyses and Robustness Checks

We nail down our investigation to gain a deeper understanding about the nature of these relationships. We begin by predicting AMEs on corporate use of green incentives conditional different levels of MONITEXP, IMIMIC and CMIMIC (not tabulated). At a first sight, all curves show a non-linear shape with higher levels of monitoring experience (MONITEXP) and peer pressures (IMIMIC and CMIMIC) influencing positively but with decreasing marginal effects the probability that a firm chooses to adopt environmental incentives. In particular, MONITEXP is monotonic indicating higher level of corporate maturity in using environment-oriented monitoring mechanism to be associated with positive but lower probabilities to insert green measures in compensation contracts. IMIMIC and CMIMIC show inverse U functions with increasing marginal effects up to, approximately, 80% threshold, and subsequently decreasing marginal effects for higher levels of peer pressures.

In addition, we conduct several checks to reinforce the confidence in our primary results, in particular regarding the potential endogeneity of our models.

First, as suggested by (Chenhall and Moers 2007, 185), the mere fact that the establishment of an environmental policy (GRPOLICY) and monitoring experience (MONITEXP) are choice variables does not imply endogeneity in our empirical model. However, in our setting, potential endogeneity would stem for correlated omitted variables. As such, we address the potential of omitted variables problem by using relevant additional controls.

In particular, we include stock price volatility (PVOL) as a measure of the company's overall risk. This inclusion controls for both market- and firm-specific risk factors potentially influencing the firm to recognize to need for an environmental strategy and, thereby, adopt environmental management practices, such as the provision of green incentives, as a form of risk management tools. In accordance with this argument, some authors documented the need for companies to implement an environmental strategy by showing the existence of a negative relationship between corporate environmental performance and the cost of capital of the firm (Cheng et al. 2014; El Ghoul et al. 2011). Other scholars found that firms benefit from improved environmental risk management through a reduction in the value of beta (Sharfman and Fernando 2008) or in the firm unsystematic risk (Bansal and Clelland 2004). To measure PVOL, we use stock price volatility data item from Thomson Reuter's Datastream, which is calculated as the stock's average annual price movement to a high and low from a mean price for each year.

Second, there is the question of whether IMIMIC and CMIMIC are endogenous in equation (1) because of potential reverse causality bias. Although these variables are not computed at the organization-level but at higher level of measurement (respectively, at the industry and country level), it is still possible that they could be simultaneously related to our dependent variable, GRINC. For instance, the proportion of peers choosing to use green incentives in time t could depends on the decision of the focal firm to use green incentives in the same period (Antonakis et al. 2010). This could be even more likely for highly visible companies, whose behavior particularly drive peers attention and, thereby, could influence them to imitate certain business and operating decisions. Accordingly, Ansari et al. (2010), DiMaggio and Powell (1983) and Rogers (1995) argue that a firm's decision to adopt a certain management practice is a function of its perceived observability, which in turn depends also on the firm's visibility. In addition, based on legitimacy predictions (Cho, Guidry, et al. 2012; Marquis and Toffel 2012; Bénabou and Tirole 2010; Reid and Toffel 2009), company visibility might affect the likelihood that the firm responds to stakeholder concerns other than shareholders'. So, we expect highly visible companies to be positively linked to both green incentives adoption and their peers imitating behavior. In particular, we use two indicators to proxy company visibility at both the industry and

the country level. More specifically, we measure company market shares, denoted IMSHARE and CMSHARE, by computing the yearly ratios of company revenues to the total revenues for all firms, respectively, in the same industry and in the same country. So, we include IMSHARE and CMSHARE in equation (1) to mitigate potential reverse causality.

Third, our sample composition is also moderately skewed towards US companies, representing alone almost 29% of the entire sample. This overrepresentation constitutes a source of potential sample selection distortion, threatening our primary results to be biased because of significant US specific influences possibly not valid for firms domiciled in other countries. To address this issue, we investigate the hypothesized relationships and the proposed additional controls over a sample of firms not legally domiciled in the US.

Table 6 presents the results of 3 different logistic models. Model 6 tests equation (1) and adds PVOL as extra control variable. Model 7 tests Model 6 specifications with IMSHARE and CMSHARE as addition controls. Model 8 tests Model 7 specifications over a restricted sample of 512 firm-year observations, composed only by non US-based companies. Overall, results remain consistent with our primary findings.

In addition, in the non-US sample corporate environmental concern (ENVCON) turns to be positively and significantly linked with a firm's decision to implement green incentives. For instance, excluding US companies, firms that pollute more than their industry mean are on average more likely to insert green measures in compensations plans. This result indicates higher responsiveness to CO^2 concerns of non US-based firms than US ones. Wald test of equality of Model 7 and Model 8 ENVCON indicates that difference in coefficients is statistically significant at 5 percent level.[19]. Overall, these findings corroborate our previous inferences.

At a first look, these results contrast with findings from prior studies focusing on the US market and showing a positive relationship between firm environmental performance and higher use of green management information (Cho, Guidry, et al. 2012; Reid and Toffel 2009; Cho and Patten 2007). However, the main focus of these studies is on corporate use of voluntary disclosure practices which constitute externally-oriented accounting tools, often used instrumentally, as a means of "greenwash" (Marquis and Toffel 2012; Bénabou and Tirole 2010). In our case, we examine an internally-oriented mechanism aimed at influencing managers and employees behavior (Zimmerman 2000) and, thus, less exposed to be used as classical external "greenwashing" mechanism. Based on this difference, our results suggest non US firms to be

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[19] Results from these robustness checks are not displayed.

more responsive to environmental concerns compared to US ones from a management control perspective.

		Global sample (6.) logistic reg.		Global sample (7.) logistic reg.		Non US firms (8.) logistic reg.	
TABLE 6. Robustness checks: Determinants of Corporate Use of Green Incentive Schemes							
Independent Variables	*Predicted Sign*	dy/dx	se	dy/dx	se	dy/dx	se
Rational Accounts							
GRPOLICY	+	0.0935**	(0.0446)	0.0975**	(0.0446)	0.0895*	(0.0522)
MONITEXP	+	0.0310***	(0.0119)	0.0297**	(0.012)	0.0392**	(0.0156)
Social Accounts							
ENVCON	+	0.0122	(0.0172)	0.0120	(0.0171)	0.0565**	(0.0263)
IMIMIC	+	0.9317***	(0.3452)	0.9490***	(0.3456)	0.7259*	(0.4082)
CMIMIC	+	1.0511***	(0.3438)	1.0298***	(0.3484)	0.8882**	(0.3886)
Control Variables							
PVOL		-0.0007	(0.0024)	-0.0003	(0.0024)	0.0015	(0.0032)
IMSHARE				0.9121	(0.7812)	1.0074	(1.4514)
CMSHARE				-0.1423	(0.3909)	-0.1462	(0.4204)
SIZE		0.0556***	(0.0159)	0.0491***	(0.0178)	0.0482**	(0.0219)
R&D		0.2367	(0.4414)	0.2418	(0.4393)	0.0966	(0.647)
MTB		0.0045	(0.007)	0.0048	(0.007)	-0.0028	(0.0091)
CYCLICAL		0.0184	(0.0164)	0.0163	(0.0164)	0.0163	(0.0192)
DISTRESS		-0.0058	(0.0545)	-0.0095	(0.0547)	0.0306	(0.0639)
Industry effects		Yes		Yes		Yes	
Country effects		Yes		Yes		Yes	
Year effects		Yes		Yes		Yes	
Number of observations		756		756		512	
Number of distinct firms		353		353		238	
Pseudo R-Squared		0.1294		0.1310		0.175	
Log-likelihood		-378.465		-377.769		-241.1009	

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

Note: Models use logistic regression with average marginal effects (dy/dx). Standard errors are in parentheses clustered by firm. Models (6) and (7) refer to the entire sample. Model (8) refers to a restricted sample including only non-US based firms. The dependent variable is an indicator variable assuming value of 1 if the firm has used green incentives, 0 otherwise. All models include industry (CIGS parent sector) effects, country effects, and year effects.

One potential explanation for these findings refers to the significant differences existing in corporate governance practices among countries (Ioannou and Serafeim 2012). In the United States, for example, it is only in the last 10 years that sustainability has become a prominent topic in top management's agenda (TCB 2012) while the governance of continental European firms has traditionally reflected a wider implicit social contract. So a potential lag for US companies figuring out how to respond to environmental concerns level should be expected. Similarly,

Ioannou and Serafeim (2012) showed that countries whose laws and regulations promote market competition and shareholder protection (i.e.: US) are associated with lower corporate environmental performance.

Additionally, we control for cultural characteristics potentially explaining, at least partially, firms' decision to tie employees' compensation contracts to environmental objectives. To do this, we include dummy indicators to capture cultural clusters across sample companies based on common cultural roots of the country of domicile. Specifically, we create dummies for Germanic, Nordic, Anglo, Latin European and Latin American, Eastern European, Middle-East, Japan and Asian clusters. Results from this analysis (not tabulated) remain substantially unchanged. Notably, in line with Ioannou and Serafeim (2012), we find that firms domiciled in "communitarian" countries such as those in the Germanic cluster are more likely to use green incentives than companies from "individualistic" nations in the Anglo cluster.

Finally, we perform additional analyses, none of which hint at the existence of significant variations from our primary findings. First, we exclude 2013 observations and we rerun equation (1) to control for potential sample underrepresentation due to 2013 drop in the total number of firms covered by ASSET4 database. Then, we control for sample selection bias potentially caused by the coverage of CDP database that dramatically increased over years. CDP database by construction does not provide prior information regarding the use of green incentives by companies entering in the database at certain time t. As a result, CDP data do not track the complete adoption cycle of green compensation contracts for many of the firms included in the sample. To reduce this concern, we rerun equation (1) over a subsample of firms in the years 2010-2013 representing the period where both ASSET4 and CDP coverage is maximized. Third, we use different alternative measures for monitoring experience, environmental concern and company visibility within the domiciled country. In particular, we measure monitoring experience by creating different compositions among the various items used to operationalize the construct[20]. On the other hand, we measure corporate environmental concern through a new binary indicator assuming values of 1 when a firm's carbon emissions scaled by the level of net sales is higher than its industry mean, and 0 otherwise. Lastly, we measure company visibility within its

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[20] Because of the exploratory nature of our variable MONITEXP, we create different proxies for corporate monitoring experience through different combinations of the items ISOEXP, SREPEXP, SAUDEXP, and SCOMEXP. For instance, we create the following groups: ISOEXP, SREPEXP and SCOMEXP; ISOEXP, SREPEXP and SAUDEXP; ISOEXP, SCOMEXP and SAUDEXP; SREPEXP, SCOMEXP and SAUDEXP. Then, for each group we calculate principal component analysis to unveil the existence of significant common factors. All estimated components are strong with loading coefficients greater than 0.55 and Cronbach alpha measures of internal consistency above 0.74.

domiciled country by computing the ratio of company carbon emissions to the total emissions of all firms based in the same country.

5.3. Determinants of the Time of Green Incentives Adoption

To investigate firms' decision about the time of green incentives adoption, we initially examine equation (1) by graphically looking at differences in the magnitude of the determinants of corporate use of green incentives over time. Based on Model 6 results, Figure 1 depicts the predicted average marginal effects (AMEs) of environmental policy (GRPOLICY), monitoring experience (MONITEXP), industry-peer pressure (IMIMIC) and country-peer pressure (CMIMIC) on a firm's yearly decision to use green incentives.

However, graph results suffer from potential sample selection bias because they are influenced by the effects of companies which have never adopted green incentives and, thereby, are useless to estimate the timing of adoption.

So, we subsequently dig our investigation by looking at the differences between earlier adopters and late adopter firms within our sample. More specifically, we estimate the following equation:

$$
\begin{aligned}
(TADOPT_i \mid FST\_ADOPT_i = 1) = F(&\beta_0 + \beta_1 aGRPOLICY_i + \beta_2 rMONITEXP_i + \beta_3 ENVCON_i \\
&+ \beta_4 dIMIMIC_i + \beta_5 dCMIMIC_i + \beta_6 rPVOL_i + \beta_7 IMSHARE_i + \beta_8 rCMSHARE_i \\
&+ \beta_9 rSIZE_i + \beta_{10} rR\&D_i + \beta_{11} rMTB_i + \beta_{12} CYCLICAL_i + \beta_{13} DISTRESS_i \\
&+ \beta_{14} IND_i + \beta_{15} CNT_i + \varepsilon_i)
\end{aligned}
\tag{2}
$$

where ε represents the residual and i represents firm i belonging to FST_ADOPT = 1, a restricted subsample grouping only companies in the first year they report to use environmental incentives. Similarly to what previously executed, we include the indicators PVOL, IMSHARE and CMSHARE to check for potential correlated omitted variables and reverse causality concerns and reinforce the confidence in the findings of our investigation.

FIGURE 1. Determinants of the Time of of Green Incentives Adoption

Main determinants of green incentives adoption
Different effects at different points in time (AMEs)
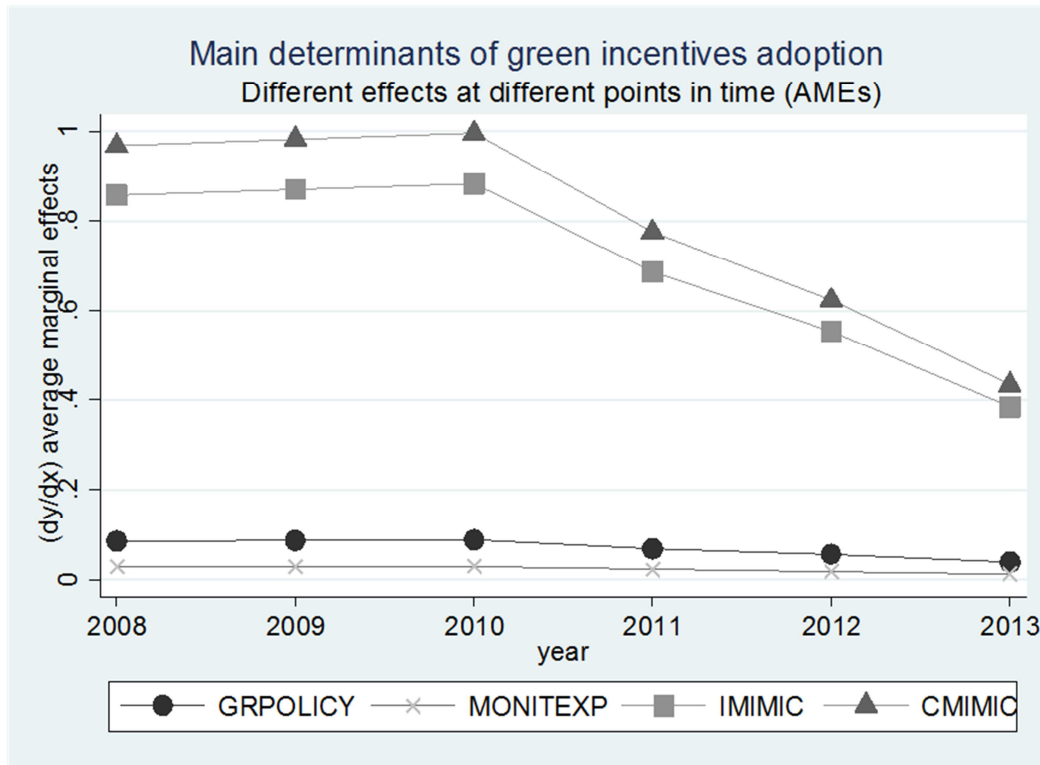
Because the results from this analysis could be affected by time effects having a significant impact on the yearly values of the regressors, we time-deflate our independent variables and controls where needed. We begin by generating an adjusted version of the variable environmental policy to distinguish between early and late or not adopters of the policy. So, we create aGRPOLICY, a binary indicator taking value of 1 for firms that have adopted an environmental policy already in 2006, and 0 for companies that choose to implement it at a later stage or that still have to adopt the policy. Hence, we continue by substituting other potentially biased regressors with time-deflated versions obtained through two different procedures. First we select all variables measured at the organization level and we demean them by calculating the yearly difference between the firm's value and its respective industry mean (step A). Subsequently, we check for potential time-inflation among the remaining variables, measured at the industry and country level. In particular, for each indicator we look at the number of non-missing observations per year in ASSET4 and CDP information to verify the presence of significant time trends within data collecting processes. Then, we instrument the time-inflated variables by separately regressing each of them on the yearly number of observations (that expresses the time trend of

ASSET4 data collection procedure). Finally, we take the residuals as the de-trended versions to be inserted in equation (2) (step B).

Prefix a, preceding the variable GRPOLICY, indicates the adjustment executed to the variable environmental policy to measure the time of adoption of a green policy – more specifically, early adoption vs late or not adoption. Prefix r (preceding the variables MONITEXP, PVOL, SIZE, R&D, MTB and DISTRESS) and prefix d (preceding the variables IMIMIC, CMIMIC) in equation (2) indicate where, respectively, step A and step B are applied.

Table 7 presents the results of our analyses. In particular, since TADOPT is by construction an ordinal variable with seven continuous categories and shows an approximately normal distribution, in Models 9-12 we test equation (2) using OLS regression (Menard 2010)[21]. In particular, Models 9 and 10 refer to the entire global sample while Models 11 and 12 focus on a subsample of non US firms. Also, Models 9 and 11 report the outcome of two regressions run over the entire sample of adopting firms as they enter in the CDP database. On the other, Models 10 and 12 focus on a restricted sample of companies that entered in the database in the year 2007. This is to control for potential sample selection bias caused by firms entering in the database at different years and leading to incomplete information regarding the real date of adoption of green incentives in the period under scrutiny.

Controls

Referring to control variables, we document an earlier use of green incentive schemes among larger organizations and companies with higher market share. This evidence is consistent with prior literature on the attributes of the diffusion of innovations (Rogers 1995) claiming that larger organizations tend to enjoy resource advantages at the initiation stage and, thereby, are more likely to experiment novel management practices at an earlier stage.

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[21] Based on Menar (2010), we treat TADOPT as interval or ratio variable by using OLS regression with an ordinal dependent variable. As Menard points out (2010, 195–196), "treating the dependent variable as though it were measured on an interval or ratio scale effectively assumes that the data are measured more precisely than they really are; but for ordinal variables respecting specific conditions, it may produces reasonable results". In particular, (1) our dependent variable represents a true construct and not an abstract concept. (2) The number of ordered categories is relatively large so to make homoscedasticity assumption less likely to be violated. (3) Our ordinal variable respect distribution properties assumption since it represents an underlying interval/ratio indicator with a normal distribution.

Further, in accordance with rational accounts for the diffusion of management practices (Ansari et al. 2010; DiMaggio and Powell 1983), we document that the level of exogenous noise in environmental performance is positively (negatively) associated with the probability that a firm

TABLE 7. Determinants of the Time of Green Incentives Adoption

		Global sample				Non US firms			
		(9.)		**(10.)**		**(11.)**		**(12.)**	
		Entire sample		Restricted sample		Entire sample		Restricted sample	
Independent Variables	*Predicted Sign*	b	se	b	se	b	se	b	se
Rational Accounts									
aGRPOLICY	-	-0.7116***	(0.1879)	-0.6835***	(0.245)	-0.4160*	(0.2416)	-0.2614	(0.3804)
rMONITEXP	-	0.3996***	(0.0504)	0.4896***	(0.0675)	0.4148***	(0.0556)	0.4964***	(0.0809)
Social Accounts									
ENVCON	+	-0.0831	(0.0704)	-0.1099	(0.0828)	-0.0170	(0.0863)	-0.0751	(0.1152)
dIMIMIC	+	3.8097***	(0.9028)	2.6836**	(1.2496)	3.8978***	(1.0494)	2.6395	(1.6628)
dCMIMIC	+	-3.6650***	(0.8878)	-5.9801***	(1.2314)	-2.4961**	(1.1191)	-5.4848***	(1.7292)
Control Variables									
rPVOL		0.0166	(0.0102)	0.0069	(0.0131)	0.0193	(0.0124)	0.0108	(0.0165)
IMSHARE		-8.3823***	(1.7728)	-6.2868***	(1.9804)	-12.1103***	(2.18)	-9.7831***	(2.5734)
CMSHARE		0.0388	(1.1503)	2.0403	(1.6563)	0.6236	(1.3376)	2.1058	(2.1124)
rSIZE		-0.3299***	(0.0773)	-0.3250***	(0.1112)	-0.3358***	(0.0887)	-0.2452	(0.149)
rR&D		-2.5771	(1.9121)	-2.8532	(2.6788)	-4.7479*	(2.7539)	-4.9468	(5.3019)
rMTB		-0.0365	(0.0295)	-0.0523	(0.0414)	-0.0319	(0.0458)	-0.0565	(0.0604)
CYCLICAL		0.4372***	(0.0797)	0.4134***	(0.0909)	0.4085***	(0.0907)	0.3767***	(0.11)
rDISTRESS		-0.2317	(0.2125)	-0.4560	(0.291)	-0.2002	(0.2392)	-0.6277*	(0.3658)
Industry effects		Yes		Yes		Yes		Yes	
Country effects		Yes		Yes		Yes		Yes	
Observations		470		269		338		176	
R-Squared		0.5221		0.6599		0.5469		0.6898	

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

Note: Models use OLS regression. Robust standard errors are shown in parentheses. The model includes industry (CIGS parent sector) effects and country effects.

The dependent variable (TADOPT) is a unit-value categorical variable ranking sample firms in an increasing order based on the first year companies adopt green incentives.

Specifically, TADOPT assumes value from 1 to 7 (i.e. 1 = 2007 adopters; 7 = 2013 adopters). Prefix 'a' indicates the adjustment executed to the variable GRPOLICY to measure

the time of adoption of a green policy – more specifically, aGRPOLICY is a binary indicator assuming value of 1 when firms have adopted an environmental policy already in 2006,

0 when firms choose to implment it at a later year or still have to adopt the policy. Prefix 'r'=indicates demeanded variables (relatively to the industry mean computed on a yearly basis).

Prefix 'd'=indicates detrended variables (instrumented on the yearly coverage trend of CDP dbase)

chooses to adopt green incentives at later (earlier) stages. However, we find no evidence that a firm's propensities to innovate and growth, as well as its relative stock price volatility and financial distress, influence the decision about when to insert environmental elements in compensation plans.

Hypothesized relationships

The squared multiple correlation coefficients for Model 10 and 12 equal 65.9% and 68.9%, indicating that the independent regressors explain a high portion of the variance in a firm's choice regarding the time of green incentives adoption. Following our hypothesized relationships, we expect in equation (2) the coefficients $\beta 1$ and $\beta 2$ to be negative while the coefficients $\beta 3$, $\beta 4$, $\beta 5$ to be positive. Overall, we document that management practices diffusion research only partially explain the time of green incentives adoption.

In particular, we find that companies that implemented a business policy for environmental sustainability already in 2006 are significantly more (less) likely to adopt green incentive schemes at an earlier (later) stage than firms that adopted the policy at a later stage or still have to introduce it. Specifically, based on Model 10 results, the presence of a green policy in 2006 is associated with a 0.68 years earlier use of environmental performance measures in employees' compensation plans. This finding is in line with economic accounts for management practices diffusion, assuming a positive relationship between a firm's market-based strategic orientation and an early adoption of specific managerial innovations aimed at fostering strategy execution (Ansari et al. 2010; DiMaggio and Powell 1983). However, this evidence does not hold for international firms, suggesting environmental policy not to be a significant predictor of the time of green incentives adoption outside the US market.

Contrary to our hypothesis, we find corporate monitoring experience (rMONITEXP) to be positively (negatively) associated with later (earlier) use of green incentives. Relatively to their industry mean, firms with one-unit higher monitoring maturity on environmental performance are more likely to adopt green incentives 0.49 years later. Although this result appears in opposition to classical practices diffusion theory (Ansari et al. 2010; DiMaggio and Powell 1983), it suggests an economic rationale. As firms cumulate knowledge on controlling environment-related decisions over time, they are more likely to rely and use more efficiently the information content included in environmental performance measures, thereby deciding to insert them in compensation contracts.

On the other side, consistent with social accounts predictions, we find that higher industry peer pressure (dIMIMIC) is positively associated with the probability that a firm adopts green

incentives at a later stage. However, country peer pressure (dCMIMIC) is negatively (positively) associated with firm use of green incentives at a later (earlier) time. In particular, companies with 10 percent higher proportion of peers using green incentives are more likely to start implementing this mechanism approximately 0.26 years later and 0.59 years earlier for, respectively, industry and country peers. Overall, the latter finding suggests higher corporate response speed to local peer pressures.

However, we note that corporate environmental performance concern (ENVCON) is not significantly associated with a firm's decision regarding the time of green incentives adoption.

Finally, we perform additional tests by using alternative measures for monitoring experience, environmental concern and company visibility at the country level in the spirit of what previously proposed. Overall, results remain consistent with our findings.

6. SUMMARY AND CONCLUSIONS

This paper examines factors influencing corporate provision of incentives to motivate behavior by managers and employees towards the achievement of environmental targets (i.e., reducing carbon emissions, energy efficiency goals, climate change risk mitigation plans, sales of "environment-friendly" products and services). In particular, we explore some relevant determinants explaining both the choice of using and the time of green incentive adoption. Using a sample of 2007-2013 data from 829 global listed firms operating in various industries, we find that the integration of environmental issues into a company's business strategy through the adoption of an *ad-hoc* green policy positively affects the probability that a firm provides green incentives. This evidence is in accordance with agency theory predictions stating that the design of an optimal compensation contracts involves the choice of specific performance measures based on the level of informativeness regarding the manager's efforts (Milgrom and Roberts 1992; Holmstrom 1979). Further, we document that corporate investment in monitoring environmental performance is positively associated with the likelihood that a firm decides to insert green performance measures in compensation plans. This result supports the notion that the selection of a performance measure to evaluate and reward agent's behavior depends on principal's monitoring effort, aimed at improving the overall quality of the measurement process and, thereby, the effectiveness in contracting with the agent (Milgrom and Roberts 1992). In particular, results unveil the existence of a not-linear relationship between monitoring investment and green incentive adoption, indicating higher levels of monitoring efforts to exercise positive but decreasing marginal effects on corporate choice to use environmental performance measures in compensation plans.

Consistent with "legitimacy" arguments on the use of management practices (Ansari et al. 2010; Reid and Toffel 2009; Cho and Patten 2007; DiMaggio and Powell 1983), we provide evidence on the role of social influences to impact corporate provision of green incentives. As the proportion of peers using green incentives increase both at the industry and the country level, firms are more likely to mimic their behavior and take the decision to adopt the mechanism. In particular, peer pressures show inverse U functions with increasing marginal effects up to, approximately, 80% threshold, and subsequently decreasing marginal effects for higher proportion of peer green behavior. Also, our results demonstrate that, compared to US based companies, firms not domiciled in the US are more likely to respond to higher environmental concern through the provision of green incentives, designed to make managers and employees accountable for environmental objectives. In particular, we interpret these findings based on the work of Ioannou et Serafeim (2012) showing that companies domiciled in countries whose laws and regulations promote market competition and shareholder protection (i.e.: US) are typically associated with lower corporate environmental performance as opposed to firms whose headquarter is located in stakeholder-oriented nations.

Regarding the timing of adoption of green incentive schemes, our results are only partially in line with theoretical predictions from practice diffusion research (Ansari et al. 2010; Rogers 1995; DiMaggio and Powell 1983). In accordance with rational accounts theorizing early adopters of organizational practices to be driven by a desire to improve performance (DiMaggio and Powell 1983), we find that firms that implemented a business policy for environmental sustainability at an earlier stage are more likely to use green incentive schemes at an earlier time in the period under scrutiny. However, this result does not hold for international firms, suggesting environmental policy not to be a significant predictor of the time of green incentives adoption outside the US market. Then, contrary to our expectations, our findings indicate that companies investing more in monitoring the environmental aspects of the business are more likely to be later adopters. Nevertheless, this result suggests a rational organizational behavior indicating the need for the principal to cumulate knowledge and experience about the information content provided by environmental performance measures before deciding to include them in compensations contracts. Also, consistent with social accounts predictions explaining later adoption of organizational practices (DiMaggio and Powell 1983), we find that industry peer pressure is positively associated with a firm's decision to use green incentives at a later stage. However, country peers exercise a more immediate effect and influence firm provision of climate change-related incentives at an earlier time, indicating higher speed in corporate response to "proximity"

pressures stemming from local neighbors. Finally, we find no support for claims that higher environmental performance concern influences corporate provision of green incentive at a later stage.

Consistent with extant research on the diffusion of management innovations among organizations (Ansari et al. 2010; Rogers 1995; DiMaggio and Powell 1983), we also note that larger size, as well as higher market size are significantly associated with corporate use of green incentives at an earlier time. On the contrary, higher levels of exogenous noise in environmental performance measures relate to a later adoption of green incentives.

As with any empirical study, our works is subject to several limitations. For instance, in testing corporate provision of green incentives to managers and employees, agency theory predictions are used to analyze the impact of relevant determinants at a broad organizational level. However, prior research argues that a firm's choice about the design of compensations contracts is also a function of the nature of the tasks performed and the level of delegation assigned to the entitled agents (Moers 2006; Milgrom and Roberts 1992). As a result, it is possible that the way the proposed determinants influence the decision to assign these incentives depends on the different organizational position of the individuals entitled to benefits from these systems. In our opinion, not examining the potential differences related to agents' organizational roles is unlikely to confound our results, but future research can extend our investigation and significantly enrich the level of understanding about the use of this more and more popular and, at the same time, severely discussed organizational practice.

Moreover, as previously mentioned, in our setting potential endogeneity would stem from correlated omitted variables. In particular, the constructs "environmental policy" (GRPOLICY) and "investment in monitoring" (MONITEXP) can be associated with some unobserved company-specific factors that potentially correlate with a company's decisions both to provide incentives for the attainment of green targets and to integrate environmental issues in the business strategy, as well as to invest in environment-focused information systems that improve the quality of environmental performance measurement. The inclusion of the control indicator PVOL partially addresses this concern and corroborates the existence of a positive relationship between environmental policy and monitoring experience, on the one side, and corporate provision of green incentives, on the other. Overall, our results suggest that any potential omitted variable bias may be not severe. However, it is still possible that the proposed models do not completely capture all omitted confounding factors. We believe that attempts to address this issue constitute a fruitful area for future research.

Further we acknowledge that other caveats are related to work. Still, we contribute to the literature by providing solid evidence that corporate choice about the provision and the time of green incentive adoption is driven by both important determinants related to the efficacy in contracting and to social influences.

FIGURE A. Diffusion Trends of Sustainability-Oriented Governance Mechanisms

Monitoring for sustainability
Diffusion (%)

A. Sustainability compensation
B. Sustainability reports
C. Sustainability committee
D. External sustainability audit
E. ISO 14001

Note: Diffusion of external sustainability audit refers to the proportion of assured sustainability reports
Source: Thompson Reuters ASSET4 Database
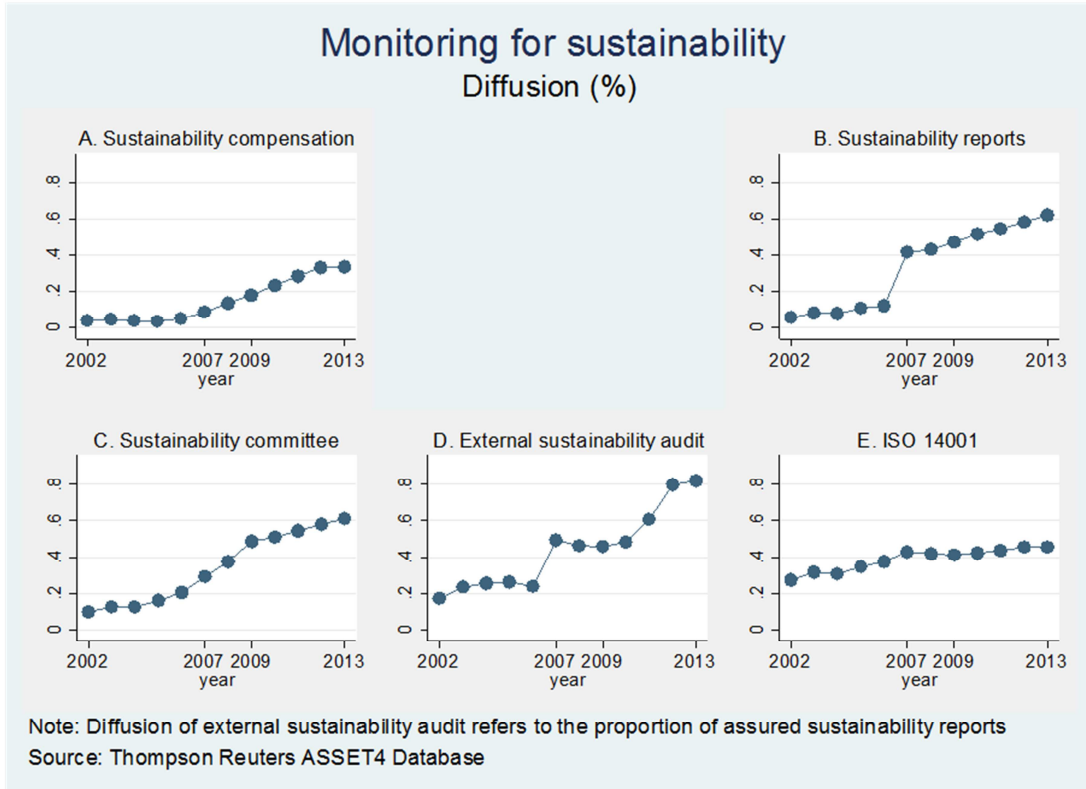
TABLE A. Examples of Green Incentives from 2013 CDP Survey Answers

Green incentives	Description
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 CO_2 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 (e.g., carpool) for their daily travel to and from work and who are unable to travel home via their regular sustainable transportation mode ..."
Company F (Constructions 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 though 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 Symantec'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 Symantec will match their cash donation up to $1,000 per calendar year …"

CHAPTER III

Does CSR-linked Executive Compensation Promote CSR Performance?[*]

Does CSR-linked Executive Compensation Promote CSR Performance?

ABSTRACT: The research described in this paper examines effectiveness of contracting associated with the use of CSR-linked executive compensation across firms. Empirical analysis of a cross-industry sample of 5,720 firm-year observations from 783 US listed companies for the period 2002-2013 revealed that, in accordance with agency theory predictions, the provision of CSR-linked incentives for senior executives promotes firms' CSR performance. Corporate choice to tie senior managers' pay to CSR targets produces positive effects already in the year subsequent to the date of adoption, and increases CSR results monotonically as firms accumulate experience in using this mechanism over the years. Results are robust after controlling for potential endogeneity by means of a 2SLS estimation procedure with instrumental variables. Furthermore, the use of CSR-focused advisory and monitoring systems is shown to increase the positive effects of a firm's experience in tying top managers' compensation to CSR targets. In accordance with agency theory and corporate governance research, it was found that a company's experience in using CSR-linked executive compensation is likely to promote even higher CSR outcomes when a CSR committee is established within the board of directors or a CSR report is publicly disclosed. In contrast, CSR external audits do not improve CSR performance, suggesting that they are likely to play a merely symbolic role.

1. INTRODUCTION

Concern regarding corporate social responsibility (CSR) has now become a priority among organizations. Corporate constraints when considering CSR practices are traditionally twofold. First, from an economic perspective, firms make socially responsible investments only when they maximize shareholder value. Accordingly, companies create a business case for sustainability and incorporate green and social aspects in their strategies and operations because of the potential financial benefits associated with CSR performance (Porter and Kramer 2011; Bénabou and Tirole 2010; Porter and Linde 1995)[1]. Second, from a sociopolitical perspective, firms make investments that benefit society to comply with regulations and to avoid the deterioration of their reputation (Marcus and Fremeth 2009). Such investments represent attempts to conform to societal boundaries and behave legitimately by responding to non-shareholder constituents' demands, potentially, but not necessarily, to the detriment of the economic interest of shareholders. If managers decide to engage in CSR activities because of reputational considerations, then some of those activities may be undertaken at the expense of shareholders[2] (Moser and Martin 2012; Bénabou and Tirole 2010).

Sustainability issues have recently become increasingly popular in the boardroom, with shareholders being key actors in the management of CSR. In this regard, Tonello and Aguilar (2012) analyzed the total sample of shareholder proposals submitted to firms registered with the SEC between January 2011 and August 3, 2011. The authors found that 35% related to matters of environmental and social policies, a significant increase from 28% in 2010 and 29% in 2007. In addition, a 2010 survey by The Conference Board (2012) examined a restricted sample of US listed firms and notes that approximately half of the investigated companies assigned ultimate responsibility for oversight of sustainability to the board of directors or one its committees.

There are many different ways a board of directors can signal formally to executive members the need for active management of corporate sustainability on their behalf. In this regard, in the last 20 years there has been a substantial increase in the number of firms adopting ad-hoc governance mechanisms and monitoring systems to ensure that senior executives make informed decisions and carry out effective communication concerning relevant CSR issues. Specifically, board members have started to incentivize senior executives to achieve CSR objectives tying their compensation to the firm's environmental and social performance, thus rendering them formally

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[1] See Porter and Kramer (2006; 2011) for insights and examples of companies that have developed strong linkages between their business strategies and CSR.

[2] The expression "at the expense of shareholders" refers to Moser and Martin's definition (2012, 798) that "the costs of the socially responsible activity to the firm exceed the benefits to the firm".

accountable for these outcomes. An analysis of Thomson Reuters ASSET4[3] data over more than 4,500 global public companies has revealed that in 2013 approximately 31.82% of listed firms linked at least one of their senior executives' compensation to CSR goals, as compared to 3.85% in 2002 (see Table 1).

TABLE 1. Corporate Use of CSR-focused Governance-type Mechanisms - Time Distribution and Dynamics

	year											
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Global sample												
CSR Executive Compensation	3.85%	4.46%	3.67%	3.36%	5.01%	8.35%	13.34%	17.90%	23.13%	28.15%	32.85%	31.82%
CSR Committee	7.21%	9.50%	8.32%	10.27%	13.30%	18.26%	21.71%	24.23%	29.84%	27.84%	30.26%	29.91%
CSR Report	5.44%	7.87%	7.61%	10.73%	12.15%	41.39%	42.81%	46.88%	51.79%	54.71%	58.40%	59.38%
CSR External Audit	17.07%	1.85%	1.91%	2.77%	2.78%	17.74%	18.73%	20.12%	22.28%	27.62%	34.98%	37.19%

At the institutional level, there is a flourishing body of guidance literature for investors and companies on how to integrate CSR issues appropriately into executive management goals and incentive schemes (PRI 2012). Similarly, articles in the press and surveys document a growing number of firms tying compensation contracts to sustainability performance for both managers and employees (The Guardian 2014; Ceres 2014; Glass Lewis &Co 2013; TCB 2012; Berns et al. 2009).

For example, in the executive compensation section of its 2014 proxy statement, Walmart International disclosed that a portion of named executive officers' (NEOs) 2013 cash incentive payments were subject to satisfying pre-established diversity and inclusion objectives, in the form of "good faith efforts" and "placement goals" (Walmart International 2014, 55). Specifically, the company declared that each NEO's cash incentive payment could be reduced by up to 15% if these objectives were not satisfied. In addition, the Audit Committee judged the company's achievement of general compliance goals against a pre-established program. These objectives covered subjects in the fields of anti-corruption, anti-money laundering, health, safety and wellness compliance, environmental compliance, and labor and employment compliance. Referring to the Audit Committee's judgment, the Compensation Committee could exercise negative discretion to reduce or eliminate the cash incentive payments to NEOs.

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[3] Thomson Reuters' ASSET4 collects ESG public information from more than 4,500 global listed firms.

At Marriott International (2014, 48), the NEOs' 2013 annual cash incentive program consisted of two components under which payments were based on actual performance measured against pre-established financial and operational targets: (1) the "Incentive Plan", which focused on a diluted EPS objective; and (2) the "Individual Plan", which focused on other financial, operational and human capital objectives. In particular, the human capital objective referred to associate engagement was assigned a weight of 5% of the total award for the year. Assessment of associate engagement was measured by the results of the company's annual associate engagement survey (conducted by a third party) as compared to external benchmark results.

In 2011, the annual incentive objectives for all executive officers at Xcel Energy were based entirely on the attainment of corporate goals with pre-determined weights of 15%, 5% and 20% of total award t, respectively for safety, employee engagement, and environmental leadership targets (Xcel Energy 2014, 44). In addition, approximately 20% of NEOs' long-term equity compensation embodied a performance goal based on achieving environmental targets, while maintaining a competitive price for services provided to customers. The performance was measured relative to peers at the end of a three-year period.

At FedEx International, 2013 annual cash payouts for each NEO were adjusted upward or downward based on the officers' achievement of individual performance objectives established at the beginning of the year. Among various performance parameters, these targets involved the inclusion of females and minorities for open positions and promotional opportunities. None of these factors were given a particular pre-established weight in determining whether and how much to adjust the bonus amount (FedEx Corporation 2014, 29–31).

Despite the increasing number of references, empirical research on the role of CSR-linked incentive schemes is scarce and has produced scattered findings. Some authors have followed the economic rationales of principal-agency theory (Milgrom and Roberts 1992) and argue that the design of CSR-linked incentive contracts addresses the general problem of influencing the agent to act on behalf of the principal's desires towards corporate sustainability (Campbell et al. 2007; Cordeiro and Sarkis 2008; Deckop 2006). Specifically, if sustainability has become a corporate priority, then appropriate incentives for top executives need to be associated with it. Accordingly, this body of research investigates the empirical association between the CEO's compensation and the firm's CSR performance and finds the existence of a significant positive relationship between the two constructs. However, all studies investigate sample data from prior to 2004, i.e. before the CSR phenomenon gained its documented popularity within firms' governance structures, thus motivating the need to update the validity of this inference.

Other scholars have discussed the existence of deviations from agency-theory predictions and claim that the hypothesized benefits associated with implementing a sustainability pay-for-performance system depend on a number of factors (Eccles et al. 2013; Berrone and Gomez-Mejia 2009). In particular, Berrone and Gomez-Mejia (2009) adopted an institutional approach to complement agency models and justify the corporate choice of tying executive bonus plans to sustainability performances even if such measures do not provide significant incentives. As suggested by Armstrong et al. (2010), bonus plans that are explicitly tied to non-price performance such as CSR information may also serve as a signal to shareholders and stakeholders that the board is responding to their pressure to obtain information about the firm's CSR activities and to monitor executives' CSR commitment. In line with these propositions, Berrone & Gomez-Mejia (2009) analyzed longitudinal data of 469 US firms from 1997 to 2003 and found that higher environmental performance increases CEO pay, that pollution-preventing strategies affect executive compensation more than end-of-pipe pollution control, and that explicit use of green governance mechanisms (specifically, an environmental pay policy and an environmental committee) does not strengthen this link, suggesting that these mechanisms play a merely symbolic role. However, their sample data are from prior to 2004 and the measure used to proxy environmental governance captures corporate use of green incentives schemes only spuriously.

In contrast, Eccles et al. (2013) examined the behavioral implications associated with the use of prosocial goals in incentive systems. According to the crowding out theory of intrinsic motivation (Bénabou and Tirole 2006), employees may engage in CSR actions with the aim of contributing to the public good. Providing explicit monetary incentives may then crowd out their intrinsic motivation, eventually leading to a worse CSR performance. To find support for the crowding out theory, the authors analyzed a cross-industry sample of global listed firms over the period 2007-2010, and investigated the effectiveness of monetary and non-monetary incentives to employees for the achievement of climate-change targets. Interestingly, they found that the use of monetary incentives is associated with higher CO^2 emissions than the implementation of non-monetary rewards or the absence of explicit green incentives. However, they also found that this effect on carbon emissions is eliminated when monetary incentives are provided to employees with formally-assigned responsibility for environmental performance. In particular, the authors focused on both top executives and lower-level employees to examine the effects of various types of green rewards, without disentangling the effects associated with different hierarchical levels in an organization. Therefore, it is important to note that in the authors' empirical setting firms providing environmental incentives to board members and executives are unlikely to represent

the majority of the sample (approximately 30% of the total respondents based on the 2013 CDP investor survey). As a result, it is difficult to extend their inferences to top executives whose compensation contracts are based on aggregate performance measures (Core, Guay, and Larcker 2003), such as overall firm environmental performance, and composed of monetary incentives as opposed to lower-level managers (CDP 2013; Frey and Neckermann 2008).

Overall, the general understanding of whether and how a corporation's choice to use CSR-linked executive compensation promotes CSR performance remains limited. Also, to the best of my knowledge no studies control for the use of *ad-hoc* monitoring systems enabling companies to face the significant challenge of designing an effective pay-for-performance system in the context of CSR.

In this paper, I contribute to the debate by investigating two questions based on agency theory that will shed light on the effectiveness of the use of CSR-linked executive compensation in terms of CSR performance. First, I examine the relationship between the firm's use of CSR-linked incentives for senior executives and CSR performance to verify whether the inclusion of environmental and social performance measures in compensation contracts increases the alignment between the agent and the principal making the contracting more effective (Milgrom and Roberts 1992). I disentangle the performance consequences of the firm's cumulative experience in linking top executive pay to CSR targets. I also test whether CSR benefits need a long-term time frame to realize (inter-temporal) benefits (Bénabou and Tirole 2010). Secondly, I explore the effects associated with the interactions between corporate experience in using CSR-linked executive compensation and the use of CSR-focused governance mechanisms exerting an advisory role (CSR committee) or a monitoring function (CSR reporting and CSR external audit). I believe that governance mechanisms can interact with CSR-related compensation schemes. For example, boards of directors with sufficient expertise and CSR-specific knowledge may be required to advise and guide senior executives in managing CSR issues (Armstrong et al. 2012). Prior agency literature contends that companies investing more in advising and monitoring agents' behavior are likely to guide effective decision-making and reduce the information asymmetry with the agents (Milgrom and Roberts 1992). On the other hand, some scholars have investigated the exact relationship between monitoring and executive compensation and suggested that they work as substitutes. In this respect, as executives receive appropriate incentives that align executive behavior to shareholders' interests, monitoring activities are needed to a lesser extent (Armstrong et al. 2010; Hoskisson et al. 2009; Lippert and Moore 1995; Rediker and Seth 1995). Accordingly, I assess whether specific CSR-focused governance

structures moderate the effects associated with the use of CSR-linked incentives, serving as complements to or substitutes for each other while contributing to the firm's CSR performance.

I analyze empirically a cross-industry sample of 5,720 firm-year observations over the period 2002-2013, from 783 distinct publicly-listed firms domiciled in the US. I develop the sample by merging four databases: Thomson Reuters' ASSET4, which collects data on CSR-focused incentives and governance structures; KLD STATS, which provides CSR ratings; Compustat Execucomp, which provides data on senior executive compensation; and Thomson Reuters' Datastream, which provides industry affiliation and financial data.

In line with agency theory predictions (Milgrom and Roberts 1992), I find that corporate use of CSR-linked incentives for senior executives is positively associated with the firm's CSR performance. In particular, the results reveal that corporate choice to link senior executive compensation to CSR targets produces positive effects already in the year subsequent to the date of adoption, and monotonically increases CSR outcomes as firms cumulate experience in using this mechanism over the years.

Furthermore, the simultaneous use of CSR-linked executive compensation and other CSR-focused governance structures is significantly associated with higher CSR performance. In particular, I find that managers' compensation linked to CSR targets exerts higher significant effects when used in combination with advisory or, alternatively, monitoring systems (focused on the social and the environmental aspects of the firm). Specifically, the presence of a CSR committee as well as the choice of elaborating and disclosing a CSR report positively moderate the benefits associated with more experience in tying senior executives' pay to CSR performance. In contrast, one last monitoring mechanism – the CSR external audit - does not promote CSR performance, suggesting that CSR audits are likely to play a merely symbolic role. These results are in accordance with prior literature on corporate governance (Armstrong et al. 2012; Coles et al. 2008) emphasizing the key role played by boards of directors in advising top executives, particularly in the context of complex and firm-specific investments, such as CSR activities. Consistent with agency theory (Milgrom and Roberts 1992), the findings also underline the importance of designing ad-hoc monitoring systems in the context of CSR. In particular, the results highlight the reputational value of producing public CSR reports as a form of voluntary contract between managers and both shareholders and other constituencies. Additionally, CSR reports serve to reveal previously-hidden information about the firm's environmental and social strategies, and such information results in improved monitoring of executives.

This study contributes to the literature in several ways. Firstly, I highlight the efficacy of using pay-for-performance contracting arrangements for top executives in the context of CSR. Overall, I add to current debate on the economic rationale driving firms to implement incentive systems as a function of CSR performance for their employees. Despite the increasing relevance of CSR issues in boardrooms, a limited group of empirical studies focuses on the relationship between managers' compensation contracts and CSR performance (Eccles et al. 2013; Berrone and Gomez-Mejia 2009; Cordeiro and Sarkis 2008; Campbell et al. 2007; Stanwick and Stanwick 2001). Furthermore, their findings are inconsistent, thus calling for further research to shed light on the true role played by CSR-linked compensation contracts, particularly in the case of senior executives (who have decision-making authority and exert significant influence on overall company performance). Secondly, this work expands the body of knowledge on performance evaluation by detecting the role of nonfinancial indicators such as environmental and social performance measures inserted in executive compensation plans. Thirdly, I provide strong and consistent evidence on the benefits of using various combinations of governance mechanisms focused on CSR issues. This is an addition to existing corporate governance and executive compensation research, as current understanding of the correlations between different governance structures is still relatively limited (Armstrong et al. 2010, 210). Finally, I contribute to CSR management literature by showing the relevance of tying top executives' pay to CSR performance in order to promote an effective CSR execution. This research also has important practical implications. I reveal the need for the design of an articulated system of governance mechanisms to achieve better CSR. Specifically, firms that have tied executives' pay to CSR targets would benefit from the establishment of a committee with a CSR-specific advisory function or from the public disclosure of their actions and performance in the form of a CSR report that facilitates the monitoring on their executives' CSR efforts. Furthermore, the results have important implications for the investing community. The findings might be useful to investors interested in allocating their assets to socially-responsible investments. For example, the fact that certain configurations of CSR-focused governance structures predict a better CSR performance indicates that such information might be used as unbiased criteria to allocate capital to efficient socially-responsible investments.

The remainder of the paper is organized as follows. Section II I discuss the literature and develop the research hypotheses. Section III describes the research design. Section IV illustrates the results, and Section V concludes with a summary of the findings and the limitations of the study.

2. BACKGROUND THEORY AND DEVELOPMENT OF RESEARCH HYPOTHESES

From an economic perspective, it is well know that incentive systems influence the behavior of managers and employees (Fama and Jensen 1983; Baker et al. 1988). Principal-agency theory predictions state that the design of an incentive contract addresses the general problem of motivating the agent to act according to the principal's desires (Milgrom and Roberts 1992). Prior work on performance evaluation has investigated the structure of optimal compensation contracts and focused on the importance of identifying performance measures to evaluate the manager's action and make his pay dependent on his performance (Milgrom and Roberts 1992; Holmstrom 1979). Specifically, agency models focus on the informativeness and congruence properties of the performance parameters used in incentive plans to conceptualize the alignment of the agent with the principal (Ittner et al. 1997; Feltham and Xie 1994; Banker and Datar 1989; Holmstrom 1979). Following these arguments, a body of research in the field of CSR management investigated the empirical association between the CEO's compensation and the firm's CSR performance and documented a significant positive relationship between the two constructs. In particular, Campbell et al. (2007) analyzed a sample of US-based companies in the years 1992-1994 and observed a positive link between the firms' environmental performance and the environment-related component of the CEOs' compensation plans. The authors indicate that a risk premium exists in compensating CEOs for incremental environment-related personal and economic risks in more environmentally sensitive industries. Cordeiro and Sarkis (2008), using data from a sample of 207 S&P500 firms in the US in 1996, reported a significant impact of firm-level environmental performance on CEO total pay in firms stating an explicit link between the company's green performance and the CEO's compensation. More indirectly, given the long-term nature of CSR payouts and consequences, Deckop et al. (2006) drew 313 firms from the 2001 S&P500 and note that short-term CEO pay is negatively associated with corporate social performance, whereas a long-term focus of CEO pay positively relates to corporate social performance.

Another stream of CSR research contends that economic theories alone cannot entirely explain individuals' sustainability behavior in the workplace (Bénabou and Tirole 2010; Marcus and Fremeth 2009). Consequently, some authors have suggested an institutional approach to justify the benefits associated with the use of CSR-linked employee compensation empirically even when sustainability targets do not provide significant incentives (Berrone and Gomez-Mejia 2009). In this regard, an extensive empirical literature on executive compensation documents the

declining importance of cash pay in general and, more specifically, of non-market-based performance measures (such as accounting-based and nonfinancial performance indicators) in determining top executive monetary incentives (Armstrong et al. 2010; Core, Guay, and Verrecchia 2003). For example, Core et al. (2003) found that the fraction of US CEOs' monetary incentives tied to performance indicators other than stock performance was less than approximately 10% of their total monetary incentives and, so, discussed the relatively minor incentive power of these measures vis-à-vis stock price. In the context of CSR, Guay (The Guardian 2014) declared in the press that "sustainability accounts for only a tiny percentage of actual compensation analysis – in most cases, it's less than 1% of an executive's overall performance review" and that, "it is still not sure whether sustainability will ever make the top 10 items a board of directors uses to determine a company's and executive's performance". It is still not clear whether and how much impact sustainability-linked incentives could exert on a firm's CSR performance given the extant structure of managers' compensation contracts. However, the fact that boards of directors use stock price as the main performance measure in providing incentives to top executives leaves room for hopes that environmental and social performance measures might play a role in executive compensation. As documented by ASSET4, over the last 12 years in the US an increasing number of companies have chosen to include CSR parameters in the compensation contracts of senior executives. Armstrong et al. (2010) suggested that bonus plans that are explicitly tied to non-price performance, such as CSR information, may serve as a signal to shareholders and stakeholders that the board is responding to their pressures and exerting effort both to obtain information about the firm's activities and to monitor executives appropriately. In addition, even though CSR-based bonuses may not greatly influence top executives' monetary incentives, "contracting fictions in real institutional settings may make it efficient to have top executives' bonus plan parallel to that of lower-level managers and employees" (Armstrong et al. 2010). In line with these conjectures, Berrone and Gomez-Mejia (2009) used an institutional approach to complement agency models and explain the corporate choice of formally tying executive compensation contracts to environmental sustainability performances. In particular, the two authors analyzed longitudinal data for 469 US firms from 1997 to 2003 and, consistent with agency predictions, they found that improved environmental performance increases CEO pay and that pollution-preventing strategies (generally associated with a longer-term time frame of realization) affect executive compensation more than end-of-pipe pollution control (generally linked to a shorter term). However, their findings document the fact that an explicit use of green governance mechanisms (in the forms of environmental pay

policy and environmental committee) does not strengthen this link, suggesting that these mechanisms play a merely symbolic role.

Other scholars have focused on behavioral implications associated with the use of prosocial goals in incentive systems (Eccles et al. 2013). In this regard, Bénabou and Tirole (2006) suggested that individuals may regard CSR acts as prosocial behavior. Accordingly, the underlying reasoning for engaging in these actions is not the maximization of private gains but rather the contribution to a public good. In the workplace, when employees exert effort on CSR behavior because they believe they contribute to the public good, providing them with explicit monetary incentives may crowd out their intrinsic motivation or reputational motivation and eventually lead to worse CSR performance. On the other hand, if employees engage in socially-responsible behavior because they intend to maximize the long-term profitability of the firm and, in turn, their own share of the resulting economic benefits, then the use of material or monetary incentives will be relatively more effective in motivating employees. Consistent with this idea, Eccles et al. (2013) empirically investigated the effectiveness of assigning monetary and non-monetary incentives to managers and employees for the achievement of climate-change targets in a cross-industry sample of global listed firms between 2007 and 2010. In particular, they validated the crowding out effect of material incentives by showing that firms using monetary incentives are more likely to produce higher CO^2 emissions than are companies declaring they adopt non-monetary rewards or not implementing any explicit employee compensation tied to the firm's environmental performance. In addition, the authors showed that this effect on CO^2 emissions is fully absorbed when monetary incentives are provided to employees with formally assigned responsibility for environmental performance.

Overall, empirical research on the link between CSR-linked executive compensation and CSR performance has produced mixed findings. In addition, it is important to note three other concerns that motivate the need to complement these inferences. First, excluding the work of Eccles et al. (2013), all prior studies examine sample data from before 2004, i.e. before the CSR phenomenon gained its documented popularity in firms' boardrooms, suggesting he need to update the validity of results. Second, Berrone and Gomez-Mejia (2009) focused on a broader concept of environmental governance, and proxied for it with a measure that spuriously captures corporate use of green incentives schemes. In particular, the two authors use a composite variables accounting for the presence of both an environmental pay policy and an environmental committee. As such, it is difficult to make inferences regarding effects associated solely with the implementation of formal green compensation contracts for CEOs. Finally, Eccles et al. (2013)

did not disentangle the effects associated with firms' decision to use of monetary and non-monetary green incentives only for top executives. On the contrary, the authors adopted a broader organizational view and examine corporate provision of incentives to both top executives and lower level employees who are generally not directly accountable for overall corporate environmental performance (if otherwise explicitly established in their job descriptions). Extant literature on performance evaluation emphasizes the difficulties associated with making lower level managers' and employees' pay dependent on an overall corporate performance parameter, such as stock price (Core 2001; Bushman et al. 1995). From an agency theory perspective, an agent should be evaluated and rewarded by a performance measure on which significant influence or control can be directly exercised (Holmstrom 1979). As a consequence, it is common for senior executives to be formally incentivized according to aggregate company-level performance measures, such as stock return, total operating income, and, more recently, overall CSR performance (i.e. inclusion in the Dow Jones Sustainability index and reduction of corporate CO^2 emissions). On the other hand, stock price and other aggregate firm performance measures are less informative about specific actions of lower-level managers. Local measures of performance (such as business unit and division profits) are more relevant and hence frequently inserted in the compensation contracts of lower-level employees for incentive purposes (Ittner et al. 1997; Bushman et al. 1995). Also, as suggested by Deckop et al. (2006) decisions in the area of CSR are likely to be long-term by nature and to reflect low programmability. Related performance targets/achievements are hence difficult to specify ex-ante and to measure ex-post, in particular for lower-level employees having limited decision-making power and low ability to influence their firms' CSR performance significantly. In situations such as this, monetary incentives do not always work well (Frey and Neckermann 2008). Indeed, in this case, "it is hard to make a monetary payment which is considered to be fair by the recipients" (Frey 2007, 9). In this situation, non-monetary incentives or soft awards generally taking a broader view of the agent's efforts become more useful (Frey and Neckermann 2008; Holmstrom and Milgrom 1991). Accordingly, in 2013 the CDP investor survey collected information over 1,743 global listed firms and documented 71.83% of these companies declaring provision of individual incentives to managers and employees for the attainment of climate-change targets. In particular, 516 firms declared provision of incentives to board members and top executives. Specifically, 88.18% of these firms chose to assign monetary incentives and only 18.60% use non-monetary incentives such as public recognition, usually in the form of awards. On the other hand, 1,195 firms disclosed provision green incentives to lower-level managers. Similarly, 87.19% of these

companies used monetary rewards but a significantly higher proportion (57.54%) chose to provide non-monetary incentives alone or in combination with them. As a result, there is reason to argue that different organizational positions can contribute to explaining both the firm's choice regarding the type of incentives and the effects associated with them.

To sum up, it is still not clear whether and to what extent CSR-linked executive compensation promotes CSR performance. In this work, I contribute to the debate and propose a principal-agent framework to shed light on the effectiveness in contracting associated with the use of formal CSR targets in senior executive compensation contracts. Specifically, I test whether and to what extent a firm's choice to use CSR-linked executive compensation affects CSR performance to test the hypothesis that the inclusion of environmental and social performance measures in pay contracts increases the alignment between the agent and the principal making contracting more effective (Armstrong et al. 2010; Core, Guay, and Verrecchia 2003). This premise motivates the following hypothesis:

H1a: Firms are more likely to have higher CSR performance when their senior executives' pay is formally tied to CSR targets.

According to economic advocates of CSR (Porter and Kramer 2011; Bénabou and Tirole 2010), being socially responsible "is about taking a long-term perspective to maximizing (inter-temporal) profits" (Bénabou and Tirole 2010, 10). In this respect, Deckop et al. (2006) emphasized that firms' investments on CSR are more likely to have long-term consequences and less likely to have positive short-term effects. As indicated in Deckop et al. (2006), strength aspects of CSR involve, for example, taking positive actions in the areas of community relations, human rights, the safety of the firm's products or services, the environment, diversity and fairness in hiring, and other facets of employee relations. Many of these actions, for instance, often require behavioral changes among employees and the introduction of new technologies and operating processes. These types of actions are generally unlikely to have a direct impact on the firm's short-term CSR performance. Similarly, the negative consequences of actions that result in CSR performance concerns, such as problems in the areas of environmental pollution, employee safety, and product safety, are unlikely to impact on short-term outcomes affecting the firm in the long-term. All these arguments suggest that "socially responsible investors should position themselves as long-term investors who monitor management and exert voice to correct short-termism" (Bénabou and Tirole 2010, 10). In line with this argument, CSR-linked executive compensation may contribute to discouraging top managers from taking those short-term actions

potentially at the expense of future CSR performance and, thereby, facilitating the realization of CSR results.

In addition, as prior research on CSR performance evaluation has emphasized, typical managerial incentive structures suffer from short-term bias and do not necessarily promote sustainable value creation (Derchi and Oyon 2015; Derchi et al. 2013; Bénabou and Tirole 2010). In practice, managers take decisions that increase short-term profit, but potentially hurt workers or other constituencies. As firms introduce environmental and social performance measures in executive compensation contracts, top executives are likely to adjust to their new utility function, shifting their managerial attention towards long-term goals and allocating their efforts to additional, different, and possibly unknown tasks. As such, it is reasonable to assume that this adjustment process may create some tension in executive decision-making and it may take some time for them to reach the optimal equilibrium. Over time it is indeed likely that top executives will become more aware of CSR-specific information and learn how to deal with the new incentivized targets.

Following this reasoning, I disentangle the performance consequences of firms' cumulative experience in using top executive pay linked to CSR targets to explore whether CSR incentives require a long-term time frame to achieve (inter-temporal) benefits (Bénabou and Tirole 2010). I thus propose the following hypothesis:

H1b: Firms are more likely to have higher CSR performance as they gain experience in tying their senior executives' pay to sustainability targets.

Based on principal-agency theory, the informativeness of a measure used to evaluate the agent's actions is also a function of the effectiveness of the monitoring process implemented by the principal (Milgrom and Roberts 1992). Accordingly, principals may decide to invest in appropriate information systems to increase the overall quality of the measurement, thus reducing the information asymmetry with the agents. As argued by Hunton et al. (2008), "examples of information systems that are used for monitoring purposes include dedicated budgeting systems, reporting procedures, direct supervision, and internal and external audit". In the domain of CSR, the principal's monitoring activities are likely to influence the extent to which environmental and social performance measures are informative concerning the agent's effort towards CSR activities. For example, CSR reports can potentially provide a segmentation of performance and actions which overall performance measures, such as the stock price or the aggregate CSR scores assigned by independent raters, alone do not provide. "Knowledge about the firm's specific

strengths and weaknesses can help boards and shareholders to monitor top executives and correct certain agency conflicts, such as perquisite consumption, poor investments, and misleading disclosures" (Armstrong et al. 2010, 203). Not surprisingly then, the ASSET4 database documents the growing diffusion among global organizations of CSR-focused voluntary monitoring mechanisms possibly implemented by firms to align the board and the managers' interests with CSR outcomes desired by shareholders and other constituencies. In this light, for example, I observe that the number of firms disclosing a separate sustainability report or publishing a sustainability-related section in the annual report increased sharply from 5.44% in 2002 to 59.38% in 2013 (see Table 1). In addition, firms increasingly choose to purchase external auditing of their sustainability reports to ensure the validity of the disclosed information, with percentages rising from 17.07% in 2002 to 37.19% in 2013 (see Table 1).

Furthermore, I noted that ASSET4 reveals that the proportion of firms establishing ad-hoc CSR committees with an advisory role within the board of directors increased from 7.21% in 2002 to 29.91% in 2013 (see Table 1). The evidence is consistent with the bulk of theoretical and empirical literature on executive compensation discussing the key role played by the board of directors in advising top executives, particularly in the context of complex investments (e.g., substantial R&D, intangible assets) where considerable firm-specific knowledge is needed to guide management (Armstrong et al. 2012; Coles et al. 2008). Hence, a board with sufficient CSR-specific expertise may be necessary to advise and guide senior executives in managing CSR issues effectively (Armstrong et al. 2012).

However, other scholars in the fields of management, accounting and finance have assessed the exact economic relationship between control mechanisms (monitoring and executive compensation) and noted that these may work as substitutes in a system of governance (Armstrong et al. 2010; Hoskisson et al. 2009; Lippert and Moore 1995; Rediker and Seth 1995). Specifically, they argue that the intensity of board monitoring activities needs to be lower when top executives are granted effective incentives, that is, able to align their managerial efforts with the desires of principals. They suggest therefore the presence of a systematic balance between these types of governance arrangements. Similarly, in the context of corporate sustainability, higher investment in CSR monitoring activities should entail provision of lower compensation incentives. As a result, in our setting higher investment in CSR monitoring may negatively moderate the performance implications associated with a firm's greater experience in using CSR-linked executive compensation contracts.

Despite their growing popularity, to the best of my knowledge no empirical studies examine the role played by CSR-focused monitoring and advisory systems in supporting firms facing the significant challenge of designing effective CSR-linked incentives for top executives. I therefore propose an exploratory framework to assess empirically whether CSR-linked executive compensation and other CSR-focused governance structures serve as complements to or substitutes for each other while contributing to the firm's CSR performance. Specifically, I explore the effects associated with the interaction between CSR-linked executive compensation and CSR-focused governance mechanisms exerting an advisory role (CSR committee) or a monitoring function (CSR reporting and CSR external audit). I thus the following null hypothesis:

H2: The use of CSR executive compensation in combination with CSR governance structures with advisory or monitoring roles does not affect the firm's CSR performance.

3. RESEARCH DESIGN

3.1. Data and Sample Collection

I began by using information on US-domiciled firms' CSR-linked executive compensation contracts and CSR-focused governance structures taken from the ASSET4 database. Thomson Reuters ASSET4 is a Swiss-based company which since 2002 has been providing professional investors with objective, relevant, and auditable environmental, social and governance (ESG) annual information to enable socially responsible investment analysis. A team of 120 specially trained research analysts collects more than 750 ESG evaluation points per firm, where all the primary data used must be objective and publically available. In 2014, the ASSET4 database covered globally over 4,500 listed companies including MSCI World, MSCI Europe, STOXX 600, NASDAQ 100, Russell 1000, S&P 500, FTSE 100, ASX 300 and MSCI Emerging Markets. Recently, it has been estimated that investors representing more than €2.5 trillion in assets under management use the ASSET4 data, including prominent investment houses such as BlackRock, Goldman Sachs, and Merrill Lynch (Cheng et al. 2014). Moreover, a number of prominent empirical studies in the management field elaborate ASSET4 information to provide robust evidence of the phenomena under observation (Cheng et al. 2014; Eccles et al. 2014; Eccles et al. 2013). Panel A in Table 2 displays the sample selection process. First, I identified a panel containing 12,336 firm-year observations and corresponding to 1,028 US-based unique firms which in the period 2002 – 2013 reported non-missing information on the following four governance aspects: (1) the use of senior executives compensation linked to CSR/Health and

Safety (H&S)/Sustainability targets; (2) the establishment of a CSR committee within the board of directors; (3) the disclosure of a separate CSR/H&S/Sustainability report or a dedicated section in the annual report focused on CSR/H&S/Sustainability issues; and (4) the purchase of external auditing of the CSR/H&S/Sustainability report.

TABLE 2. Sample Selection and Main Characteristics		
Panel A.		
	Number of firm-years	Number of distinct firms
All firm_year observations in ASSET4 database	12,336	1,028
Less:		
Observations not covered by KLD database	-2,895	-104
Observations not covered by Compustat Execucomp database + Datastream annual file + Observations below the minimum firm-size parameters	-3,721	-141
Final Sample	**5,720**	**783**

I then combine the ASSET4 data with CSR performance from KLD STATS. KLD is produced by the RiskMetrics Group (formerly KLD Research and Analytics, Inc.), which specializes in assessing the ESG performance of publicly-traded US companies and covers more than 3,100 firms. As of 1991, KLD has used a combination of surveys, financial statements, articles in the popular press and academic journals, as well as government reports, to determine independently whether a company is socially responsible in seven qualitative performance areas, including corporate governance, community relations, diversity, employee relations, environment, human rights and product. In addition, KLD provides information on involvement in the following exclusionary controversial business categories: alcohol, gambling, firearms, military contracting, nuclear power, and tobacco. KLD STATS data is organized by year. Each year, KLD raters assign a number of positive indicators (strengths) and negative indicators (concerns) in each non-exclusionary dimension. If the company does not have a strength or concern in that issue, this is indicated with a 0. To date, KLD data have been used extensively in scholarly research to operationalize firms' CSR performance (Servaes and Tamayo 2013; Hoi et al. 2013; Kim et al. 2012; El Ghoul et al. 2011; Margolis et al. 2009; Chatterji et al. 2009; Deckop 2006; Turban and Greening 1997). Deckop et al. (2006, 334) described KLD as "the largest multidimensional corporate social performance database available to the public". Chatterji et al. (2009) contended that KLD's social ratings are among the most influential and the most

widely accepted CSR measure used by academics. Mattingly and Berman (2006) found that KLD data have construct validity and asserted that they have become the standard for the quantitative measurement of corporate social actions. After matching KLD data with the ASSET4 database, I obtained a sample of 9,441 firm-year observations corresponding to 924 unique firms.

I then retrieved annual corporate financial information and senior executive compensation data from, respectively, Thomson Reuters' Datastream and Compustat Execucomp. Lastly, to alleviate the noise caused by smaller company size, I removed observations from firms with net sales and total assets of less than $10 million, and less than 10 employees. After subtracting observations with missing data, the final sample consisted of an unbalanced panel set containing 5,720 firm-year observations, corresponding to 782 unique firms.

TABLE 2. Sample Selection and Main Characteristics

Panel B.

Variable	N	Mean	SD	P25	Median	P75
Total Assets ($ million)	5720	38,000	160,000	3,200	7,300	20,000
Net Sales ($ million)	5720	13,000	30,000	2,100	4,700	12,000
Employees	5720	36,301	90,277	4,900	12,700	34,779
ROE	5720	19.70%	190.61%	7.75%	14.22%	22.03%
Leverage (Tot. Liabilities / Total Asset)	5720	0.58	0.21	0.45	0.59	0.72
Market to Book Value ratio	5720	3.14	32.82	1.50	2.31	3.76

Panel B of Table 2 shows a highly positive skew distribution of sample firm size. Average total assets account for $38,000 million with median and Q3 values of, respectively, $7,300 million and $20,000 million. Annual net sales of the average (median) firm are $13,000 million ($4,700 million) and the mean (median) number of employees is 36,301 (12,700)[4]. The average (median) firm has a ROE of 19.70% (14.22%), leverage (computed as total liabilities divided by total assets) equal to 0.58 (0.59), and a market-to-book value ratio of 3.14 (2.31). In addition, the final sample covers wide range of industries. As displayed in Panel C of Table 2, final sample firms operate in 15 CIGS Industry Groups with greater concentrations in Industrial Goods and Services (20.95%), Financials (19.16%), Technology (11.49%), Retail (8.68%), Healthcare (7.54%), and Oil & Gas (7.15%).

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[4] It is acknowledged that final sample size is biased towards larger companies, by construct. However, based on Ioannou et al. (2014) and Derchi and Oyon (2015), in the context of social and environmental performance, public policy and pressure from society fall predominantly on the world's largest companies. Therefore, the largest companies represent a highly relevant sample for investigation of the research questions.

TABLE 2. Sample Selection and Main Characteristics				
Panel C.				
	Final Sample		ASSET4 database	
	Freq.	Percent	Freq.	Percent
Industry distribution				
Ind. Goods & Services	164	20.95	205	19.94
Automobiles & Parts	13	1.66	17	1.65
Chemicals	21	2.68	28	2.72
Construct. & Material	18	2.30	21	2.04
Food & Beverage	21	2.68	31	3.02
Pers & Househld Goods	47	6.00	53	5.16
Financials	150	19.16	200	19.46
Basic Resources	22	2.81	26	2.53
Oil & Gas	56	7.15	77	7.49
Healthcare	59	7.54	81	7.88
Media	23	2.94	40	3.89
Retail	68	8.68	81	7.88
Technology	90	11.49	113	10.99
Telecommunications	6	0.77	14	1.36
Travel & Leisure	25	3.19	41	3.99
Total	**783**	**100**	**1028**	**100**

To check for possible selection biases related to the sampling procedure, I compare sample firms year-end market value to the total market capitalization of domestic companies listed on US stock exchanges. Based on World Bank statistics[5], 2012 US total market capitalization accounted for approximately $18,668 billion. In the same period, final sample group companies with a cumulate market value of around $10,000 billion represented a significant portion (53.57%) of total US market capitalization.

In addition, I compared final sample industry distributions to the complete ASSET4 database including all US companies covered by the analysts. Panel C of Table 2 reports the comparison between the two groups. In particular, the ASSET4 database includes 1,028 firms with industry distributions similar to the final sample.

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[5] In accordance with World DataBank, year-end market capitalization of a company (also known as market value) is obtained by multiplying the share price by the number of shares outstanding at the end of the year. Listed domestic companies are the domestically-incorporated companies listed on the country's stock exchanges at the end of the year. Listed companies do not include investment companies, mutual funds, or other collective investment vehicles.

3.2. Measurement of Dependent and Independent Variables

3.2.1. CSR-linked Executive Compensation

I use the variable "Compensation Policy/Sustainability Compensation Incentives" from the ASSET4 dataset to proxy for corporate choice to tie senior executive compensation to CSR/H&S/Sustainability targets. Specifically, I create a binary indicator CSR_COMP, taking a value of 1 each year the firm reported inserting CSR/H&S/Sustainability goals in the compensation contracts of senior executives, and 0 otherwise.

TABLE 3. Corporate Use of CSR-linked Governance-type Mechanisms - Time Distribution and Dynamics

Panel A.

	year											
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
US sample												
CSR_COMP	6.72%	5.50%	5.29%	6.24%	9.74%	11.21%	18.30%	23.56%	31.47%	38.64%	40.77%	37.04%
CSR_COMMIT	10.45%	10.31%	11.11%	11.55%	14.74%	18.10%	19.13%	19.94%	25.12%	22.06%	24.68%	24.28%
CSR_REP	1.49%	2.41%	2.12%	3.00%	4.47%	24.78%	29.28%	30.82%	33.49%	31.34%	27.42%	29.01%
CSR_AUD	0.00%	0.00%	0.00%	0.00%	0.00%	4.31%	4.66%	4.98%	7.75%	11.11%	16.64%	19.14%

Panel A in Table 3 shows that, over the period 2002-2013, firms increasingly included social and environmental targets in compensation plans for senior executives: the diffusion of CSR-linked executive rewards across organizations increased by 30.32 percentage points, from 6.72% in 2003 to 37.04% in 2013, indicating higher frequency than the whole ASSET4 sample including international firms. Overall, CDP data confirm the growing relevance of this organizational practice particularly in the US market. In addition, Panel B of Table 3 reports high time consistency in corporate use of CSR-linked executive compensation. Indeed, 78.57% of companies using CSR-related rewards in a certain year t, continue to implement them in t+1, while the remaining 21.43% decide to drop the system. On the other hand, 89.21% of firms not using CSR incentives in a year t, continue with the same strategy in t+1, and the remaining 10.79% adopt the mechanism. Over time distribution characteristics strengthen confidence in the quality of the variable.

TABLE 3. Corporate Use of CSR Governance-type Mechanisms - Time Distribution Dynamics							
Panel B.							
	CSR Compensation - year t+1				CSR Committee - year t+1		
CSR Compensation (CSR_COMP) - year t	No = 0	Yes = 1	Total (percent)	CSR Committee (CSR_COMMIT) -	No = 0	Yes = 1	Total (percent)
0 (= "No")	89.21	10.79	100	0 (= "No")	95.31	4.69	100
1 (= "Yes")	21.43	78.57	100	1 (= "Yes")	6.14	93.86	100
Total (percent)	75.85	24.15	100	Total (percent)	79.53	20.47	100
	CSR Report - year t+1				CSR External Audit - year t+1		
CSR Report (CSR_REP) - year t	No = 0	Yes = 1	Total (percent)	CSR External Audit (CSR_AUD) - year t	No = 0	Yes = 1	Total (percent)
0 (= "No")	92.17	7.83	100	0 (= "No")	97.34	2.66	100
1 (= "Yes")	9.34	90.66	100	1 (= "Yes")	5.62	94.38	100
Total (percent)	75.95	24.05	100	Total (percent)	92.42	7.58	100

3.2.2.   Experience in Using CSR-linked Executive Compensation

The construct "experience in using CSR-linked executive compensation" is a proxy for a firm's level of continuous experience gained over time of using CSR performance to determine the pay of senior executives. In particular, I elaborated the variable CSR_COMP to create a new measure CSR_COMPEXP to assess the firm's cumulative experience in using CSR-linked executive compensation. CSR_COMPEXP measures the number of years prior to the proxy date a firm has formally tied senior executive compensation to CSR performance. The variable ranges from 0 to 11 years.

3.2.3.   CSR-focused Monitoring and Advisory Structures

From ASSET4 information, I created the following three variables to identify the use of dedicated governance structures with specific advisory or monitoring functions on the social and environmental aspects of the business.

(1) CSR_COMMIT proxies for the firm's establishment of a dedicated board committee with an advisory role on CSR issues. Berrone and Gomez-Mejia (2009) describe sustainability committees as subgroups of knowledgeable board members, senior executives and other lower level managers to whom corporate environment- or, more in general, sustainability-related daily tasks are formally delegated. This composition would increase the board's ability to guide and assess corporate performance in social and environmental areas more accurately. Accordingly, evidence from case studies indicates such a committee as being a powerful for providing senior management with appropriate knowledge and expertise, and for driving corporate accountability on sustainability issues (Paine 2014). In this respect, two different ASSET4 variables provide

useful information on the company's choice to establish a CSR committee. Both indicators are dummy variables. The first indicator marks whether the firm uses a CSR committee or team without specifying its hierarchical position within the organization. The second refers to the company having a policy of maintaining an effective and independent CSR committee within the board. As the aim of this paper is to capture the role of the board in advising senior management on specific CSR issues, I calculated the product between the two mentioned variables to identify those firms having a CSR committee in combination with an explicit policy aimed at maintaining its effectiveness and independence within the board. I assumed the simultaneous presence of the two practices to be a good proxy for the functioning of the CSR committee at the board level. As such, I obtained CSR_COMMIT as a binary indicator assuming a value of 1 each year of the firm establishment of a CSR committee within the board of directors, 0 otherwise.

(2) CSR_REP refers to the firm's elaboration and disclosure of dedicated CSR reports serving a monitoring function. CSR reports are considered as publicly disclosed separate CSR/H&S/Sustainability reports or a section in the firm's annual report dedicated to CSR/H&S/Sustainability, produced on a voluntary basis and intended to meet the information needs of all stakeholders. Based on an agency theory approach, sustainability reports are produced to signal the efforts to reduce the information asymmetry between the firm and the market/public regarding the social and environmental dimensions of the business (Simnett et al. 2009). Like shareholders, stakeholders are assumed to be at an informational disadvantage when monitoring managers. CSR reporting aims to mitigate the potential agency conflicts between the parties. According to an ASSET4 rule, a minimum of 5 pages are required in order for the document to classify as a formal official CSR report. In this research then, CSR_REP is a binary variable taking a value of 1 each year the firm publicly discloses a separate CSR/H&S/Sustainability report or a dedicated section in the annual report focused on CSR/H&S/Sustainability issues, and 0 otherwise.

(3) CSR_AUD indicates the firm's choice to purchases an external audit on the CSR report. In the context of financial reporting, Watts and Zimmerman (1990) argue that the efficacy of the accounting system in reducing agency conflicts depends on assurances that the reports have been prepared in accordance with what the contracting parties have agreed. In this respect, "the auditing process of financial reporting is viewed as a set of mechanisms that provides this assurance to contracting parties" (Armstrong et al. 2010, 191). In parallel, CSR audits are voluntary purchases of external assurance of the CSR reports serving "as a useful control mechanism to enhance the credibility of the disclosed information and facilitate greater users'

confidence" (Simnett et al. 2009, 941). In the area of CSR, the use of external auditing appears particularly important given the voluntary nature of CSR information disclosure. In some cases, corporate reputation or image concerns with respect to shareholders and other stakeholders demanding socially responsible behavior could drive firms to engage in some sort of instrumental CSR reporting taking the form of 'greenwash'. This means "disseminating an incomplete or misleading picture of environmental friendliness or other CSR behavior, or one that is accurate in some dimensions but serves to obscure less savory ones" (Bénabou and Tirole 2010, 11). Including a CSR audit in the analysis would help to partial out the effects associated with instrumental use of CSR reporting and to permit better assessment of the monitoring function of CSR publicly disclosed information. In this work, CSR_AUD is a binary indicator taking the value of 1 each year the firm purchases an external audit of the CSR/H&S/Sustainability report, and 0 otherwise.

Overall, Panel B of Table 3 reports high time consistency in corporate use of these CSR governance mechanisms increasing confidence in the quality of the proposed variables.

3.2.4. CSR Score

Each year, KLD evaluates CSR on aspects including corporate governance, community relations, diversity, employee relations, environment, product, alcohol, gambling, military contracting, nuclear power, and tobacco. As previously mentioned, the last five elements are exclusionary screen categories. Like Kim et al. (2012, 767), "I did not consider these exclusionary categories in constructing CSR scores, as these dimensions do not pertain to a firm's discretionary activities". Furthermore, corporate governance is perceived as a distinct construct from CSR. As defined by Armstrong et al. (2010), corporate governance is viewed as the set of contractual mechanisms that help to align the actions of managers with the interests of shareholders, while CSR refers to social objectives and stakeholders other than shareholders (Servaes and Tamayo 2013). I therefore constructed the variable CSRSCORE based on the five remaining categories, excluding corporate governance. In particular, in accordance with prior studies (Kim et al. 2012; Chatterji et al. 2009; Johnson and Greening 1999), I computed CSRSCORE as total strengths minus total concerns in the following five social categories of KLD rating data: community, diversity, employee relations, environment, and product. I then added the minimum net score of the overall distribution to obtain CSRSCORE as an aggregate measure of non-negative integers.

Like Servaes and Tamayo (2013), I acknowledge that the number of strengths and concerns in each category has evolved over time as KLD has refined the database, making direct

comparison across years impossible. In contrast with these two authors however, I observed low variability between 2002 and 2011. Specifically, I noticed that only one additional strength and one concern have been added in the community category in 2005, and that one strength has been removed and one added in the environmental category, respectively in the years 2005 and 2006 (RiskMetrics Group 2011). Overall, in the same period I detected total numbers of strengths ranging from 33 to 34 and total concerns from 26 to 27. Higher variability is instead observed in the period 2012-2013. As a result, I also tested the empirical model over a restricted sample excluding the years 2012 and 2013 to validate the robustness of the findings. Results (not tabulated, for the sake of brevity) remained substantially unchanged.

I am also aware of other potential drawbacks in the KLD rating system. KLD ratings are based exclusively on binary variables. Using binary indicators to indicate a strength or concern of a company on a certain environmental or social issue leads to the problem of not capturing its gradual variation across years. However, in this work the proposed variable CSRSCORE is, by construction, an aggregate measure of five different dimensions of CSR performance. It thus aims to capture any potential variation across years which can be explained by different combinations of strengths and concerns belonging to various areas of performance. To clarify this point, I verified the magnitude of the time-series variability in the firm's CSR involvement. First, I selected all the companies having at least 5 consecutive years of non-missing KLD rating data. I then computed the average standard deviation of their CSRSCORE over time. The mean of these standard deviations is 1.39. Finally, I compared this result with the cross-sectional variability in CSRSCORE calculated on an annual basis, which ranges from 2.99 in 2007 to 3.89 in 2011. The relative magnitude suggests that there is substantial time-series variability in firm's CSR behavior.

Overall, the above checks increase confidence in the quality of the proposed variable.

3.3. Measurement of Control Variables

Additional factors may affect corporate environmental and social performance. First, it is reasonable to assume a firm's CSR performance is the result of prior activities in the areas of community relations, human rights, the safety of the firm's products or services, the environment, diversity and fairness in hiring, and other facets of employee relations. In addition, a firm's engagement in CSR may explain both the decision to adopt CSR-linked incentives formally and the attainment of a higher CSR score. To capture these effects, I included CSRSCORE_PROPENSITY to proxy for the firm's propensity to socially-responsive behavior. Specifically, given the long-term nature of CSR investments (Porter and Kramer 2011; Bénabou

and Tirole 2010; Deckop 2006), I computed CSRSCORE_PROPENSITY as the average of the respective yearly CSRSCORE over the three year preceding the proxy date. Secondly, previous studies have documented a significant positive relationship between long-term CEO pay and CSR performance (Berrone and Gomez-Mejia 2009; Deckop 2006; Johnson and Greening 1999). In parallel, other scholars have found a negative link between the use of short-term bonuses for managers and employees and the firm's social and environmental performance (Eccles et al. 2013; Deckop 2006). I computed top management team (TMT) long-term compensation, denoted LT_COMP, to control for potential effects of senior executives' orientation to long-term results originated by their monetary compensation structures. Similarly to Larcker et al. (2007), from Compustat Execucomp I measured LT_COMP as the average fraction of the total annual compensation that is made up of performance plans, stock options, and restricted stocks plans for the five highest-paid members of the executive team, including the CEO. Moreover, I winsorized this variable at its 1st and 99th percentiles, to control for potential outlier effects. Thirdly, several studies have found that company size significantly affects its green outcome and certain dimensions of its social performance (Cheng et al. 2014; de Villiers et al. 2011; Henri and Journeault 2010; Berrone and Gomez-Mejia 2009; Patten 2002; Johnson and Greening 1999). I therefore checked for firm size by using FIRM_SALES, measuring the company's net sales. Fourthly, I used MTB, the ratio of market-to-book value, as a proxy for a firm's growth and investment opportunities (Galema et al. 2008). In particular, I winsorized these variables at their 1st and 99th percentiles. Fifthly, to isolate the effects of CSR-linked incentives and other CSR-focused governance structures on the CSR score after partialling out the potential influence of the firm's financial adversity and economic performance (Eccles et al. 2014; Eccles et al. 2013; Henri and Journeault 2010; Berrone and Gomez-Mejia 2009), I checked for company leverage and profitability (LEV and ROE, respectively) in the regressions, winsorizing both variables at their 1st and 99th percentiles. Finally, I used industry dummies (IND) based on the GICS Parent Sector classification and I included year dummies (T) to account for unobserved changes in norms and expectations that occurred between 2003 and 2013.

3.4. Empirical Models

To test the hypothesized relationships, I estimate the following equations:

$$
\begin{aligned}
Log(1+CSRSCORE)_{it} = &\; \alpha_0 + \alpha_1 CSR\_COMP_{it-1} / Log(1+CSR\_COMPEXP)_{it-1} \\
&+ \alpha_2 CSR\_COMMIT_{it-1} + \alpha_3 CSR\_REP_{it-1} + \alpha_4 CSR\_AUD_{it-1} \\
&+ \alpha_5 Log(1+CSRSCORE\_PROPENSITY)_{it-1} + \alpha_6 LT\_COMP_{it-1} \\
&+ \alpha_7 Log(FIRM\_SALES)_{it-1} + \alpha_8 ROE_{it-1} + \alpha_9 LEV_{it-1} \\
&+ \alpha_{10} MTB_{it-1} + \alpha_{11} IND_t + \alpha_{12} T_t + \varepsilon_{it}
\end{aligned}
\tag{1}
$$

$$
\begin{aligned}
Log(1+CSRSCORE)_{it} = &\; \alpha_0 + \alpha_1 Log(1+CSR\_COMPEXP)_{it-1} \\
&+ \alpha_2 CSR\_COMMIT_{it-1} + \alpha_3 CSR\_REP_{it-1} + \alpha_4 CSR\_AUD_{it-1} \\
&+ \alpha_5 CSR\_COMMIT_{it-1} * Log(1+CSR\_COMPEXP)_{it-1} \\
&+ \alpha_6 CSR\_REP_{it-1} * Log(1+CSR\_COMPEXP)_{it-1} \\
&+ \alpha_7 CSR\_AUD_{it-1} * Log(1+CSR\_COMPEXP)_{it-1} \\
&+ \alpha_8 Log(1+CSRSCORE\_PROPENSITY)_{it-1} + \alpha_9 LT\_COMP_{it-1} \\
&+ \alpha_{10} Log(FIRM\_SALES)_{it-1} + \alpha_{11} ROE_{it-1} + \alpha_{12} LEV_{it-1} \\
&+ \alpha_{13} MTB_{it-1} + \alpha_{14} IND + \alpha_{15} T_t + \varepsilon_{it}
\end{aligned}
\tag{2}
$$

where: ε represents the residual or that portion of the endogenous variable that is not explained by the exogenous regressors, i represents firm i, and t is year t. To normalize the distribution of residuals, I used the logarithmic transformation of 1 plus CSRSCORE and 1 plus CSRSCORE_PROPENSITY as proxies for, respectively, the firm's CSR performance and its prior propensity to CSR based on KLD independent assessments. In addition, I computed the natural logarithm of 1 plus COMPEXP to proxy for cumulated experience in using CSR-linked executive compensation. Finally I inserted the log of FIRM_SALES to control for firm size.

In particular, equation (1) alternately tests hypotheses H1a and H1b. Equation (2) includes the interaction terms between corporate experience in using CSR-linked executive compensation and the implementation of, respectively, CSR Committee (CSR_COMMIT), CSR Report (CSR_REP) and CSR Audit (CSR_AUD), and was hence used to test hypothesis H2. As recommended by Balli and Sørensen (2012), I subtracted firm-specific means from the variable Log(1+CSR_COMPEXP) in the interaction terms to facilitate the interpretation and reduce potential collinearity.

I estimated equation (1) with panel data multiple regressions with OLS regression. Standard errors were clustered by firm to account for heteroskedasticity and nonindependence among observations from firms included in various years. In addition, a fixed effect (FE) estimator was used to control for firm characteristics that are unobservable but stable over time, and their possible correlations with explanatory variables. The omission of such controls may indeed result in spurious findings. As suggested by Angrist and Pischke (2009), I chose a FE estimator after

conducting tests for consistency to select the best specification for the proposed econometric models[6]. A consistent FE model was then used to estimate equation (2). Finally, to prevent simultaneity constraints, independent variables in all models were lagged one year.

4. RESULTS

4.1. Descriptive Statistics

Table 4 contains descriptive statistics for all variables. In accordance with the proposed model specifications, all independent and control variables in Table 4 are presented with a one-year lag and, therefore, refer to the period 2002-2012. The mean value of the combined CSRSCORE is 9.99 (ranging from 0 to 26). Overall, the distribution of CSRSCORE shows higher values than those reported in Kim et al. (2012). This difference is likely to be associated with the longer sample period (from 1991 to 2009) investigated by Kim et al. (2012). The average value of CSRSCORE_PROPENSITY is 9.47. At a first sight, a comparison between the distributions of CSRSCORE and CSRSCORE_PROPENSITY indicates that KLD raters assess a general positive trend in sample firms' overall CSR involvement across years. To provide a complete picture of the main dependent variable, Table 4 shows the statistical distributions of ENVSCORE and SOCSCORE, which constitute, respectively, the environmental and social performance scores composing the CSRSCORE. Based on the procedure used to compute CSRSCORE, ENVSCORE refers to the net score - converted to non-negative numbers - obtained by the firm in the environmental KLD rating category. Similarly, SOCSCORE groups the remaining four investigated KLD areas of social performance: community, diversity, employee relations, and product. The mean values of ENVSCORE and SOCSCORE are, respectively, 5.19 (ranging from 0 to +10) and 9.73 (ranging from 0 to +21).

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[6] In particular, an overidentification test (Hausman-like test), assuming the random effect (RE) estimator is fully efficient and provides consistent estimates under null hypothesis, is run to choose between the RE and FE estimators. Test results reject the null hypothesis and suggest the FE specification leading to consistent estimates of the proposed model.

				TABLE 4. - Summary statistics				
Variable	N	Mean	SD	Min	P25	Median	P75	Max
CSRSCORE	5,099	9.9943	3.372	0.000	8.000	9.000	12.000	26.000
CSRSCORE_PROPENSITY	4,081	9.4680	2.918	1.333	7.667	9.000	10.667	23.667
ENVSCORE	5,099	5.1947	1.253	0.000	5.000	5.000	6.000	10.000
SOCSCORE	5,099	9.7264	2.788	0.000	8.000	9.000	11.000	21.000
Strengths_CSRSCORE	5,099	3.2102	3.416	0.000	1.000	2.000	5.000	21.000
Concerns_CSRSCORE	5,099	2.2891	2.260	0.000	1.000	2.000	3.000	15.000
CSR_COMP	5,099	0.2096	0.407	0.000	0.000	0.000	0.000	1.000
CSR_COMPEXP	5,099	0.6409	1.364	0.000	0.000	0.000	1.000	11.000
CSR_COMMIT	5,099	0.1840	0.388	0.000	0.000	0.000	0.000	1.000
CSR_REP	5,099	0.2100	0.407	0.000	0.000	0.000	0.000	1.000
CSR_AUD	5,099	0.0555	0.229	0.000	0.000	0.000	0.000	1.000
LT_COMP	5,099	0.6602	0.199	0.000	0.566	0.7114	0.805	0.994
FIRM_SALES ($ million)	5,099	13,000	29,000	74	2,100	4,800	12,000	430,000
ROE	5,099	15.17%	23.02%	-78.80%	7.76%	14.39%	22.10%	126.26%
LEV	5,099	0.5815	0.208	-0.482	0.448	0.589	0.723	2.883
MTB	5,099	3.1772	3.280	-10.280	1.480	2.290	3.700	22.630

Variable Definitions:

CSRSCORE: net score of CSR ratings (measured as total strengths - total concerns, in five social categories of KLD ratings data: community, diversity, employee relations, environment, and product) + minimun value of firms' net CSR ratings overall distribution;

CSRSCORE_PROPENSITY: 3 year average of the firm's CSRSCORE prior to the proxy date, computed as the formula: Avg(CSRSCORE(t-1;t-3));

ENVSCORE: net Environmental score (total strengths - total concerns in the environmental KLD category) + minimun value of firms' net environmental scores overall distribution;

SOCSCORE: net Social score (total strengths - total concerns in four KLD categories: community, diversity, employee relations, and product) + minimun value of firms' net social scores overall distribution;

Strengths_CSRSCORE: total strengths in five social categories of KLD ratings data: community, diversity, employee relations, environment, and product;

Concerns_CSRSCORE: total concerns in five social categories of KLD ratings data: community, diversity, employee relations, environment, and product;

CSR_COMP: indicator variable = 1 the firm formally links senior executives' compensation to sustainability targets in the year prior to the proxy date, 0 otherwise;

CSR_COMPEXP: number of prior continuous years the firm has formally linked senior executives' compensation to sustainability targets;

CSR_COMMIT: indicator variable = 1 the firm has a dedicated sustainability committee established within the board of directors in the year prior to the proxy date, 0 otherwise;

CSR_REP: indicator variable = 1 the firm publicly discloses a sustainability report in the year prior to the proxy date, 0 otherwise;

CSR_AUD: indicator variable = 1 the firm purchases an assurance on the sustainability report from a specialized external auditor, in the year prior to the proxy date, 0 otherwise;

LT_COMP: TMT average (stock options + restricted stocks +non-equity long-term incentives plan payments + deferred earnings reported as compensation) / TMT total average compensation, 1 year prior to the proxy date;

FIRM_SALES: total net sales, 1 year prior to the proxy date;

ROE: ROE, 1 year prior to the proxy date;

LEV: total liabilities / total assets, 1 year prior to the proxy date; and

MTB: market value of equity/book value of equity, 1 year prior to the proxy date;

In addition, I disaggregated the CSRSCORE into total strengths and total concerns. I report strengths_CSRSCORE and concerns_CSRSCORE which refer to, respectively, the total strengths and the total concerns in the five social KLD categories investigated in this study. The mean values of the strengths_CSRSCORE and concerns_CSRSCORE are, respectively, 3.21 and 2.29. Across years, the best performing firm obtained 21 strengths out of the maximum possible

number of 34, and the worst performer obtained 15 concerns out of the maximum of 27. Although CSRSCORE is, by construct, a censored variable, the distribution of sample values reveals features that justify the indicator being treated as a continuous measure in the empirical analyses. Firstly, the indicator presents a sufficiently large number of categories (Agresti 2002, 277–278). Secondly, all data fall within the middle section of the rank scale used by the raters (in particular, between 30% and 70% of the theoretical distribution) and suggest the existence of a linear relationship with no need to obtain predicted values beyond those values – certainly not beyond the minimum 0 and the maximum +61 (equal to 34 max strengths plus 27 minimum concerns) (Agresti 2002).

CSR_COMP indicates that, between 2002 and 2012, 20.96% of sample companies choose to tie top executive compensation to CSR targets. More specifically, CSR_COMPEXP reveals the some firms as having implemented CSR-linked executive compensation for the entire period under scrutiny. A more detailed analysis (not tabulated) indicates that the median adopting firm used CSR-linked executive compensation for 2 years and the fourth quartile of the distribution grouping companies implemented this mechanism for at least 3 years. Furthermore, 18.40% of sample firms established a CSR committee (CSR_COMMIT), 21.00% publicly disclosed a CSR report (CSR_REP), and 5.55% purchased a CSR external audit (CSR_AUD). Finally, the average (median) top five executives' long-term component accounted for 66.02% (71.14%) of their total annual compensation.

Table 5 illustrates the descriptions of the main covariates, and provides frequency and mean distribution of firm-year observations by the quartile of CSRSCORE. As expected, companies in the fourth quartile of CSRSCORE more often use CSR-linked executive compensation, establish CSR committee within the board of directors, disclose a CSR report and purchase external assurance on the CSR report in the form of a CSR audit. However, upon disentangling CSRSCORE by strengths and concerns, it is interesting to note that there are not significant differences in the mean distribution of CSR-focused governance structures between positive and negative sustainability components. At first sight, these findings signal the existence of a potential reverse causality in the relationship between a firm's choice to implement CSR-focused governance structures and its CSR score.

Table 6 provides the correlation matrix of dependent and explanatory variables. Overall the Pearson correlation coefficients give little cause for multicollinearity concern.

TABLE 5. Frequency and Mean Distribution of Firm-Year Observations by the Quartile of CSR KLD ratings

		CSR_ COMP	CSR_ COMPEXP	CSR_ COMMIT	CSR_ REP	CSR_ AUD
CSRSCORE						
Quartile 1	mean	0.181	0.478	0.135	0.102	0.012
	n	1,762	1,762	1,762	1,762	1,762
Quartile 2	mean	0.174	0.510	0.109	0.094	0.021
	n	890	890	890	890	890
Quartile 3	mean	0.167	0.550	0.172	0.196	0.038
	n	1,483	1,483	1,483	1,483	1,483
Quartile 4	mean	0.360	1.199	0.362	0.537	0.194
	n	964	964	964	964	964
Strengths_CSRSCORE						
Quartile 1	mean	0.147	0.357	0.063	0.042	0.002
	n	2,109	2,109	2,109	2,109	2,109
Quartile 2	mean	0.153	0.372	0.116	0.093	0.007
	n	717	717	717	717	717
Quartile 3	mean	0.197	0.669	0.202	0.251	0.036
	n	1,200	1,200	1,200	1,200	1,200
Quartile 4	mean	0.384	1.348	0.447	0.573	0.215
	n	1,073	1,073	1,073	1,073	1,073
Concerns_CSRSCORE						
Quartile 1	mean	0.173	0.499	0.107	0.149	0.036
	n	2,357	2,357	2,357	2,357	2,357
Quartile 2	mean	0.196	0.543	0.132	0.180	0.040
	n	986	986	986	986	986
Quartile 3	mean	0.215	0.637	0.192	0.250	0.066
	n	652	652	652	652	652
Quartile 4	mean	0.297	1.034	0.389	0.343	0.105
	n	1,104	1,104	1,104	1,104	1,104
Total	mean	0.210	0.641	0.184	0.210	0.056
	n	**5099**	**5099**	**5099**	**5099**	**5099**

	TABLE 6. Table of Correlations										
	1.	**2.**	**3.**	**4.**	**5.**	**6.**	**7.**	**8.**	**9.**	**10.**	**11.**
1. Log(1+CSRSCORE)	1										
2. Log(1+CSRSCORE_PROPENSITY)	0.7630***	1									
3. CSR_COMP	0.1128***	0.0559***	1								
4. CSR_COMMIT	0.1596***	0.1352***	0.2466***	1							
5. CSR_REP	0.3461***	0.304***	0.3199***	0.3939***	1						
6. CSR_AUD	0.2530***	0.2403***	0.256***	0.2453***	0.4701***	1					
7. Log(1+CSR_COMPEXP)	0.1493***	0.0784***	0.8296***	0.3231***	0.3791***	0.3315***	1				
8. LT_COMP	0.1872***	0.1335***	0.1281***	0.1281***	0.2231***	0.1171***	0.155***	1			
9. Log(FIRM_SALES)	0.1737***	0.199***	0.1619***	0.3072***	0.3588***	0.2418***	0.2195***	0.123***	1		
10. ROE	0.0992***	0.109***	0.032**	0.0362***	0.0607***	0.044***	0.0294**	0.0591***	0.1243***	1	
11. LEV	0.0200	0.0423***	0.0485***	0.0823***	0.0939***	0.0393***	0.0683***	-0.1089***	0.2926***	0.043***	1
12. MTB	0.0875***	0.1209***	-0.046***	-0.0457***	-0.0164	-0.0106	-0.0603***	0.0769***	-0.0375***	0.4468***	0.0601***

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

4.2. The Effects of CSR-linked Executive Compensation on CSR Performance

Table 7, Panel A reports equation (1) results on the CSR effects (CSRSCORE) associated with the use of CSR-linked executive compensation (CSR_COMP). 5 different regression models were carried out. Models 1-4 elaborated on equation (1) and displayed OLS hierarchical regressions that separately tested for the impact of the hypothesized relationship and the identified relevant controls. CSR-linked executive compensation (CSR_COMP) was included in Model 1, CSR-specific governance structures (CSR_COMMIT, CSR_REP, CSR_AUD) in Model 2, prior firm propensity to socially-responsive behavior (CSRSCORE_PROPENSITY) in Model 3, and other controls added in Model 4. Furthermore, Model 5 reports FE estimates of equation (1) in its complete specification.

The squared multiple correlation coefficients (R^2) are equal to 66.81% in Model 4 and 75.21% in Model 5 indicating that the independent regressors explain a high portion of the variance in firms' CSR score. Except for Model 2, the use of CSR-linked executive compensation is significantly associated with higher CSR performance in all the model specifications proposed, providing strong support for H1a. Specifically, results from Model 5 show that a corporate decision to tie top executives' pay to CSR performance is likely to increase the net CSR score of the average sample firm by approximately 3.46%, with all other independent variables constant. Consistent with agency theory predictions, the establishment of a CSR committee within the board of directors and the public disclosure of a CSR report also correlate positively to the firm's CSR score, contributing to an increase of, respectively, 3.73% and 7.23%. Surprisingly, a firm's decision to purchase an ad-hoc external audit on its CSR report does not significantly impact on its social and environmental performance. The latter finding suggests the merely symbolic role played by a CSR audit and emphasizes the reputational value of producing public CSR reports as a form of voluntary contract between managers and both shareholders and other constituencies. Companies choose to disclose the environmental and social aspects of their business, including performance targets and results, as formal signal of their commitment to CSR and in order to provide information for assessment independent of the additional reliability indicated by the purchase of an external audit on the information contained in the disclosed reports.

Dependent variable = Log(1+CSRSCORE(t))	Predicted Sign	(1)	(2)	(3)	(4)	(5)
Independent Variables						
CSR_COMP	+	0.0927***	0.0143	0.0316***	0.0274***	0.0346***
		(0.0174)	(0.0160)	(0.0082)	(0.0082)	(0.0122)
CSR-specific Control Variables						
CSR_COMMIT				0.0600***	0.0363***	0.0268***	0.0373*
				(0.0222)	(0.0090)	(0.0092)	(0.0196)
CSR_REP				0.2137***	0.1017***	0.0843***	0.0723***
				(0.0188)	(0.0093)	(0.0098)	(0.0136)
CSR_AUD				0.1202***	0.01	0.0023	0.0225
				(0.0256)	(0.0151)	(0.0153)	(0.0241)
Log(1+CSRSCORE_PROPENSITY)					0.7833***	0.7715***	0.3289***
					(0.0139)	(0.0139)	(0.0382)
Other Firm-specific Control Variables						
LT_COMP						0.0672***	0.0489**
						(0.0155)	(0.0217)
Log(FIRM_SALES)						0.0175***	0.0142
						(0.0034)	(0.0219)
ROE						0.0001	0.0004*
						(0.0002)	(0.0002)
LEV						-0.0345**	-0.1079**
						(0.0175)	(0.0452)
MTB						0.0021*	0.0055***
						(0.0011)	(0.0018)
Fixed effects		no	no	no	no	yes
Year effects		yes	yes	yes	yes	yes
Number of observations		5,099	5,099	4,081	4,081	4,081
Number of distinct firms		773	773	741	741	741
R-Squared		0.1805	0.2896	0.6625	0.6681	0.7521

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

Note: Models 1-4 use OLS regression. Model 5 uses panel regression with fixed effects estimators. Standard errors are clustered by firm and reported in parentheses. A constant is included in all of the regressions but is not reported. The dependent variable is the natural logarithm of 1 plus CSRSCORE at time t: net score of CSR ratings (measured as total strengths - total concerns in five social categories of KLD ratings data: community, diversity, employee relations, environment, and product) + minimun value of firms' net CSR scores overall distribution

Further, we find that prior propensity to CSR behavior significantly predicts the future CSR score. This evidence is mainly determined by the variable design, which is however performed in accordance with theoretical and empirical contributions indicating CSR performance as having a long-term focus and 'sticky' nature (Porter and Kramer 2011; Bénabou and Tirole 2010; Deckop 2006). Omitting to control for this factor would result in spurious findings. As displayed in Model 3, the inclusion of this variable permits better isolation of the performance effects associated with

the use of CSR-linked executive compensation and CSR-focused governance structures other than those driven by prior investments in CSR activities. Specifically, R^2 increases from 28.96% in Model 2 to 66.25% in Model 3, indicating that CSRSCORE_PROPENSITY more than doubles the explanatory power of the proposed empirical model. As expected, the effects stemming from a CSR committee, a CSR report and a CSR audit decrease significantly after the insertion of prior CSR propensity as an additional covariate, with the coefficient of the CSR audit becoming insignificant. On the other hand, the coefficient of the main independent variable, CSR_COMP increases.

In line with previous literature (Eccles et al. 2014; Eccles et al. 2013; Henri and Journeault 2010; Galema et al. 2008; Deckop 2006), firm size (FIRM_SALES), long-term orientation concerning top executives' compensation structure (LT_COMP), company financial performance (ROE), and the ratio between market-to-book values (MTB), are positively and significantly associated with the CSR score, while company leverage (LEV) is negatively correlated. However, firm size seems to be a weak predictor of CSR performance being insignificantly linked to the CSR score when a fixed effect estimator is used (Model 5).

Table 7, Panel B summarizes the results of the empirical analysis regarding the relationship between the firm's cumulated experience in using CSR-linked executive compensation (CSR_COMPEXP) and its CSR performance (CSRSCORE). Model 6 tests equation (1) using an OLS regression. Models 7 and 8 report fixed effects estimates. In particular, Model 8 disentangles the effects associated with different years of corporate experience in linking senior managers' pay to CSR performance. Instead of fitting the regression as a continuous function of the firm's cumulative experience, it includes indicators for each year of experience as a separate covariate.

Overall, the explanatory power of the models does not increase significantly compared to Model 5, which does not explicitly control for the firm's experience in using CSR-linked executive compensation (R^2 coefficients equal to 75.42% and 75.83% for, respectively, Model 7 and Model 8). As expected, I find that companies with greater experience in using CSR-linked executive compensation also have a higher CSR score. In particular, Model 7 indicates that a company with a year's more experience in tying top executives' compensation to CSR performance than the average has a 10.61% higher CSR score.

TABLE 7 - Panel B. The Effects of Corporate Experience in Using CSR-linked Executive Compensation on CSR Score

Dependent variable = Log(1+CSRSCORE(t))	Predicted Sign	(6) b	(6) se	(7) b	(7) se	(8) b	(8) se
Independent Variables							
Log(1+CSR_COMPEXP)	+	0.0255***	(0.0064)	0.0680***	(0.0157)		
CSR_COMPEXP==1	+					0.0266*	(0.0151)
CSR_COMPEXP==2	+					0.0512**	(0.0207)
CSR_COMPEXP==3	+					0.0890***	(0.0241)
CSR_COMPEXP==4	+					0.1184***	(0.0313)
CSR_COMPEXP==5	+					0.2091***	(0.0464)
CSR_COMPEXP==6	+					0.2099***	(0.0412)
CSR_COMPEXP==7	+					0.2082***	(0.0529)
CSR_COMPEXP==8	+					0.2341**	(0.1116)
CSR_COMPEXP==9	+					0.4920***	(0.1103)
CSR_COMPEXP==10	+					0.6706***	(0.2155)
CSR_COMPEXP==11	+					0.6149***	(0.1291)
CSR-specific Control Variables		included		included		included	
Other Firm-specific Control Variables		included		included		included	
Fixed effects		no		yes		yes	
Year effects		yes		yes		yes	
Number of observations		4,081		4,081		4,081	
Number of distinct firms		741		741		741	
R-Squared		0.6685		0.7542		0.7583	

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

Note: Model 6 uses OLS regression. Models 7 and 8 use panel regression with fixed effects estimators. Standard errors are clustered by firm and reported in parentheses. A constant is included in all of the regressions but is not reported. The dependent variable is the natural logarithm of 1 plus CSRSCORE at time t: net score of CSR ratings (measured as total strengths - total concerns in five social categories of KLD ratings data: community, diversity, employee relations, environment, and product) + minimun value of firms' net CSR scores overall distribution.

This result provides strong support for hypothesis H1b which predicts that firms are more likely to achieve higher social and environmental performance as they gain experience in tying their senior executives' pay to sustainability targets. In particular, Model 8 shows that the relationship between different levels of CSR_COMPEXP and CSRSCORE shows increasing marginal effects approximately up to the 5th year of continuous use of CSR-linked executive compensation and then becomes scattered but with a general positive trend for higher cumulated experience. Caution is in order when interpreting the magnitude of the coefficients because of the few firm-observations in the categories with more than 5 years of experience. For instance, recoding the variable by grouping all companies with more than5 years of experience in one single group provides clearer linear results regarding the investigated relationship (not tabulated).

In addition, I found that the use of CSR-linked executive compensation is able to promote the firm's CSR performance already in the year subsequent to the adoption date - the statistical power of the coefficient is weaker than those of the indicators for higher cumulative experience but still significant at the 10 percent level. At a first sight, this result contradicts previous research discussing the long-term nature of CSR investments (Porter and Kramer 2011; Bénabou and Tirole 2010; Deckop 2006). However, it suggests the existence of short-term performance effects associated with the company's probable engagement in CSR activities determined by the use of dedicated explicit incentives for senior executives. Lastly, the coefficients and the standard errors of other CSR-specific variables and relevant controls (not tabulated) are generally unchanged as compared to Model 5 results.

4.3. Robustness Checks

I conducted several checks to reinforce the robustness of the results. First, I used an adjusted measure for the company's experience in using CSR-linked executive compensation (CSR_COMPEXP) to control for potential error in the measurement of the variable derived from the ASSET4 database composition. In particular, for companies included in the ASSET4 dataset as CSR-linked executive compensation adopters (with indicator CSR_COMP equal to 1) there is some uncertainty concerning prior year adoption, not mapped in the dataset. As a result, CSR_COMPEXP might indeed lead to underestimation of the true level of cumulative experience for these firms. To address this concern, I removed all observations from firms reported in the ASSET4 dataset with a starting value of 1 and ran the analysis over an unbiased restricted sample. Overall, results (not tabulated) remained consistent with primary findings. Secondly, I controlled for potential sample selection bias associated with differences in sample composition across years justified by the increasing coverage of the ASSET4 database. I chose the year 2007 as a new initial point for sample selection, as ASSET4 starts covering more than half of the distinct firms composing the final sample in this year. I thus created a restricted sample of firms from 2007 to 2013 and I re-computed firm experience in using CSR-linked executive compensation (CSR_COMPEXP) starting from the new initial year. Lastly, I ran the model over this restricted sample to verify the validity of the results. Additionally, I repeated the procedure starting from the year 2008 covering more than two third of total distinct sample firms and I obtained similar findings (not tabulated).

4.4. Two-stage OLS Regression with Instrumental Variables

One more concern regarding the research design is whether corporate provision and, in turn, the cumulated experience in using CSR-linked executive compensation is exogenous or endogenous in equation (1). Potential endogeneity concerns need to be addressed to verify whether the investigated relationship is more likely to be causal as opposed to an association (Armstrong et al. 2010). In this setting potential endogeneity would stem from reverse causality or correlated omitted variables. On the one hand, the specification of equation (1) explicitly models for one-year lagged covariates to avoid simultaneity issues and includes previous CSR performance (in the form of CSRSCORE_PROPENSITY) as an additional control to mitigate potential reverse causality originated by certain levels of CSR involvement driving firms to use CSR-specific managerial mechanisms. Nevertheless, it is still possible that the main independent indicator CSR_COMPEXP simultaneously relates to the dependent variable, CSRSCORE. For example, given the long-term nature of CSR investments (Porter and Kramer 2011; Bénabou and Tirole 2010; Deckop 2006), it is plausible to assume that there exists some variation in the firm's CSR performance at time t that is yielded by prior investments/disinvestments in CSR activities, which have not yet produced any visible effect at time t-1 and, therefore are not yet recognized by independent KLD raters in prior CSR scores. In situations such as this, commitment to CSR might justify the adoption of dedicated management practices, such as CSR-linked compensation contracts, aimed at fostering the execution. On the other hand, the multidimensional nature of the CSR concept (Carroll 1979) may raise some concerns in terms of correlated omitted variables. Given the complex nature of CSR activities, it is possible that KLD ratings are not able to capture the overall CSR performance of a firm entirely. Hence, the presence of environmental and social aspects possibly not captured by the KLD score might significantly bias the results.

To resolve this issue, I ran a two-stage-least-squares (2SLS) regression analysis with instrumental variables (IV) that permits controlling for the potential endogeneity of CSR_COMPEXP. Table 8, Panel B shows the results of both OLS and 2SLS estimations.

Specifically, I followed the approach described by Larcker and Rusticus (2010) to select valid instruments. According to Derchi and Oyon (2015), peer behaviors in the field of CSR exert pressures to copy both at the industry and the country level and significantly influence a company's decision to adopt similar managerial practices. In addition, peer socially responsible behaviors are unlikely to affect the firm's CSR score directly, but they might significantly influence it indirectly through the firm's decision to imitate these actions.

TABLE 8. Sensitivity Analysis

Dependent variable = Log(1+CSRSCORE(t))	Predicted Sign	OLS	2SLS	
			First-stage	Second-stage
Independent Variables				
Log(1+CSR_COMPEXP)	+	0.0680***		0.0776*
		(0.0105)		(0.0435)
Instruments				
Industry_MIMIC			0.8698***	
			(0.0741)	
State_MIMIC			0.5849***	
			(0.0625)	
CSR-specific Control Variables				
CSR_COMMIT		0.0321**	0.0734**	0.0312**
		(0.0132)	(0.0210)	(0.0159)
CSR_REP		0.0689***	0.0855**	0.0680***
		(0.0116)	(0.0184)	(0.0128)
CSR_AUD		0.0128	0.1539**	0.0111
		(0.0172)	(0.0273)	(0.0210)
Log(1+CSRSCORE_PROPENSITY)		0.3158***	0.2302**	0.3135***
		(0.0251)	(0.0397)	(0.0364)
Other Firm-specific Control Variables		included	included	included
Fixed effects		yes	yes	yes
Year effects		yes	yes	yes
Number of observations		4,081	4,081	4,081
Number of distinct firms		741	741	741
R-Squared		0.7542		0.7514
Partial R-Squared			0.7644	
Partial F-statistic (*p*-value)			F_p=123.37 (*p*=0.0000)	
Over-identifying restictions test (*p*-value)			*p*=0.2492	
Exogeneity test (*p*-value)			*p*=0.8292	

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

Note: Both OLS and 2SLS models use fixed effects estimators. Robust standard errors are reported in parentheses.

A constant is included in all of the regressions but is not reported. The dependent variable is the natural logarithm of 1 plus

CSRSCORE at time t: net score of CSR ratings (measured as total strengths - total concerns in five social categories of KLD ratings data

community, diversity, employee relations, environment, and product) + minimun value of firms' net CSR scores overall distribution.

As a result, for each company I computed the proportions of other firms, respectively, in any given industry-year pair (Industry_MIMIC) and in any given state-year pair (State_MIMIC) that use CSR-linked executive compensation and I selected these as instruments to insert in the first-stage regression model. Consistent with standard IV approach (Larcker and Rusticus 2010) I included all exogenous variables in the first-stage. Similarly to previous research (Derchi and Oyon 2015; Eccles et al. 2013), I found that both Industry_MIMIC and State_IMIMC are

strongly associated with the firm's choice to tie top executives' pay to CSR performance. The R^2 of this first-stage regression with FE specification is 82.27%. After removing the control variables, the partial R^2 accounts for 76.44%, contributing to explain a high proportion of firms choosing to use CSR-linked executive compensation. Moreover, the Cragg-Donald Wald F statistic is 123.37, above the threshold recommended by Stock et al. (2002). Overall, these findings indicate strong instruments. The 2SLS approach was then completed by estimating the second-stage. The 2SLS coefficient for CSR_COMPEXP indicates that higher CSR score are determined, at least partly, by the firm's greater experience in formally linking top executive pay to CSR performance. However, the magnitude of the CSR_COMPEXP coefficient is not statistically higher than the OLS estimate. To assess the robustness of this 2SLS analysis, I conducted a formal test for over-identifying restrictions, which are appropriate under the assumption that at least one of the instruments is valid. Test results failed to reject the hypothesis that the instruments are exogenous (p-value is 0.2492) and confirmed the quality of the selected instruments, as well as the robustness of the findings. Finally, the Durbin-Wu-Hausman test was performed to verify whether the use of 2SLS is preferable to OLS for the equation (1) model. Surprisingly, the test results strongly reject the exogeneity of corporate experience in using CSR-linked executive compensation (p-value is 0.8292). As a consequence, the implementation of a robust IV estimation reveals the exogeneity of the proposed main regressor in our setting and strengthens the confidence on the quality, as well as the efficiency of the initial findings (Angrist and Pischke 2009). Overall, these results confirm the importance to firms of gaining experience in using CSR-linked executive compensation to promote CSR performance significantly.

4.5. The Interaction effects between CSR-linked Executive Compensation and CSR-focused Governance Structures

Table 9 summarizes results from equation (2) analysis which explores the effects associated with the interaction between CSR-linked executive compensation (CSR_COMPEXP) and CSR-focused governance mechanisms exerting either an advisory role, in the forms of a CSR committee (CSR_COMMIT), or a monitoring function, in the forms of CSR reporting (CSR_REP) and CSR external auditing (CSR_AUD).

I ran 4 different FE regression models. Model 7 reproduces the findings from Table 7, Panel B as baseline of the investigation. Models 9 and 10 include the interaction terms between CSR_COMPEXP and, respectively, CSR_COMMIT and CSR_REP to test separately for the impact of the simultaneous use of various combinations CSR-focused governance structures.

Model 11 adds the interaction term between CSR_COMPEXP and CSR_AUD to Model 10, to control for the interaction effect of a firm's choice to purchase an external CSR audit.

As expected, I found that, on average, the presence of governance structures focused on CSR issues positively moderates the effects on a CSR score associated with a higher level of experience in using CSR-linked executive compensation. In particular, results show how top executive incentives tied to CSR targets and, respectively, monitoring or advisory systems focused on the environmental and social aspects of the business serve as complements to each other in promoting the firm's CSR performance. Overall, results strongly reject hypothesis H2 which predicts that the use of CSR executive compensation in combination with CSR-focused governance structures does not affect the firm's CSR performance.

Specifically, Model 9 indicates that firms with greater experience in using CSR-linked executive compensation are able to achieve a higher CSR score even without the establishment of a CSR committee with an advisory role within the board of directors. Compared to Model 7, the coefficient of CSR_COMPEXP is lower but the difference is not statistically significant (F-test not tabulated). On the other hand, the presence of a CSR committee positively moderates the effects of higher levels of experience of CSR-linked executive compensation. That is, I found the coefficient a5 in Model 7 to be positive and significantly related to the CSR score. More specifically and ceteris paribus, firms are able to more than double their CSR performance (represented by the sum of the coefficients (a1+a5)) when they created a CSR committee to support the decision-making process on CSR issues of senior managers whose payment contracts are conditional on the attainment of sustainability targets. That is, the sum of coefficients (a1+a5) according to an F-test was found to be significantly greater than zero (p-value is 0.0000). Similarly, Model 10 reports that greater corporate experience in using CSR-linked executive compensation is likely to promote higher CSR score even in the absence of dedicated monitoring systems, in the forms of CSR reporting. The CSR_COMPEXP coefficient is lower, but not statistically different (F-test not tabulated) from that in Model 7. Yet Model 10 reports that the disclosure of a CSR report positively moderates the effects of CSR_COMPEXP on the CSR score. Specifically, results show that, ceteris paribus, firms with greater experience in CSR-linked executive compensation obtain a CSR performance which is approximately twice as good when CSR reports are publicly disclosed, thereby permitting shareholders and other constituencies to monitor the CSR efforts of senior managers whose payment contract is formally tied to sustainability targets. That is, the coefficient a6 is positive and significantly associated with the

CSR score and the sum of coefficients (a1+a6) is significantly greater than zero (p-values are 0.0000).

Model 11 reveals that a CSR audit does not seem to moderate the relationship between CSR-linked executive compensation and the firm's CSR score. The coefficient a7 is not significantly associated with the main dependent variable. That is, the additional purchase of a CSR audit on the CSR report is not likely to exert any improvement in terms of CSR performance. This latter result confirms initial findings showing that external assurances on the CSR report play a merely symbolic role (Simnett et al. 2009).

Overall the findings confirm the relevance of this investigation in contributing to a greater understanding of how CSR-linked compensation contracts might exert their efficacy. These findings contribute to previous corporate governance research and shed some lights on the benefits of using various governance mechanisms in the field of CSR. In line with prior literature on corporate governance (Armstrong et al. 2012; Coles et al. 2008), these results emphasize the key role played by board of directors in advising top executives, particularly in the context of complex investments, such as CSR activities, where considerable firm- specific knowledge is needed to guide management decisions. Consistent with agency theory rationales, these estimates also clearly indicate the importance of designing ad-hoc monitoring systems in the CSR context. Accordingly, I find that the firm's investment in appropriate information systems contributes to increase the efficacy in contracting with managers by means of reducing agency conflicts originated by the information asymmetry between top executives and both shareholders and other stakeholders (Milgrom and Roberts 1992). In particular, these results highlight the reputational value of producing public CSR reports as a form of voluntary contract between managers and both shareholders and other constituencies. Similarly to what discussed by Armstrong et al. (2010), the disclosure of a CSR report serves to reveal previously hidden information about the firm' environmental and social strategies and such information results in improved monitoring of executives.

TABLE 9. Interaction Effects						
Dependent variable = Log(1+CSRSCORE(t))	Predicted Sign	b.coeff.	(7)	(9)	(10)	(11)
Independent Variables						
Log(1+CSR_COMPEXP)	+	a1	0.0680***	0.0457***	0.0499***	0.0498***
			(0.0157)	(0.0168)	(0.0182)	(0.0182)
CSR-specific Control Variables						
CSR_COMMIT		a2	0.0321*	0.0223	0.0310+	0.0328*
			(0.0192)	(0.0187)	(0.0193)	(0.0192)
CSR_REP		a3	0.0689***	0.0682***	0.0658***	0.0680***
			(0.0136)	(0.0137)	(0.0135)	(0.0135)
CSR_AUD		a4	0.0128	0.0065	0.0024	-0.0192
			(0.0236)	(0.0232)	(0.0227)	(0.0248)
demean(Log(1+CSR_COMPEXP))*CSR_COMMIT		a5		0.0790**		
				(0.0312)		
demean(Log(1+CSR_COMPEXP))*CSR_REP		a6			0.0534*	0.0360
					(0.0299)	(0.0333)
demean(Log(1+CSR_COMPEXP))*CSR_AUD		a7				0.0578
						(0.0472)
Log(1+CSRSCORE_PROPENSITY)			0.3158***	0.2981***	0.3011***	0.3010***
			(0.0380)	(0.0383)	(0.0390)	(0.0391)
Other Firm-specific Control Variables			included	included	included	included
Fixed effects			yes	yes	yes	yes
Year effects			yes	yes	yes	yes
F-test(a1+a5=0)				18.04***		
F-test(a1+a6=0)					15.82***	8.48***
F-test(a1+a6+a7=0)						11.66***
Number of observations			4,081	4,081	4,081	4,081
Number of distinct firms			741	741	741	741
R-Squared			0.7542	0.7555	0.7548	0.7550

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

Note: Models use OLS panel regression with fixed effects estimators. Standard errors are clustered by firm and reported in parentheses. A constant is included in all of the regressions but is not reported. The dependent variable is the natural logarithm of 1 plus CSRSCORE at time t: net score of CSR ratings (measured as total strengths - total concerns in five social categories of KLD ratings data: community, diversity, employee relations, environment, and product) + minimun value of firms' net CSR scores overall distribution.

5. CONCLUSIONS

In this work, I have examined the effectiveness in contracting of using CSR-linked compensation for top executives. First, I tested whether the firm's choice to tie senior executives' pay to CSR targets promotes CSR performance. Second, I investigated whether CSR-linked executive compensation incentives need a long-term time frame to realize (inter-temporal) benefits in line with CSR management literature. To do this, I explored the performance

consequences associated with the firm's cumulative experience in tying top executives' pay to CSR targets. Finally, I explored the effects of the interaction between the firm's experience in using CSR-linked executive compensation and the implementation of specific CSR-focused governance mechanisms exerting either an advisory role - in the form of a CSR committee - or a monitoring function - in the forms of CSR reporting and CSR external auditing. I used a cross-industry sample of 5,720 firm-year observations from 783 distinct companies listed in the US over the period 2002-2013, representing in 2012 around 54% of total US equity market capitalization.

Firstly, the findings support the premise that the use of CSR-linked incentives for senior executives promotes firms' CSR performance. Secondly, the analyses reveal that corporate choice to link top executives' pay to CSR targets produces positive effects already in the year following their adoption. At a first sight, this finding contrasts with prior CSR literature stating that CSR outcomes are more likely to be realized in the long-term (Porter and Kramer 2011; Bénabou and Tirole 2010; Deckop 2006). I explain this finding as a combined effect of two elements. The first element has to do with the management ability to adapt their utility function to new incentives structure in the short-run. The second element draws is the fact that not all CSR initiatives yield long-term results, rather certain CSR effects start to operate in the short-term. Hence, I try to explain why the first time adoption significantly influences CSR results.

Additionally, results show that the reiterated use of CSR-linked executive compensation monotonically increases CSR score as firms cumulate experience in using the incentives. As expected, I document a long-term effect of CSR-linked incentives on the CSR score (Porter and Kramer 2011; Bénabou and Tirole 2010; Deckop 2006), and more interestingly I find that the effect last over times. I attempt an explanation by observing CSR scores evolution over time. Considering how analysts designed the CSR scores in KLD, I see that the optimal score is yet to come for the average firm investigated over the time-frame under scrutiny. This means that the reiterated use of CSR-linked executive compensation continues to stimulate the adoption over time of additional CSR initiatives that yield CSR results. Overall, results support the notion that the inclusion of environmental and social performance measures in the compensation contracts of senior executives increases the alignment between the agent and the principal making contracting more effective (Milgrom and Roberts 1992).

Lastly, the findings suggest that the simultaneous use of CSR-linked incentives and CSR-focused governance structures is likely to exert complementary effects on the firm's CSR performance. The results are in opposition with that body of executive compensation research

positing the existence of a substituting relationship between monitoring and compensation (Armstrong et al. 2010; Hoskisson et al. 2009; Lippert and Moore 1995; Rediker and Seth 1995). Particularly, I observe that CSR-linked executive compensation is associated with higher CSR results when it is implemented in combination either with a CSR committee or with a CSR report. The third CSR-focused governance mechanism i.e. a CSR audit does not seem to moderate the relationship between CSR-linked executive compensation and the CSR score. This latter result confirms initial findings showing that the purchase of an external assurance on the CSR report plays a merely symbolic role (Simnett et al. 2009).

Taken together, this evidence supports predictions from agency theory and corporate governance research (Armstrong et al. 2010; Coles et al. 2008; Milgrom and Roberts 1992) emphasizing the importance for the principals of designing specific advising (CSR committee) and monitoring (CSR report) systems as powerful instruments for improving the effectiveness in contracting with the agents. A CSR committee, in particular, is more likely to advice and better guide management decision-making in the context of CSR initiatives, where substantial firm-specific knowledge is needed. The public disclosure of the CSR report, on the other hand, seems likely to reduce agency conflict by revealing previously hidden information about the firm's CSR outcomes.

The results are robust to additional controls for potential errors in the measurement of the main independent variable and for sample selection bias originating from variations in the coverage of the database across years. Additionally, the results hold after controlling for potential endogeneity concerns by means of a 2SLS estimation procedure with instrumental variables. In particular, the implementation of a robust IV estimation reveals the exogeneity of the proposed main regressor in our setting and strengthens confidence in the quality of the analyzed empirical model (Angrist and Pischke 2009).

This work is subject to several limitations. First, I investigate the use of CSR-linked executive compensation contracts among organizations at a comprehensive level of analysis. Specifically, ASSET4 database does not distinguish the use of incentives for different CSR categories. Thereby, I was unable to disentangle the effects of using specific CSR objectives in CSR-linked executive compensation. I am well aware that firms depending on their strategic priorities as well as on measurability issues might select different types of CSR goals such as employee relations, diversity, environmental performance, human rights issues, product quality and community engagement. As prior research on performance evaluation argues that the use of certain categories of performance indicators is more effective than others in fostering results

(Moers 2006; Ittner and Larcker 2002; Ittner et al. 1997), it is possible that different objectives included in pay-for-performance contracts for top executives exert different effects on the firms' CSR score. Further research could be directed to explore the implications on CSR performance of the use of specific CSR compensation plan. The findings would help firms and compensation consultants to design more effective CSR incentive schemes. Further, ASSET4 does not give any information concerning the weight placed on CSR performance targets relatively to the total variable compensation awarded to executives. As previously mentioned, Guay (The Guardian 2014) notes that CSR "accounts for only a tiny percentage of actual compensation analysis - in most cases, it is less than 1% of an executive's overall performance review". Further investigation could lead to seizing the relative importance of CSR incentives and, hence, provide a finer ground for the interpretation of our results. I believe that seizing the weight of CSR incentives on the overall variable compensation could help isolate the magnitude of the improvement over CSR performance and help determine the costs associated with the use of CSR-linked incentives. I believe that attempts to address these issues constitute a fruitful area for future research as well as for practice.

Second, this study focuses on the relationship between corporate use of CSR-linked executive compensation and CSR performance across US domiciled companies. However, it is possible that US-based companies behave differently as compared to international firms in respect to CSR issues. For instance, the business culture of a country, and in particular whether a country is more stakeholder- or shareholder-oriented can influence the firms' need for higher CSR involvement. Accordingly, Simnett et al. (2009) find evidence that companies in stakeholder countries are more likely to have their sustainability reports assured. In line with this argument, Derchi and Oyon (2015) note firms not domiciled in the US to be higher responsive to environmental concerns compared to US ones. Another important element of concern relates to significant differences in corporate governance practices among countries (Conyon et al. 2010). These differences are likely to explain various roles of formal and informal incentive systems towards CSR and, in turn, the way firms design compensation contracts of the CEO and the top executives. Based on ASSET4 data, US firms are more likely to tie top executives' compensation contracts to CSR performance as opposed to international firms (see Table 1 and Table 2, Panel A). Part of this difference is potentially related to the governance of continental European firms often reflecting a wider implicit social contract (i.e.: in Germany, co-determination rules require half of the supervisory board members to represent labor). Because of these differences, it would be extremely useful to examine whether and how CSR-focused governance structures are able to

promote firms' CSR performance across countries. I look forward to future research addressing these issues.

Further, I acknowledge the existence of other caveats related to this work. Still, I contribute to the literature by providing solid evidence regarding effectiveness in contracting associated with the use of CSR-linked targets for top executive compensation schemes.

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