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Market Reactions to Corporate Environmental Performance Related Events: A Meta-analytic Consolidation of the Empirical Evidence

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Abstract Research on the relationship between corporate environmental performance (CEP) and corporate financial performance (CFP) has consistently grown and is gaining widespread attention. Given the vast body of CEP–CFP studies, recently scholars have begun to take stock of the cumulative results. However, no study so far has meta-analyzed the findings yielded by event studies assessing the stock market reactions to corporate environmental performance-related events (CEP-related events). This paper sets out to close this gap by synthesizing previous empirical results regarding the stock market impact of positive and negative CEP-related events. Results indicate a positive relationship across studies in terms of positive market reactions to positive events and negative reactions to negative events. Furthermore, the findings show that the market reactions are stronger for negative events than for positive events (i.e., asymmetry in the stock market reaction). Finally, this study examines whether methodological artifacts (i.e., differences in the study designs) may explain the differences in the findings of the analyzed event studies.

Keywords Corporate environmental performance (CEP) · Corporate financial performance (CFP) · Event study methodology · Market value · Meta-analysis

Abbreviations

AR	Abnormal return
CAR	Cumulative abnormal return
CEP	Corporate environmental performance
CFP	Corporate financial performance
CI	Confidence interval
CSP	Corporate social performance
CSR	Corporate social responsibility
DJSI	Dow Jones Sustainability Index
EMS	Environmental management system
NRBV	Natural resource-based view
UNGC	Accenture and UN Global Compact

Introduction

Research on the relationship between corporate environmental performance (CEP) and corporate financial performance (CFP) has been burgeoning for years and is still expanding. A plethora of empirical studies has been examining the CEP–CFP link and the question whether it "pays to be green" continues to receive unabated attention in both general media (e.g., Diamond 2009; Elgin 2007) and scholarly publications. Moreover, corporate practitioners are increasingly faced with external pressures from different stakeholders to behave responsibly toward the natural environment (Flammer 2013). According to the latest global survey of CEOs provided by Accenture and UN Global Compact (UNGC), 93 % of the 1000 surveyed CEOs believe that sustainability will be important or "very important" to the future success of their business (UNGC and Accenture 2013).

While research rooted in neoclassical economics proposed that any discretionary efforts toward improvements of CEP would decrease profits and thus violate shareholder value maximization (e.g., Friedman 1970; Jensen 2002); other scholars have challenged this view by putting

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forward arguments for a positive impact of CEP on CFP. In particular, stakeholder theory (e.g., Donaldson and Preston 1995; Freeman 1984; Parmar et al. 2010) and the natural resource-based view (NRBV; e.g., Hart 1995; Hart and Dowell 2011) provided the theoretical grounds for postulating a positive relationship between CEP and CFP. However, empirical examinations have long yielded mixed results, ranging from findings indicating a negative relationship (e.g., Cordeiro and Sarkis 1997; Fisher-Vanden and Thorburn 2011), to non-significant findings (e.g., Cohen et al. 1997; Graves and Waddock 1999), up to findings suggesting a positive relationship between both focal constructs (e.g., Flammer 2013; Russo and Fouts 1997).

Due to the substantial body of empirical work concerned with the CEP–CFP link, scholars have begun to take stock of the cumulative results. Three meta-analyses have recently addressed the relationship between CEP and CFP (Albertini 2013; Dixon-Fowler et al. 2013; Endrikat et al. 2014).[1] In essence, the meta-analytic results suggest a modest positive relationship which, however, appears to be quite complex and subject to several moderation effects arising for example from different measurement approaches, causal ambiguity, and methodological issues (Endrikat et al., 2014). Broadly, empirical research has used three different types of methodologies for examining the CEP–CFP relationship: (1) portfolio analyses comparing the financial performance of model portfolios of firms with high CEP and low CEP, (2) multivariate analyses using multiple regression approaches or structural equation models, and (3) event studies assessing the stock market impact of positive or negative corporate environmental performance-related events (CEP-related events) (de Haan et al. 2012; Salzmann et al. 2005). The event study methodology appears particularly appropriate for examining the CEP–CFP relationship due to several reasons; for example, by focusing on stock market returns, event studies imply a forward-looking perspective on the financial consequences of CEP. Moreover, event studies evade the issue of endogeneity and are quite unambiguous with regard to the causal direction of the relationship. However, while the results of studies based on portfolio analyses and multivariate analyses have been captured by the above-mentioned meta-analyses, thus far no attempt has been made towards an integration and consolidation of the empirical evidence provided by event studies.

[1] In addition, there are several meta-analyses regarding the relationship between corporate social performance (CSP) and CFP (e.g., Allouche and Laroche 2005; Orlitzky et al. 2003). As CEP can be considered a dimension or a component of the broader construct of CSP (e.g., Busch and Hoffmann 2011; Orlitzky et al. 2003), the CSP–CFP meta-analyses partly captured the CEP–CFP link by means of subgroup analysis.

In an effort to remedy this deficiency, this paper provides a meta-analysis that accumulates 53 effect sizes derived from 32 studies concerned with stock market reactions to CEP-related events. Meta-analysis, a tool for quantitatively synthesizing the findings across a number of studies, has become increasingly common in management research (Combs et al. 2011; Geyskens et al. 2009; van Essen et al. 2012). Particularly in cases where inconsistent findings impede any generalizations, it has become the methodology of choice for establishing consensus (Geyskens et al. 2009; van Essen et al. 2012).

The current study makes three contributions. First, it contributes to the "Does it pay to be green?" debate by complementing the existing CEP–CFP meta-analyses and thus completing the body of cumulative evidence regarding the relationship between CEP and CFP. Moreover, given the advantageous properties of the event study methodology, a meta-analytically derived significant population effect would provide a rather clear indication of an impact of CEP on CFP ruling out potential reverse causality. This is of particular importance because the direction of causality (i.e., whether causation runs from CEP to CFP or vice versa) still represents a disputed issue (e.g., Endrikat et al. 2014; Molina-Azorín et al. 2009; Nakao et al. 2007). Second, picking up anecdotal evidence, which suggests stronger market reactions to negative events compared with positive ones, this work offers theoretical reasoning for this phenomenon and incorporates this issue in the meta-analytic investigation. Finally, by conducting exploratory moderator analyses (Geyskens et al. 2006; Kirca et al. 2012), this article examines potential moderation effects arising from methodological artifacts such as different study design and sample characteristics.

This paper is organized as follows. First, the theoretical background is presented from which the hypotheses are derived. Second, the data as well as the methodology employed are explained. The presentation of the results of the analyses follows. Finally, the findings are discussed and important implications highlighted.

Background and Development of Hypotheses

CEP-Related Events and the Link between CEP and CFP

The event study methodology was developed in finance (e.g., Brown and Warner 1985) and has been widely applied in management research (McWilliams and Siegel 1997). Event studies examine whether there are abnormal stock price effects due to announcements of unanticipated events or changes with regard to managerial decisions (McWilliams and Siegel 1997; McWilliams et al. 1999). The crucial assumption underlying event studies refers to the efficient

market hypothesis, which proposes that markets are able to anticipate and correctly interpret relevant news and quickly adjust security prices (Fama 1991; Frooman 1997). While it is commonly known that stock markets are not information perfect, they are considered to work with a high degree of efficiency and accuracy by continually assessing and valuing new information (Frooman 1997; Klassen and McLaughlin 1996).[2] Therefore, in cases of major events, abnormal returns (ARs) or cumulative abnormal returns (CARs) (i.e., significantly greater positive or negative returns) that accrue for the particular firm allow inferring that the event significantly influences the value of the firm (Frooman 1997; McWilliams et al. 1999).

The earliest event study examining ARs as consequence of CEP-related events, to the best knowledge of the author, was provided by Shane and Spicer (1983). They examined how the stock market reacted to releases of pollution control reports by the Council on Economic Priorities and found relatively large negative ARs especially for firms with low pollution control performance. Another prominent example is the study of Klassen and McLaughlin (1996), who analyzed the market reactions to (1) third-party announcements of environmental awards signaling superior CEP and to (2) environmental crises (e.g., oil spills) signaling weak CEP. They found significant positive returns for firms receiving an environmental award and significant negative returns for firms involved in an environmental crisis. While the majority of earlier studies focused on the US and usually examined announcements associated with pollution information, in recent times several event studies have been conducted in other institutional settings (e.g., Gupta and Goldar 2005; Xu et al. 2012) and incorporated a broader range of CEP-related events. For example, Gilley et al. (2000) provided an event study focusing on the announcement of product- and process-driven environmental initiatives. While they found no overall effect of such announcements on stock returns, the results of their study suggest differences in the market reaction with regard to the specific type of the environmental initiative announced. In particular, the stock market reacted more positively to product-driven initiatives compared to process-driven initiatives. Robinson et al. (2011) investigated how the stock market reacted to the inclusion of firms in the Dow Jones Sustainability Index (DJSI) and found significant increases in market value for the firms being included in the index. Keele and DeHart (2011) examined the market reactions to the announcement of firms' participation in the USEPA Climate Leaders program and found no statistically significant market reaction on the day of the announcement.

[2] It is worth mentioning that the efficient market hypothesis is not free from criticism. In particular, behavioral finance scholars have challenged the different forms of the efficient market hypothesis (e.g., Shleifer 2000).

While the events examined by event studies are admittedly single discrete events, they signal cumulative environmental performance and future positioning to the marketplace (Klassen and McLaughlin 1996). For example, an announcement of green supply chain initiatives can be considered a public signal with regard to a firm's decision towards a proactive environmental strategy. This information is deemed to be rapidly impounded in the stock price so that a change in its value implies a change in the market assessment of a firm's net present value and thus reflects the market's perception of the financial impact of signaled CEP (Gilley et al. 2000; Klassen and McLaughlin 1996).

Several theoretical arguments have been put forward with regard to the relationship between CEP and CFP involving different manifestations and mechanisms (Guenther and Hoppe 2014). In particular, the early literature rooted in neoclassical economics (e.g., Friedman 1970; Levitt 1958) argued that environmental activities would withdraw financial resources from a firm and thus weaken its financial performance because the financial benefits of environmental activities are deemed to be lower than their costs. Furthermore, drawing on agency theory (Jensen and Meckling 1976), scholars suggested that managers could opportunistically employ corporate resources to engage in environmental activities that enhance their own utility at the expense of good financial performance (Brammer and Millington 2008). For instance, managers may try to justify disappointing financial outcomes by engaging in conspicuous environmental activities (Preston and O'Bannon 1997).

In contrast, other scholars have argued that CEP can have a positive impact on CFP. Porter (1991) and Porter and van der Linde (1995) noted that pollution can be seen as a waste of resources and thus the reduction of a firm's environmental footprint may also strengthen its competitiveness leading to a "win–win" situation. In particular, the NRBV (e.g., Hart 1995; Hart and Dowell 2011) provides arguments for a positive relationship between CEP and CFP. According to the NRBV, a firm's ability to address the increasing challenges imposed by the natural environment fosters the development of rare and inimitable organizational resources and capabilities (both tangible and intangible), leading to a competitive advantage and superior financial performance (Chan 2005; Hart and Dowell 2011). Thus, proactive environmental strategies focusing on pollution prevention and environmentally sound product development may entail the development of organizational resources and capabilities and stimulate organizational learning (e.g., Russo and Fouts 1997; Sharma 2000). Hence, improving CEP may help in attracting and retaining a higher quality workforce (Turban and Greening 1996), may foster innovativeness (Sharma and Vredenburg 1998; Surroca et al. 2010), and may enhance decision-making

processes and other aspects of organizational culture (Hillman and Keim 2001; Sharma and Vredenburg 1998).

Along the lines of Freeman's (1984) stakeholder theory, it has been proposed that firms' engagement towards improving CEP can be seen as potentially instrumental in obtaining necessary resources or stakeholder support and in mitigating the likelihood of negative regulatory, legislative, or fiscal action (Buysse and Verbeke 2003; Cheng et al. 2014; Flammer 2013; Jones 1995). Thus, superior CEP can increase customer demand (Hart and Dowell 2011), may improve reputation (Hart 1995), can contribute towards gaining legitimacy as a "license to operate" (Porter and Kramer 2006, p. 81), may decrease financial risk (Peloza 2009), and attract financial resources from environmentally responsible investors (Consolandi et al. 2009; Heal 2005).

In sum, there are several channels and causal pathways through which CEP might positively affect CFP. Moreover, the meta-analytic results provided so far are in favor of a positive relationship between CEP and CFP. However, while these meta-analyses did not incorporate the data provided by event studies, a meta-analytic examination of event study results would be particularly useful because event studies, despite some critical issues concerning the proper design and sound application (McWilliams and Siegel 1997; McWilliams et al. 1999), exhibit several outstanding features.

First, focusing on stock market reactions obviates the need to analyze accounting-based measures of CFP, which may be subjected to potential manipulations due to choices regarding different accounting procedures (McWilliams and Siegel 1997; Richard et al. 2009). Moreover, while accounting-based measures of CFP are limited in that they entail a historical perspective (Hamann et al. 2013; Peloza 2009; Richard et al. 2009), stock market returns incorporate assessments of a firm's prospective development and reflect the notion of external stakeholders, especially investors, regarding future performance (Fryxell and Barton 1990; Hamann et al. 2013). Thus, event studies imply a forward-looking view on the financial consequences of CEP. This point is of crucial importance because several potentially beneficial impacts of CEP are considered to accrue in the long term (Hart and Ahuja 1996; Peloza 2009). In addition, stock market returns also incorporate intangible assets and reputation effects (Richard et al. 2009), which are obviously relevant given the theoretically proposed mechanism linking CEP and CFP.

Another advantage of event studies for examining the CEP–CFP link is that they can rather clearly determine the direction of causality (Heal 2005). While correlation and regression-based studies in most instances cannot rule out the possibility of reverse causality or endogeneity, issues that are likely to be at play in the relationship between CEP and CFP (Endrikat et al. 2014; Flammer 2013; Hart and Ahuja 1996; Surroca et al. 2010); event studies reasonably allow inferring causality running from CEP to CFP.[3]

Furthermore, as several third variables (either of moderating or mediating nature) have been suggested to be involved in the CEP–CFP link (Dixon-Fowler et al. 2013; Russo and Minto 2012), it is of crucial importance to control for such factors in empirical tests in order to ensure valid and reliable results.[4] In this regard, event studies "are unusually precise because companies serve as their own matched control when its stock price is compared before versus after a news announcement" (Margolis et al. 2009, pp. 13–14).

Due to the advantageous properties of the event study methodology, a meta-analytic overall effect calculated from event studies would provide strong evidence with regard to the question whether CEP has an impact upon CFP and if this impact is positive or negative.

In view of the preceding considerations regarding the theoretical arguments and given the results of available meta-analyses, the following hypotheses are posited:

H1a Across the body of event studies, there is a positive stock market reaction to positive CEP-related events.

H1b Across the body of event studies, there is a negative stock market reaction to negative CEP-related events.

Positive and Negative Events: Asymmetry in the Stock Market Reactions

There are several event studies, which have examined the stock market reactions to both positive and negative CEP-related events. Some of those studies found stronger stock market reactions (in terms of magnitude of the ARs or CARs) to negative events compared to positive events (e.g., Consolandi et al. 2009; Klassen and McLaughlin 1996; Lorraine et al. 2004). Thus, there seems to be some evidence that the market punishes firms in cases of negative CEP-related events to a greater extent than it values firms in cases of positive CEP-related events. In other words, the stock market reactions to CEP-related events appear to be asymmetric.

[3] There may be several reasons for reverse causal links between CEP and CFP. For example, firms with superior CFP may be likely to possess slack resources that allow them to invest in environmental activities (e.g., Endrikat et al. 2014; Waddock and Graves 1997). Furthermore, also CEP related events themselves might be a trigger for causal links from CFP to CEP. For instance, negative stock market reaction to negative CEP-related events in time period one may initiate corporate environmental investments leading to improved CEP in time period two. (I would like to thank an anonymous reviewer for raising this point).

[4] For example, previous empirical studies have revealed moderating effects of firm size (e.g., Sharma and Henriques 2005), innovation activities (e.g., Wagner 2010), or industry characteristics (e.g., Hull and Rothenberg 2008) and mediating effects of reputation (e.g., Russo and Fouts 1997), organizational culture (e.g., Surroca et al. 2010), or firm risk (e.g., Bansal and Clelland 2004).

Different non-exclusive explanations can be offered for this phenomenon. Psychological research, in particular research on impression formation (e.g., Anderson 1981), consistently indicates that individual impressions and judgments concerning particular events or situations are inordinately influenced by more negative information than by positive information (Baumeister et al. 2001; Skowronski and Carlston 1989). That is, humans weigh negative events more heavily than positive events (Jayachandran et al. 2013; Lankoski 2009). This pattern, denoted as negativity bias or positive–negative asymmetry effect, has been recognized and repeatedly confirmed in several research domains (Baumeister et al. 2001); for example, for the voting behavior in research in political science (e.g., Aragones 1997), for media attention in communication studies (e.g., Shoemaker et al. 1991), or for memorization processes in cognitive psychology scholarship (e.g., Robinson-Riegler and Winton 1996). In the field of economic psychology prospect theory (Kahneman and Tversky 1979) it is highlighted that individual decision-making patterns imply that greater weight is accorded to costs than to gains. By means of experiments Kahneman and Tversky (1979) revealed that people care more strongly about a loss in utility than they do about a gain of equal magnitude (Soroka 2006). A study of Sen and Bhattacharya (2001) indicated that positive–negative asymmetries might also be relevant in the area of corporate social responsibility (CSR). In particular, they found that consumers' company evaluations were more sensitive to negative CSR information than positive information. Similarly, Lankoski (2009), drawing on data from an executive survey, showed that corporate responsibility issues that reduce negative externalities entail stronger economic impacts than those that generate positive externalities.

Another explanation has been put forward by Klassen and McLaughlin (1996). They pointed to the fact that negative events such as environmental crises entail financial implications more obviously than positive CEP-related events. Thus, such events in addition to signaling poor CEP also forward information with manifested financial implications compared to positive events such as announcements of environmental awards.

Finally, preannouncement information asymmetry effects might explain asymmetric stock market reactions. Doh et al. (2010), examining the stock market reaction to the inclusion in or the deletion from the Calvert Social Index,[5] found significant ARs for deletions from the index but no significant ARs for additions. They argued that information asymmetries prior to the announcement of additions and deletions might explain this difference. While firms with superior CSP would be likely to publicize pertinent information, firms with deteriorating CSP would tend to withhold such information. Thus, announcements of addition to, or deletion from, a social responsibility index may involve differing degrees of information novelty.

In view of these arguments, the following hypothesis is proposed:

H2 Across the body of event studies, the stock market reaction to negative CEP-related events is stronger than the stock market reaction to positive CEP-related events.

Data and Methodology

Multiple search strategies were employed for this research to collect studies examining the market reactions to positive or negative CEP-related events.[6] First, searches were conducted in major electronic databases (Business Source Complete, Academic Search Complete, EconLit, ScienceDirect, and Wiley Online Library) using several combinations of keywords.[7] Second, the reference lists of the studies identified in step one were manually searched (i.e., employing an "ancestry" approach; Aguinis et al. 2011). Finally, the SSRN database was searched to find additional unpublished manuscripts.

In line with other meta-analyses aggregating the results of event studies, the statistical information provided in the studies has been used to calculate an inverse-variance weighted population *r* (e.g., Stahl and Voigt 2008). Consequently, to be included in the analysis the studies had to report statistics that allow the calculation of simple correlations.[8] After excluding a number of studies that did not provide the necessary statistical information, the final sample included 32 event studies providing 53 effect sizes based on a total of 8660 observations. The studies included were published between 1990 and 2013. Table 1 shows the main characteristics of the analyzed event studies.

In order to distinguish between market reactions to positive and negative CEP-related events, two separate meta-analyses were conducted. The analysis with regard to positive events was based on 27 effect sizes from 4449 observations. The analysis regarding negative events was

[5] The Calvert Social Index is a stock market index created by Calvert Investments. It consists of stocks of companies that are selected from the largest publicly traded US companies according to several social screening criteria.

[6] I conceived CEP-related events as incidents referring to environmentally friendly or environmentally harmful corporate actions or behavior. Thus, announcements of environmental regulations were not considered as events in the sense of this study.

[7] Keywords included terms such as environment, environmental, pollution, polluting, ecology, sustainability, performance, market, return, financial, economic, and stock.

[8] For the employed statistical conversions, see for example Lipsey and Wilson (2001).

Table 1 Studies included in the meta-analyses

Author(s)	Publication outlet	Year(s) of sample data	CEP-related event	Geographical region of sample data
Ba et al. (2012)	Production and Operations Management	1996–2009	Announcement of environmental innovations	World
Bose and Pal (2012)	Decision Support Systems	1997–2009	Announcement of green supply chain management initiatives	World
Bosch et al. (1998)	Managerial and Decision Economics	1970–1990	Announcement of violation of environmental laws (newspaper)	US
Bouslah et al. (2010)	Journal of Business Ethics	1998–2005	Announcement of third-party forest certifications	US, CAN
Capelle-Blancard and Laguna (2010)	Journal of Environmental Economics and Management	1990–2006	Announcement of environmental accidents	World
Cheung (2011)	Journal of Business Ethics	2002–2008	Announcement of inclusion in the DJSI	US
Consolandi et al. (2009)	Journal of Business Ethics	2002–2006	Announcement of inclusion in DJSI, announcement of exclusion from the DJSI	EU
Dasgupta et al. (2001)	Journal of Environmental Economics and Management	1990–1994	Announcement of firm-specific positive environmental news (newspaper), announcements of firm-specific negative environmental news (newspaper)	World
Fisher-Vanden and Thorburn (2011)	Journal of Environmental Economics and Management	1993–2008	Announcement of participation in voluntary environmental initiatives (EPAs climate leader program, Ceres program)	US
Flammer (2013)	Academy of Management Journal	1980–2009	Announcement of firm-specific positive environmental news (newspaper), announcements of firm-specific negative environmental news (newspaper)	US
Gilley et al. (2000)	Journal of Management	1983–1996	Announcement of firm-specific environmental initiatives (newspaper)	US
Gupta and Goldar (2005)	Ecological Economics	1999–2002	Announcement of good environmental ratings, announcement of poor environmental ratings (Indian center for science and environment)	India
Halme and Niskanen (2001)	Business Strategy and the Environment	1970–1996	Announcement of firm-specific environmental investments (newspaper)	Finland
Hamilton (1995)	Journal Environmental Economics and Management	1989	Announcement of TRI releases for firms with superfund sites	US
Jacobs et al. (2010)	Journal of Operations Management	2004–2006	Announcement of firm-specific environmental initiatives and environmental awards or certifications (newspaper)	US
Jones and Rubin (2001)	Advances in financial economics	1970–1992	Announcement of firm-specific negative environmental news (newspaper)	US
Karpoff et al. 1998	Working Paper	1980–1991	Announcement of violation of environmental laws (newspaper)	US
Keele and DeHart (2011)	Business Strategy and the Environment	2002–2009	Announcement of partnership with EPA climate leaders program	US
Khanna et al. (1998)	Journal of Environmental Economics and Management	1990	Announcement of TRI releases for firms with increasing toxic emissions	US
Klassen and McLaughlin (1996)	Management Science	1985–1991	Announcement of firm-specific positive environmental news (newswire services), Announcements of firm-specific negative environmental news (newswire services)	US
Lanoie et al. (1998)	Ecological Economics	1990	Announcement of TRI releases for firms not complying with environmental standards	US, CAN
Laplante and Lanoie (1994)	Southern Economic Journal	1982–1991	Announcement of potential violations of environmental laws (newspaper)	CAN

Table 1 continued

Author(s)	Publication outlet	Year(s) of sample data	CEP-related event	Geographical region of sample data
Little et al. (1995)	Journal of Accounting, Auditing and Finance	1977–1986	Announcement of potential violations of environmental laws (newspaper)	US
Lorraine et al. (2004)	Accounting forum	1995–2000	Announcement of firm-specific positive environmental news (newspaper, press release by agency), announcements of firm-specific negative environmental news (newspaper, press release by agency)	UK
Lundgren and Olson (2010)	Applied Financial Economics	2003–2006	Announcement of firm-specific environmental incidents (alert service)	World
Mathur and Mathur (2000)	Journal of Business Research	1989–1995	Announcement of firm-specific green marketing activities (newspaper)	US
Muoghalu et al. (1990)	Southern Economic Journal	1977–1986	Announcement of potential violations of environmental laws (newspaper)	US
Rao (1996)	Journal of Financial and Strategic Decisions	1989–1993	Announcement of firm-specific negative environmental news (newspaper)	US
Robinson et al. (2011)	Journal of Business Ethics	2003–2007	Announcement of inclusion in DJSI, announcement of exclusion from the DJSI	US, CAN
White (1996)	Working paper	1989–1992	Announcement of participation in voluntary environmental initiatives (Ceres program)	US
Xu et al. (2012)	Journal of Business Ethics	2010	Announcement of potential environmental risk (agency reports)	China
Yu (2009)	Working Paper	2000–2007	Announcement of participation in voluntary environmental initiatives (NEPT program)	US

based on 26 effect sizes from 2172 observations. The population correlations (*r*s) were calculated by means of random effects models.[9] Confidence intervals were calculated at the 95 % level. To assess the homogeneity of the effect size distributions, Q_B statistics were calculated (Hedges and Olkin 1985). Subgroup analysis was used in order to examine potential moderation effects (Hunter and Schmidt 1990). The complete samples for both positive and negative events were divided into subgroups referring to potential moderation effects and calculated separate meta-analyses for these subgroups (King et al. 2004).

First, the sample was split by distinguishing studies focusing on US firms and studies examining non-US firms. Although the majority of studies focused on US firms, scholars have recently begun to use samples drawn from other geographical regions (e.g., Gupta and Goldar 2005; Xu et al. 2012). Several factors which are likely to affect the market reactions to CEP-related events may originate from country-specific differences with regard to economic, social, legal, or political aspects. For instance, the level of a country's economic development has been shown to determine the general degree and enforcement of environmental regulations (Dinda 2004; Grossman and Krueger 1995), which may influence the extent to which environmental issues constitute potential threats to organizational legitimacy (Zhu et al. 2007). Moreover, general attitudes concerning environmental issues that may affect investors' reactions to CEP-related events strongly depend on national contexts (e.g., Baughn et al. 2007; Kilbourne et al. 2002).

Second, the studies were distinguished between studies examining events that occurred before the year 2000 and studies examining events that have occurred since the year 2000.[10] Environmental issues have been gaining momentum throughout the last decades in both academic research and business practice. For example, Jermier et al. (2006) surveyed scholarly journals cataloged in the ABI/Inform Global database and observed an increase of more than 300 % in the number of publications related to the field of organizations and the natural environment from the period 1990–1994 to 2000–2004. Furthermore, from 1995 to 2012, the size of the US SRI market, measured in total

[9] Meta-analytic calculations can be based on either a fixed-effects or a random-effects model (Raudenbush 1994). While a fixed-effects model assumes that the underlying population effect size is the same in all studies, a random-effects model assumes that population effect size may very across studies (Dalton and Dalton 2005; Geyskens et al. 2009). Several scholars contended that the random-effects model is more realistic and provides more accurate estimates (e.g., Cheung and Chan 2005; Geyskens et al. 2009). Thus, I followed the conventional practice and based my calculations on random-effects models.

[10] In cases of sample periods involving years before and after the year 2000, the studies were coded according to the main emphasis of the sample period.

assets under professional management, increased by 486 % (Forum for Sustainable and Responsible Investment 2012). Given the significantly increased relevance of environmental issues, it is likely that the stock market reactions to CEP-related events have changed since the 1990s. The year 2000 was chosen for splitting the samples because the DJSIs, the first global sustainability equity indexes, were launched in September 1999.

Third, the sample was divided according to whether the study explicitly mentioned that it accounted for confounding events or whether the study failed to do so. According to McWilliams and Siegel (1997), confounding events constitute the most critical issue with regard to the event study methodology. Confounding events are firm-specific events, other than the focal event, that occur during the event window and might have an impact on the firm's stock price. Such events can include dividend declarations, announcements of an impending merger, signings of major contracts, announcements of new products, filings of large damage suits, announcements of unexpected earnings, or changes with regard to key executive positions (McWilliams and Siegel 1997). Concerns regarding confounding events can be addressed by screening for potentially confounding events and excluding the relevant observations from the analysis.

Finally, this work distinguished between effect sizes derived from ARs and effect sizes derived from CARs. ARs represent the difference between expected returns and actual returns, or in other words, returns earned by firms adjusted for the "normal" return process (McWilliams and Siegel 1997). ARs are usually measured on day zero (i.e., the date of the respective event) or on day 1 (i.e., the day following the respective event). CARs are calculated by cumulating ARs over a certain period of time, the so-called event window. Thus, CARs are assumed to measure the average effect of an event on the firm's stock price (McWilliams and Siegel 1997).[11] However, the use of CARs may exacerbate the problem of confounding events, especially if long event windows are used (McWilliams and Siegel 1997). Furthermore, with regard to effect sizes calculated form CARs, this work distinguished between CARs calculated over the traditional 3-day event window (−1, 1) and CARs calculated over longer event windows.

A common issue regarding the meta-analytic methodology is manifested by the so-called publication bias or file-drawer problem. The file-drawer problem rests on the assumption that the decision for submitting or publishing studies is influenced by the presence or absence of statistically significant results in such a way that statistically non-significant findings are less likely to be published (Begg 1994; Dalton et al. 2012; Geyskens et al. 2009). Consequently, meta-analytic calculations may yield upwardly biased results. To account for the file-drawer problem, I calculated the fail–safe k, which provides an estimate of the number of null-effect studies that would be needed to make the summary effect insignificant (Rosenthal 1979).

Results

Table 2 reports the results of the separate meta-analyses. Hypotheses 1a and 1b, which predicted positive stock market reactions to positive CEP-related events and negative stock market reactions to negative events respectively, were both supported. For positive events, the population *r* across all studies was .064 (95 % CI: .017 to –.111). For negative events, the estimated *r* was −.180 (95 % CI: −.238 to −.120). None of the confidence intervals included zero, providing evidence for the existence of true effects. Considering the values of the estimated *r*s, these findings also support hypothesis 2 in predicting a stronger stock market reaction pertaining to negative CEP-related events compared to positive events.[12] The analyses regarding potential publication bias underlined the robustness of the results. For positive events, 99 additional null-effect studies, and for negative events even 1035 null-effect studies would be needed to make the population *r*s disappearing.

Table 2 also reports the results for potential moderation effects. For both cases, positive as well as negative events, the Q statistics suggested the existence of moderation effects. However, only one significant moderation effect was found. This significant moderation effect, applying to both positive and negative events, refers to the length of the used event windows over which the CARs were calculated. With regard to positive events, a significant population *r* for CARs calculated over the 3-day event window (−1, 1) amounting to .120 (95 % CI: .047 to –.192) was found, while the effect for longer event windows was not significant ($r = .008$, 95 % CI: −.069 to –.084), with Q_B suggesting a significant moderation effect ($Q_B = 4.316$, $p = .038$). With regard to negative events, the population *r* for the window of (−1, 1) amounted to −.294 ($p < .01$). For longer event windows, the effect decreased to −.109 but was still significant (95 % CI: −.175 to −.041). Again, Q_B indicated a significant moderation effect ($Q_B = 11.783$, $p < .01$).

With regard to the other subgroup analyses, no statistically significant moderation effects were found. However,

[11] For a more detailed discussion of ARs and CARs see for example Brown and Warner (1985) or Strong (1992).

[12] For proofing that the difference was statistically significant, I conducted an additional meta-analysis including both effect sizes for positive and negative events as separate subgroups whereby the sign of the effect sizes for negative events has been reversed. The Q_B indicated a significant difference ($Q_B = 200.360$, $p < .01$).

Table 2 Meta-analytic results

Sample	*K*	*N*	Estimated population *r*	95 % CI		*p*	*Q*	Moderation indicated
Positive CEP-related events								
Overall	33	5085	.064***	.017	.111	.007	61.586***	
US samples	21	4011	.053**	.001	.106	.049	41.092***	No
Non-US samples	12	1074	.092**	.008	.175	.031	17.265	
Events before the year 2000	13	545	.032	−.054	.117	.470	37.151***	No
Events as of the year 2000	20	4523	.077***	.023	.131	.005	23.964	
Controlled for confounding events	16	2912	.093***	.030	.156	.004	27.723**	No
Not controlled for confounding events	17	2173	.031	−.037	.099	.374	33.456***	
Abnormal returns	7	1181	.055	−.059	.168	.343	5.816	No
Cumulative abnormal returns	26	3904	.066**	.015	.117	.011	55.673***	
(−1, 1) days	13	2037	.120***	.047	.192	.001	28.539***	Yes
Longer event window	13	1867	.008	−.069	.084	.846	21.395***	
Negative CEP-related events								
Overall	42	3575	−.180***	−.238	−.120	.000	110.732***	
US samples	30	2965	−.164***	−.230	−.096	.000	82.227***	No
Non-US samples	12	610	−.228***	−.339	−.110	.000	24.966***	
Events before the year 2000	31	2943	−.184***	−.250	−.116	.000	86.591***	No
Events as of the year 2000	11	632	−.167**	−.286	−.043	.008	24.120***	
Controlled for confounding events	20	1823	−.139***	−.221	−.054	.001	42.657***	No
Not controlled for confounding events	22	1752	−.219***	−.298	−.137	.000	64.591***	
Abnormal returns	7	485	−.161*	−.318	.005	.058	25.074***	No
Cumulative abnormal returns	35	3090	−.183***	−.246	−.119	.000	85.656***	
(−1, 1) days	12	1206	−.294***	−.372	−.212	.000	26.750***	Yes
Longer window	23	1848	−.109***	−.175	−.041	.002	36.347**	

k number of samples, *N* number of observations, *CI* confidence interval, *Q* *Q* statistic

* $p < .10$; ** $p < .05$; *** $p < .01$

some observations might be worth mentioning. First, regarding both positive and negative events the stock market reactions tend to be slightly stronger for non-US samples than for US samples (positive events: $r = .053$, 95 % CI: .001 to –.106 for US samples vs. $r = .092$, 95 % CI: .008 to –.175 for non-US samples, negative events: $r = -.164$, 95 % CI: −.230 to −.096 vs. $r = -.228$, 95 % CI: −.339 to −.110). Second, while the population *r*s pertaining to negative events were similar for events before the year 2000 and events as of 2000, the *r* regarding positive events before the year 2000 was not significant ($r = .032$, 95 % CI: −.054 to –.117), contrary to the *r* pertaining to positive events as of the year 2000 ($r = .077$, 95 % CI: .023 to –.131).[13] Finally, for negative events, both the *r* calculated from studies which controlled for confounding events as well as the *r* derived from studies not accounting for this issue were significant ($r = -.139$, 95 % CI: −.22 to −.054 and $r = -.219$, 95 % CI: −.298 to −.137). For positive events, only the *r* calculated from studies that controlled for confounding events was significant ($r = .093$, 95 % CI: .030 to –.156). To some extent these partially non-significant effects regarding positive events may be a further indication that the stock market reactions to negative events are more robust and generalizable than those to positive events.

Discussion and Conclusion

Several studies examined the market reactions to CEP-related events and yielded mixed results. In an attempt to reconcile this inconsistency, the current work accumulated the empirical evidence of 29 event studies by means of meta-analysis. This study adds to the established body of cumulative evidence concerning the CEP–CFP link as it complements the existing meta-analyses (Albertini 2013; Dixon-Fowler et al. 2013; Endrikat et al. 2014), which did not incorporate event study findings. Overall, my results corroborate the existing meta-analytic evidence of a positive relationship between CEP and CFP by demonstrating

[13] For robustness reasons, the samples were also split using the years 1998, 1999, 2001, and 2002. The results were similar.

that there is a positive market reaction to positive CEP-related events and a negative reaction to negative events. Moreover, due to the nature of event studies, these meta-analytically derived estimates indicate a positive causal impact of CEP on CFP. CEP-related events indeed appear to alter the market's perception of firms' net present values of future profits and cash flows (Klassen and McLaughlin 1996). However, what is not clear from the current meta-analysis is the exact reason why CEP-related events change the stock market's perception of future firm value. Along the lines of the NRBV and the stakeholder theory, it could be argued that CEP-related events are effective in signaling a firm's competitive resources and capabilities and its potential effectiveness in meeting stakeholder demands. Nevertheless, which potential benefits from superior CEP and which detriments from poor CEP are in particular valued or punished by the market remains to be established.

Furthermore, the findings suggest that there is asymmetry in the stock market reactions with stronger reactions to negative than to positive CEP-related events. The asymmetry can be explained in the light of the so-called negativity bias, a pattern that may be "one of the most basic and far-reaching psychological principles" (Baumeister et al. 2001, p. 362). To this end, the findings are in line with insights from economic psychology indicating asymmetric evaluations of potential losses and gains (Kahneman and Tversky 1979). Hence, the stock market reactions to CEP-related events might just mirror a general cognitive pattern. However, from a more specific point of view, it can be argued that negative CEP-related events such as announcements of violations of environmental laws (e.g., Karpoff et al. 1998) or toxic releases (e.g., Hamilton 1995) demonstrate poor CEP in a clear and explicit manner. Thus, negative CEP-related events appear to constitute strong and (adversely) value-relevant signals for the shareholders. Contrarily, positive CEP-related events such as announcements of green supply chain initiatives (Bose and Pal 2012) or engagement in the EPA's Climate Leaders program (Keele and DeHart 2011) strictly speaking may just represent a firm's efforts not necessarily implying actual superior CEP. Accordingly, positive CEP-related events might not in all cases entail information that is sufficient to alter the shareholder's evaluation of firm value. In addition, the asymmetric stock market impacts of positive and negative CEP-related events might be explained by information asymmetries prior to the events. Superior CEP might be already factored in by the markets, as firms with superior CEP are likely to publicize pertinent information, while poor performing firms would tend to withhold such information so that the "surprise" effect is much stronger for negative events (Consolandi et al. 2009; Doh et al. 2010). Future research may expand on the asymmetry issue and explore the reasons for the asymmetric market reactions to CEP-related events in more detail.

With regard to the examination of potential moderation effects, this work only found a significant moderation effect for the length of the event windows. For negative events the population r for longer windows was significantly smaller than that for the $(-1, 1)$ window. For positive CEP-related events only the population r for the $(-1, 1)$ window was significant while a significant population r for longer event windows was not found. From a theoretical point of view, this finding further highlights the more material effect of negative CEP-related events compared to positive events. Negative CEP-related events appear to entail stock market reactions that are stronger and more persistent over time compared with the reactions to positive events. Moreover, from a methodological point of view, this finding provides support for the recommendations of McWilliams and Siegel (1997) to use event windows that are as short as possible. Contrary to the argument of Barnett and King (2008) proposing that the market may need some time to capture the full impact of certain events, the current findings suggest that the market is able to factor in the information revealed by CEP-related events rapidly.

However, it is worth mentioning that the length of the event window was the only statistically significant moderation effect that was detected in the current work. While the width of the confidence intervals and the significance of the Q statistics for most of the subgroups indicated that the variation of the findings of the event studies included in the analysis was above that expected by chance, the subgroups failed to capture these effects. That means, while subgroup analyses indicated the presence of moderation effects, the particular effects could not be specified.

The failure of the present meta-analysis to reveal moderation effects that would adequately explain the observed heterogeneity clearly suggests a need for further research to identify moderation effects, attributed to both methodology and theory that may explain the variation in the study findings. For example, scholars may explore whether country-specific differences may entail moderation effects regarding the stock market reactions to CEP-related events. The current meta-analysis showed that regarding both positive and negative events the stock market reactions seem to be slightly stronger for non-US samples than for US samples. Since several factors that are likely to influence stock market reactions to CEP-related events are dependent on country-specific institutional contexts (e.g., Bansal and Roth 2000; Baughn et al. 2007; Etzion 2007), future research exploring the national context-specific mechanisms that may account for the differences in more detail might yield important insights.

Another interesting avenue for future research may refer to the frequently expressed notion that the market's awareness regarding environmental issues has increased over time (e.g., Consolandi et al. 2009; Flammer 2013). The findings of the current study point in this direction as the population *r* calculated across studies examining stock market reactions to positive events that occurred before the year 2000 was not significant, contrary to market reactions to positive events occurring after the year 2000. Related to this, and probably even more interesting, is the question of why the increase in market reactions to CEP-related events seems to apply only to positive events but not to negative ones. Contrary to the finding regarding positive events, the *r*s pertaining to negative events were similar for events before the year 2000 and events as of 2000. This suggests that the stock market reactions to negative events may have not been subject to changes over time, while the reaction to positive events constitute a more recent phenomenon. One potential explanation may be that the negative financial effects of poor CEP arising from reputational damages or impeding fines and remediation costs have been well established for some time, while the beneficial effects of superior CEP resulting from competitive resources or improved stakeholder relationships have only recently been taken into consideration due to an increased attention on sustainability issues.

Finally, future research could also focus on the differences with regard to the specific events examined in the event studies. In view of the fact that CEP must be considered a multidimensional construct (Trumpp et al. 2015) it is obvious that also CEP-related events address quite different aspects of CEP. Therefore, one potential reason for the variation of the study results may refer to the variety of different events such as environmental awards and crises (Klassen and McLaughlin 1996), product- and process-driven environmental initiatives (Gilley et al. 2000), inclusion and exclusion from the DJSI (Consolandi et al. 2009), or membership in voluntary environmental initiatives (Keele and DeHart 2011). While it would have been interesting to explore whether the variation of the study findings might be attributed to the qualitative differences of the particular events, the very diversity of CEP-related events and, associated therewith, the small number of sufficiently similar studies did not allow constructing meaningful subgroups for contrasting the effect sizes in this regard.

To conclude, this study adds to the "Does it pay to be green?" debate by providing meta-analytic evidence for positive market reactions to positive CEP-related events and negative market reactions to negative CEP-related events. Thus, it indicates that CEP-related events affect the market's estimates of future cash flow. Furthermore, the meta-analytic results demonstrate that the market reaction is asymmetric in that the reaction is stronger for negative events than for positive events. Finally, the analyses indicate the presence of moderation effects that could not sufficiently be explained by the subgroup analyses that were feasible on the grounds of the available data. Thus, this study entails the need for further research on this topic.

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