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RESEARCH ARTICLE

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It is merely a matter of time: A meta-analysis of the causality between environmental performance and financial performance

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Abstract

Research on the relationship between corporate environmental performance (CEP) and financial performance (CFP) continuously receives high attention in both general media and academic publications. One central issue concerns the causal effects between the two constructs. Because existing primary literature is characterized by its heterogeneous study designs and mixed empirical evidence, the aim of this paper is to explicitly shed light on the causality effects between CEP and CFP by means of a meta-analysis of 893 empirical estimates from 142 CEP–CFP studies. Our findings suggest that in the short run (1 year), financial resources can increase a firm's environmental performance as proposed by the slack resources hypothesis; however, the effects disappear in the long run (after more than 1 year). Conversely, increasing environmental performance has no short-term effect on a corporate financial performance, whereas a firm significantly benefits in the long term, which is in accordance with the Porter hypothesis. Overall, our results show that the causality between environmental performance and financial performance depends on the time horizon.

KEYWORDS

causality, corporate environmental performance, corporate financial performance, environmental policy, meta-analysis, sustainable development

1 | INTRODUCTION

Over the past decades, empirical literature studying the relationship between corporate environmental performance (CEP) and financial performance (CFP) has grown rapidly. As a consequence, controversies arose concerning the sign of the relation, moderating and mediating factors, and the causality of the effect (Feng et al., 2018; Hartmann & Vachon, 2018). Due to these aspects, academics often refer to this bivariate relation as an overall heterogeneous and complex interaction (Endrikat, Guenther, & Hoppe, 2014; Guenther & Hoppe, 2014). Although literature provides a vast number of comprehensive and meaningful primary studies (among others, Hart & Ahuja, 1996; King & Lenox, 2002; Konar & Cohen, 2001; Russo & Fouts, 1997; Tang, Walsh, Lerner, Fitza, & Li, 2018) and meta-analyses (among others, Albertini, 2013; Endrikat et al., 2014; Guenther, Hoppe, & Endrikat, 2012; Hang, Geyer-Klingeberg, Rathgeber, & Stöckl, 2018), the discussion of the causality is largely fragmented. Besides the prevalent mixed empirical evidence, existing primary studies are strongly characterized by their heterogeneous study designs, which hampers comparison. Overall, the questions whether CEP affects CFP, CFP affects CEP, or if there even exists a bidirectional relation are still unresolved, also the signs of the respective effects are ambiguous.

The most common approach of addressing this issue in a primary study is the application of the Granger causality specification (Angrist & Pischke, 2009). Therein, CEP and CFP are analyzed in a regression framework, whereas the two constructs of interest are measured at different time lags. The results for the causal effects are then revealed by exchanging the dependent and independent variable or varying the time lag between them. Although delayed effects are not identical to causality, they are at least accepted as a strong indicator (e.g., Bono & McNamara, 2011; Mitchell & James, 2001; Wagner & Blom, 2011).

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Most of the existing studies focus on a single causality between CEP and CFP. The majority of articles analyzes the causality from CEP to CFP, as for example, the studies by Hart and Ahuja (1996), Hillman and Keim (2001), King and Lenox (2002), Konar and Cohen (2001), and Russo and Fouts (1997). In contrast, a smaller part of the literature investigates the causality from CFP to CEP. This includes, for example, the studies from Arora and Cason (1995), Berrone and Gomez-Mejia (2009), Cohen, Fenn, and Naimon (1995), Levy (1995), and Makni, Francoeur, and Bellavance (2009). As the concentration on a single direction of causality does not allow general conclusions, several primary studies contrast the two causal directions. Ameer and Othman (2012) and Makni et al. (2009) confirm a negative influence of CEP on CFP after 1 year. Horváthová (2012) extends this result by finding that CEP leads to a CFP decrease after 1 year, but firms profit from CEP after 2 years. Hart and Ahuja (1996) suggest that CEP has a positive effect after 1 year for accounting-based CFP measures and after 2 years for market-based CFP measures, because it takes some time until the market recognizes a firm's environmental performance. Using a 1-year lag, Nakao, Amano, Matsumura, Genba, and Nakano (2007) even find significant effects for both causal directions. However, they add that CEP increases CFP only recently, but the positive effect from CFP to CEP exists longer. In contrast, CEP does not affect future CFP according to Alvarez (2012). Heras-Saizarbitoria, Molina-Azorín, and Dick (2011) find in a longitudinal study that CEP does at least conditionally increase CFP. Their results imply that firms that are more profitable prefer investing in CEP, although there are also weak anticipation effects of investors. However, they state that firms do not profit from enhanced CEP in the future. In this context, Kim and Statman (2012) propose that the positive relation between CFP and CEP is greater in times of CFP increases in contrast to periods of CFP decreases. In contrast, Levy (1995) reveals that the effect is insignificant for both causal directions using a 1-year lag. Overall, primary studies show inconclusive results for the general question of the causality between CEP and CFP, which might especially stem from different variable measures, sample compositions, and estimation methods (Guenther et al., 2012; Guenther & Hoppe, 2014). Overall, empirical evidence from primary studies is fragmented and inconsistent.

Considering these circumstances, several meta-analyses review the cumulative results of the literature by quantitatively aggregating existing primary studies. Dixon-Fowler, Slater, Johnson, Ellstrand, and Romi (2013) examine the causality by comparing the reported results in the form of 202 Pearson correlation coefficients from 39 studies measuring CEP and CFP concurrently with measuring CFP 1 or more years ahead. However, they find no significant difference between the two groups. The causality from CFP to CEP is not analyzed due to a lack of data. Dixon-Fowler et al. (2013) encourage to also "examine this important relationship." Furthermore, Endrikat et al. (2014) analyze the causality between CEP and CFP based on 245 Pearson correlation coefficients from 149 primary studies and additionally take the reverse causality into account. Because they use multidimensional subgroups by splitting the sample according to the analyzed causality and the variable measurement, a general understanding of the causality is still not possible. Their results reveal statistically and economically significant effects from CEP to CFP for process-based CEP and subsequent accounting-based CFP as well as for outcome-based CEP and subsequent market-based CFP. Moreover, they find statistically and economically significant effects for all specifications measuring CEP and CFP concurrently. In contrast, they find no evidence for CFP affecting CEP. The meta-analyses by Albertini (2013), Guenther et al. (2012), and Horváthová (2010) do not analyze the causality issue at all. This summary demonstrates that meta-analytical literature addressing this question is also characterized by mixed results and various study designs providing only insufficient answers to the question of causality.

This study aims to provide the first complete analysis of the CEP–CFP causality by means of meta-analysis using a sample of 893 existing results drawn from 142 empirical primary studies and contributes to prior primary studies as well as meta-analyses in the following ways. We thoroughly analyze the following three relations: CEP affecting CFP, CFP affecting CEP, and the bidirectional impact. Furthermore, we investigate the temporal development of the effects by including yearly lagged effects up to 5 years, which has yet not been done in previous literature. This approach allows more general and fine-grained conclusions regarding CEP–CFP causality. In contrast to prior reviews, we use the partial correlation coefficient derived from regression coefficients to measure the bivariate relationship. As advantages over traditional Pearson correlation coefficients as used in the majority of previous literature, disruptive effects are filtered out in order to isolate the effect of interest. Moreover, primary studies mostly report multiple results in their regression analysis (for different time periods, model specifications, and other subgroups) but only few studies report Pearson correlations. Accordingly, the use to partial correlations computed from regression results maximize the sample of primary studies and effect sizes to be included in the meta-analysis. Moreover, we also test for the potential presence of publication bias. In general, publication selection bias refers to the phenomenon that certain estimates are systematically underrepresented in empirical literature (Rosenthal, 1979). In other words, publication selection bias exists when researchers prefer statistically significant results or results that are consistent with the theory and previous research outcomes (Stanley, 2005). One potential source of publication bias might be the selective reporting of results depending on the number of lagged years (Bruns & Stern, 2018). Finally, we explore the heterogeneity of results by applying a meta-regression analysis incorporating differences in measurement, study quality, regions, time, industry, data, and estimation procedures among the primary studies. This procedure should reveal the main drivers of the variation among the primary study results.

The remainder of this paper is structured as follows. Section 2 sums up the theoretical literature for the different causalities between CEP and CFP. The data set and the applied meta-analytical procedures are described in Section 3. Subsequently, Section 4 presents the empirical results, whereas Section 5 concludes the paper.

2 | THEORY OF THE CEP-CFP RELATION

For the interaction between the two dimensions, three causal directions are plausible: CEP influences CFP, CFP affects CEP, and a bidirectional relationship. Besides the direction of the effect, literature is also inconsistent about the sign of the relation, which might be negative, neutral, or positive. In this section, we briefly present the theoretical considerations, each pointing to a certain causality between CEP and CFP, as they also underlie the primary studies included in our meta-analytical data set. For the categorization of the existing theoretical constructs, we follow the structure by Preston and O'Bannon (1997) and Waddock and Graves (1997), which is summarized in Figure 1 and briefly outlined below.

2.1 | CEP affects CFP

Concerning the first causal sequence, the most antiquated argument for the potential impact of CEP on CFP is known as the trade-off hypothesis, indicating a negative influence as formulated by Levitt (1958). Thus, environmental engagement requires financial investments by the firm, which are not completely compensated by financial returns from environmental activities. These negative effects might especially occur in the short term, when the costs are realized. Because firms not investing in CEP do not have to bear these costs, following Aupperle, Carroll, and Hatfield (1985) and Vance (1975), these unfair costs might be a danger to free market economy. As the generation of financial returns constitutes the primary goal of a firm, CEP stands in a competing relationship with CFP. Research by Bragdon Jr. and Marlin (1972) complements that there is only a choice between investing in a profitable firm or a responsible firm. Conversely, the creation of additional value is the single social corporate responsibility (Friedman, 2002).

The supply and demand model, a theoretical framework modeling CFP independently from CEP and vice versa, is developed by McWilliams and Siegel (2001). It proposes the existence of an optimal investment in environmental engagement, which can be determined by cost–benefit analysis. Accordingly, the decision for environmental investments should be based on the same principles as any other investment (Barnett, 2007; McWilliams & Siegel, 2001). This leads to a synthesis of interests, as not only the maximization of profitability demanded by shareholders is considered but also the claims of stakeholders for environmental responsibility, such as those of customers, employees, and communities (McWilliams & Siegel, 2001). However, firms following this procedure do not exhibit higher profitability than those who do not invest in environmental activities. Assuming that all firms take optimal decisions and they are within the optimum between supply and demand, they are equally profitable. As soon as one firm has a higher return on investment, the competing company would change its product strategy (McWilliams & Siegel, 2001).

A positive impact of CEP on CFP is motivated by the Porter hypothesis. Consequently, environmental regulation might induce innovations in order to increase a firm's efficiency and competitiveness (Esty & Porter, 1998). Because pollution as an outcome of CEP can be seen as economic waste, pollution reduction contributes to a firm's profitability (Porter & van der Linde, 1995). We conclude that although innovations take time for development, firms profit from them in the long run.

Furthermore, the assumption of a positive influence of CEP on CFP by the natural-resource-based view (NRBV) is based on the resource-based view proposed by Barney (1991), Hart (1995), and Wernerfelt (1984). Hence, the strategic advantages of a firm can be reduced to the access to strategically valuable resources in a firm's individual and hard to duplicate resource bundle, for example, the particular mix of management skills, business processes, routines, or knowledge and a superior utilization of the available resources (Barney, Ketchen, & Wright, 2011). However, in consideration of technological developments and changes in the environment, the concentration on core competences loses its effect, which justifies the relevance of the NRBV (Kraaijenbrink, Spender, & Groen, 2010; Tushman & Anderson, 1986). Accordingly, the competitive advantage of a firm is directly linked to how it deals with the natural environment, as responsible behavior enables a firm to gather further capabilities and new resources, such as knowledge or enhanced corporate culture (Branco & Rodrigues, 2006). Hart (1995) complements that strategy and competitive advantages are strongly influenced by the environmental performance of a firm, whereas pollution prevention, product stewardship, and sustainable development are the core drivers. Following Davis (1973), environmental responsibility consequently leads to a long-term profit maximization followed by a better community and society.

The NRBV is supported by the instrumental stakeholder theory (Davis, 1973; Donaldson & Preston, 1995; Jones, 1995; Orlitzky, Schmidt, & Rynes, 2003). Thus, each firm is surrounded by a network of expectations from contractual relationships, for example, from suppliers, employees, or customers. Managing these stakeholder interests leads to increasing profitability, stability, and growth (Damak-Ayadi & Pesqueux, 2005). As Jones (1995) points out, trusting and cooperative behavior solve problems related to opportunistic behavior. Because environmental engagement can be seen as an effort to meet these stakeholder expectations, a firm has to meet these requirements to achieve financial advantages, although such behavior may seem to be economically irrational or altruistic (Buysse & Verbeke, 2003; Jones, 1995). For example, economic advantages might be greater

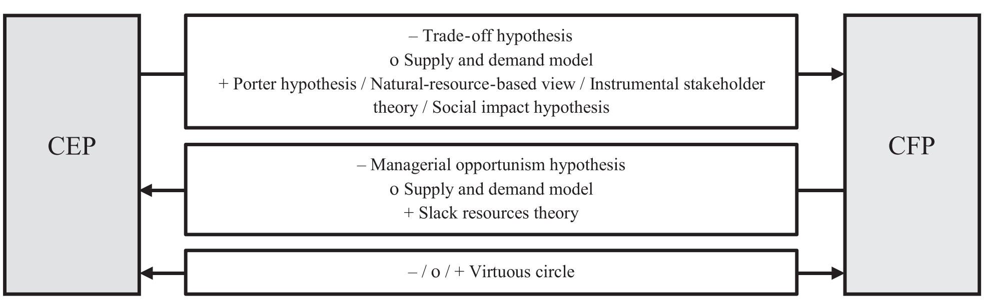

FIGURE 1 Typology of theoretical CEP–CFP relations. CEP: corporate environmental performance; CFP: corporate financial performance

customer loyalty, long-term supply relationships, better reputation, product differentiation, and higher selling prices. We hypothesize that this effect might especially hold in the long term.

In this context, literature often refers to the social impact hypothesis coined by Latané (1981). Accordingly, a firm must not only meet explicit expectations of stakeholders as shown above but also implicit expectations such as quality service or environmental responsibility (Cornell & Shapiro, 1987). If such expectations are not fulfilled, fears and risk on the market increase and such firms may be faced with additional and more costly explicit agreements in the future, for example, as parties such as the government pass more stringent rules to ensure more environmentally conscious behavior. Because changes in the trust and contractual conditions of stakeholders are not assumed to arise in the short term, we expect these negative effects to occur in the medium to long run. On the contrary, environmentally conscious firms have more low-cost implicit claims, resulting in a higher financial performance (McGuire, Sundgren, & Schneeweis, 1988). Hence, environmental consciousness is a means to retain freedom in decision making (Davis, 1973).

2.2 | CFP affects CEP

For the second causal sequence, literature provides the managerial opportunism hypothesis, which suggests a negative impact of CFP on CEP (Preston & O'Bannon, 1997). This position is grounded on the assumption that managers follow their own targets, which may not be in the best interest of the shareholders (Alkhafaji, 1989; Posner & Schmidt, 1992; Weidenbaum & Vogt, 1987). This circumstance directly leads to inefficiencies in the operating firm, which may result from wages linked to short-term profits and stock prices (Preston & O'Bannon, 1997; Weidenbaum & Vogt, 1987). Thus, especially when a firm performs well, managers tend to increase their own income by reducing environmental investments, which we expect to affect CEP in the long run. Apart from that, managers may expand corporate environmental expenditures to compensate bad corporate performance (Preston & O'Bannon, 1997). These effects might especially occur in the short term, if a firm suffers unexpected bad business results. This managerial behavior is especially driven by a firm's compensation system. According to Preston and O'Bannon (1997), opportunistic activities are reinforced if manager salaries are linked to short-term profits of a firm and the improvement of environmental performance is postponed for the benefit of private bonus payments. One potential solution might be the linkage of executive compensation to corporate environmental performance (Cordeiro & Sarkis, 2008).

Representatives of the slack resources theory suggest a positive impact of CFP on CEP. Hence, slack resources generated from good financial performance enable companies to invest in environmental programs (Kraft & Hage, 1990). Analogous to the NRBV, investing in environmental activities is connected with enhancing internal resources, new capabilities, and comparative advantages of the firm, as well as possibilities for differentiation through innovative and eco-friendly developments (Bourgeois, 1981). Thus, investing slack resources also allows firms to adapt to their external environment for long-term profitability. Although firms often want to act environmentally friendly and socially, they might be restricted by limited availability of financial resources (Preston & O'Bannon, 1997). If financial slack is only available in 1 year, there might be too little time to develop proactive environmental strategies and a firm instead invests in ecological one-off actions.

2.3 | Bidirectional relationship between CEP and CFP

Waddock and Graves (1997) reconciled the two previously explained causal relations, proposing the "virtuous circle"—a concurrent relationship between CEP and CFP (Waddock & Graves, 1997). Following this hypothesis, superior CEP initiates better CFP, which again allows companies to reinvest in CEP. This leads to a two-way causality for the two constructs. The process might either begin with available financial slack or with an initial investment in environmental performance. This mutually supportive process might, however, also arise as a negative synergy (Allouche & Laroche, 2005).

3 | EMPIRICAL ANALYSIS

This section describes the search for empirical studies and the subsequent preparation of data. Second, the statistical approaches of Hedges and Olkin-type meta-analysis and publication bias test are presented.

3.1 | Data search and preparation

Meta-analysis starts with the collection of available CEP–CFP studies. First, we gathered the sample of 149 primary studies used by Endrikat et al. (2014). In the next step, we extended their sample by studies published after 2012 using the same search strategy to search major databases[1] for published research articles and grey literature using a comprehensive search term incorporating various keywords for CEP, CFP, and applied empirical methodology. At the end, the literature search left us with 198 relevant publications.

To identify the studies that are eligible to be included in our analysis, we adopt the following set of selection criteria on the sample of relevant work:

a. Studies examining disclosure data as proxy for CEP are dropped, because recent empirical analyses show an inconsistent and contradictory behavior in contrast to other frequently used measures as, for example, intensity of emissions (among others, Aragón-Correa, Marcus, & Hurtado-Torres, 2016; Hughes, Anderson, & Golden, 2001; Patten, 2002);
b. Because statistical aggregation of empirical results of many studies requires that the effect sizes are comparable across studies (Stanley & Doucouliagos, 2012), event studies and findings from probit/logit models are excluded;
c. Each study has to report appropriate statistical results from regression analysis including regression coefficients, the corresponding standard error (or *t*-statistics), and the underlying

[1]The screened databases are ABI/Inform Complete, Business Source Complete, EconLit, GreenFILE, ScienceDirect, and Social Science Research Network.

sample size. This is necessary to extract the empirical effect between CEP and CFP in form of partial correlation coefficients.

After employing the selection criteria, the final sample is composed of 142 empirical primary studies. All studies are included and highlighted in the reference list by an asterisk (*).

As effect size to be synthesized across studies, we use the partial correlation coefficient, which is directly calculated from the studies' regression results. The partial correlation coefficient (*r*) is defined as follows:

$$r = \frac{t}{\sqrt{t^2 + df}}, \tag{1}$$

where t is the t-statistic of the regression estimate collected from the primary studies and df represents the corresponding degrees of freedom. The variance of the partial correlations is computed by:

$$v(r) = \frac{(1 - r^2)}{df}. \tag{2}$$

The partial correlation coefficient from Equation (1) measures the intensity of the CEP–CFP relation, while keeping constant all other variables in model.[2] This effect size is preferable for our analysis due to several aspects. First, compared with the Pearson correlations, the effect of interest is corrected for spurious influences. Second, the use of Pearson correlations would lead to a smaller set of studies to be included. Furthermore, using partial correlations allows collecting multiple estimates from each study as most authors report empirical results for several regression models.

After inspecting the appropriateness of each regression analysis in the collected primary studies, the sample of 142 primary studies provides a database of 893 partial correlation coefficients, which are obtained from 757,154 firm-year observations.[3]

3.2 | Hedges and Olkin-type meta-analysis

For the aggregation of reported effect estimates, we apply Hedges and Olkin-type meta-analysis (HOMA; Hedges & Olkin, 1985) in order to calculate mean effect sizes. Consequently, the mean effect size for a bivariate relation and its standard deviation are computed by:

$$\bar{r} = \frac{\sum (w_i \times r_i)}{\sum w_i} \text{ and } w_i = \frac{1}{v_i + \tau^2}, \tag{3}$$

where w_i is the effect size-specific weight and v_i is the variance of the effect size as calculated by Equation (2). Up to now, the primary studies, effect sizes respectively, are assumed to share one common population effect size and variation in the effect sizes only stems from a study-specific sampling error covered by the variance v_i. However, it could be argued that the population effect size follows a normal distribution due to variation induced by random effects across the primary studies and effect estimates respectively. In order to account for such unobserved heterogeneity in the effect sizes, a random-effects model is more appropriate incorporating a random-effects component τ^2 as shown in Equation (3). The latter is estimated by the restricted maximum likelihood estimator. This approach produces random-effects weights calculated by the inverse sum of these two variance components. By including τ^2 in the weighting scheme, the analysis accounts for typical drivers of heterogeneity in this field of research, such as measurement difference, regional differences, temporal effects, differences in study quality, study characteristics, and data characteristics. For the estimation of τ^2 and further explanations of the HOMA procedure, please refer to Borenstein (2009), Carney, Gedajlovic, Heugens, van Essen, and van Oosterhout (2011), and van Essen, Otten, and Carberry (2015). The standard error of the mean effect size is given by:

$$SE(\bar{r}) = \sqrt{\frac{1}{\sum w_i}}. \tag{4}$$

Moreover, we use Fisher's z-transformation in a robustness test in order to correct for potential skewness in r_i and to achieve normally distributed effect sizes. Consequently, the z-transformed effect sizes and their standard error are calculated by:

$$z_i = 0.5^* \ln\left(\frac{1 + r_i}{1 - r_i}\right) \text{ and } SE(z_i) = \frac{1}{\sqrt{n_i - 3}}, \tag{5}$$

where n_i is the number of firms related to a certain effect size. The transformed values are then retransformed into the correlation metric for interpretation.

3.3 | Publication bias test

As typically applied in meta-analysis, we investigate the presence of selective reporting of research results. Publication selection bias exists if specific estimates are systematically overrepresented in empirical literature (Rosenthal, 1979). This means that researchers favor statistically significant results or results that are in line with theory and previous research outcomes (Stanley, 2005). If publication selection bias is present in literature, the overall picture across the available literature will be distorted (Card & Krueger, 1995; Doucouliagos & Stanley, 2013).

The statistical analysis of publication bias is carried out by analyzing the relation between the observed effect sizes and their standard errors. Accordingly, the model can be formulated as follows (Card & Krueger, 1995):

$$r_i = \beta_0 + \beta_1 SE(r_i) + \varepsilon_i, \quad \varepsilon_i \sim N\left(0; SE(r_i)^2\right). \tag{6}$$

The dependent variable r_i is the i-th partial correlation coefficient, $SE(r_i)$ is the standard error of the partial correlation, and ε_i is the error term.

[2]Due to different definitions of CEP in primary studies for the measurement of the CEP-CFP relation, the sign of the estimated impact of CEP on CFP might differ (Albertini, 2013). For example, CEP measured by "the total amount of waste" should produce the inverse sign compared to "the amount of reduced emissions." As a consequence, the sign of the effect size is unified across studies so that higher values of a certain variable are associated with higher CEP.

[3]The number of firm-year observations is calculated as the sum of the number of firms times the corresponding number of observed years (balanced panel) across studies. In the case of an unbalanced panel, the exact number of firm observations over the research period is used.

As proposed by the Egger test (Egger, Smith, Schneider, & Minder, 1997), the *t*-test of the regression coefficient β_1 in this model investigates publication selection bias. If $\beta_1 = 0$, it can be reasoned that literature is unbiased. Hence, the probability of measuring the true population effect increases with the precision of the estimates, and the reported effect estimates in the primary studies are normally (symmetrically) distributed around the true population effect. If there is statistically significant evidence that $\beta_1 \neq 0$, certain results are overrepresented, and the presence of publication bias would be confirmed.

While performing the publication bias test, the following aspects are considered in the model specification. (a) The errors of the regression might be heteroskedastic due to the usual great variation of the standard errors of the reported estimates across the primary studies. Therefore, a weighted least squares (WLS) approach is conducted using the inverse standard errors of the effect sizes as weights. Accordingly, studies reporting lower standard errors, more precise results respectively, get larger weights in the MRA estimation (Hedges & Olkin, 1985). (b) Multiple estimates per study are integrated in our meta-analysis. For this reason, potential within-study correlation among the effect sizes obtained from the same study has to be taken into account. Thus, standard errors are clustered at the level of each individual study (Hedges, Tipton, & Johnson, 2010). (c) We perform a random-effects model to account for residual heterogeneity. The latter might, for example, come from deviations of the effect sizes due to unobserved heterogeneity on the firm-level (such as management quality).

4 | PRESENTATION OF META-ANALYTICAL RESULTS

4.1 | Results of Hedges and Olkin-type meta-analysis

For the analysis of the causality between CEP and CFP, we conduct Hedges and Olkin-type meta-analysis measuring the effect between CEP and CFP in the form of a random-effects mean effect size. The adequacy of the random-effects model is especially motivated by the results from heterogeneity tests. Table 1 sums up the results given by the *Q* statistic (Cochran's heterogeneity statistic), I^2 (percentage of total variation across studies, which stems from heterogeneity rather than chance), and τ^2 (variance of the effect size parameters across the population of studies; Higgins, Thompson, Deeks, & Altman, 2003). In general, the statistics confirm that a statistically and economically significant part of the variation of effect sizes stems from heterogeneity. For this reason, the assumption of random effects seems appropriate.

The random-effects model is applied to various subsamples of effect sizes measuring the relation between CEP and CFP depending

TABLE 1 Results of Hedges and Olkin-type meta-analysis

Subsample	*n*	*k*	Random-effects mean effect size	Standard error	Results of heterogeneity test: Q statistic (*df*)	I^2 (%)	τ
Full sample							
Total	142	893	0.072***	0.006	5217.99*** (892)	85.68	0.144
$CEP_t \leftrightarrow CFP_t$							
Total	106	569	0.077***	0.007	2705.32*** (568)	82.32	0.134
$CEP_t \rightarrow CFP_{t+j}$							
Total	46	260	0.056***	0.010	1553.49*** (259)	89.40	0.150
$j = 1$	42	186	0.030**	0.012	1112.07*** (185)	88.10	0.146
$j = 2$	9	54	**0.110*****	0.024	376.06***(53)	93.40	0.161
$j = 3$	5	18	**0.158*****	0.022	18.65 (17)	0.02	0.001
$j = 5$	1	2	**0.117*****	0.031	0.05 (1)	0.00	0.000
$CFP_{t-j} \rightarrow CEP_t$							
Total	12	64	**0.100*****	0.020	672.76***(63)	88.23	0.146
$j = 1$	10	59	**0.104*****	0.021	667.68***(58)	89.35	0.150
$j = 2$[a]	1	1	−0.058	0.118	-	-	-
$j = 3$[a]	1	4	0.055	0.041	-	-	-
$j = 5$[a]	0	0	-	-	-	-	-

Note. This table shows the results from Hedges and Olkin-type meta-analysis for the CEP–CFP relation. Data are split according to the number of lagged years *j* between the two constructs. *n* is the number of studies, and *k* is the number of effect sizes. Besides, the random-effects mean effect sizes and their standard errors are shown. Because mean correlation coefficients are accepted as remarkable in meta-analysis when they exceed 0.10 (Cohen, 1992), mean correlation coefficients are highlighted in a bold font when they are equal to or larger than 0.10. CEP: corporate environmental performance; CFP: corporate financial performance.

[a]Due to the small number of observed effect estimates, the calculations cannot be performed completely for this subgroup.

*Significant at 10% level;

**Significant at 5% level;

***Significant at 1% level.

on the number of lagged years between the two constructs as reported in primary studies. Following the common practice introduced by Cohen (1992), we assess mean effect sizes as economically significant, if they are greater than 0.10. The results are displayed in Table 1.

Starting with the full sample, the results show a mean effect size of 0.072, which is statistically significant at any common level. The same holds for the subsample of effect sizes measuring CEP and CFP concurrently with a mean effect size of 0.077. However, according to Cohen (1992), these effects are not economically significant.

Continuing with the causality from CEP to CFP, the full subsample has a mean effect size of 0.056, which is statistically significant. Hence, on average, the effect seems to be slightly lower compared with the full sample. If CEP and CFP are lagged by 1 year, the effect even decreases to just 0.030, statistically significant at 5%. Because the two previous values do not exceed the threshold of 0.10, we do not share the opinion of Ameer and Othman (2012), Hart and Ahuja (1996), Horváthová (2010), Makni et al. (2009), Nakao et al. (2007), and Rassier and Earnhart (2011) that CEP really affects CFP in the following year. However, the effect increases when the time lag is extended to 2 years as proposed by Hart and Ahuja (1996) and Horváthová (2010). In this case, the mean effect size is 0.110, which is statistically significant, and the mean effect size also lies above the threshold by Cohen (1992). Hence, this effect is assessed as economically significant, which allows the conclusion that increasing CEP leads to financial benefits after 2 years. As an extension of existing literature contrasting the different causalities, we continue with the effects for 3-year and 5-year lags. As found for the 2-year lag, the statistically and economically significant effect holds for the time lag of 3 years. Here, the mean effect size even increases to a statistically significant value of 0.158. For a time lag of 5 years, the mean effect size again drops to 0.117, which is still statistically and economically significant.

For the causality from CFP to CEP, the mean effect size for the full subsample is 0.100, which is statistically and also economically significant. For a more comprehensive analysis, the mean effect sizes are again calculated for the different number of lagged years. At a time lag of 1 year, the mean effect size measures 0.104, which is statistically and economically significant. This result confirms the conclusions by Heras-Saizarbitoria et al. (2011) and Nakao et al. (2007). For a time lag of 2 years, the mean effect size even gets negative with an insignificant value of −0.058. This means that increasing CEP, which stems from the availability of additional financial resources of a firm, only remains for 1 year. After 2 years, no effect is observable anymore. Furthermore, the effect remains insignificant for a time lag of 3 years with a mean effect size of 0.055.

Overall, the results suggest that increasing CEP as a consequence of additional financial resources only has a short-term effect, which lasts 1 year. This finding is in line with the slack resources hypothesis (Kraft & Hage, 1990). Accordingly, financial slack is especially invested in eco-friendly one-off actions. Hence, following our results, it would

TABLE 2 Results of Hedges and Olkin-type meta-analysis using *z*-transformed effect sizes

Subsample	*n*	*k*	Random-effects mean effect size	Standard error	Results of heterogeneity test: Q statistic (*df*)	I^2 (%)	τ
Full sample							
Total	142	893	0.073***	0.006	4852.16*** (892)	85.52	0.146
$CEP_t \leftrightarrow CFP_t$							
Total	106	569	0.078***	0.007	2521.21*** (568)	81.54	0.138
$CEP_t \rightarrow CFP_{t+j}$							
Total	46	260	0.055***	0.011	1453.18*** (259)	89.18	0.150
j = 1	42	186	0.030**	0.012	1046.58*** (185)	87.92	0.146
j = 2	9	54	**0.111***	0.025	348.94***(53)	93.55	0.165
j = 3	5	18	**0.155***	0.022	15.19 (17)	0.03	0.002
j = 5	1	2	**0.117***	0.031	0.05 (1)	0.00	0.000
$CFP_{t-j} \rightarrow CEP_t$							
Total	12	64	**0.104***	0.021	623.50***(63)	89.62	0.160
j = 1	10	59	**0.109***	0.023	619.60***(58)	90.64	0.166
j = 2[a]	1	1	−0.058	0.120	-	-	-
j = 3[a]	1	4	0.055	0.041	-	-	-
j = 5[a]	0	0	-	-	-	-	-

Note. This table shows the results from Hedges and Olkin-type meta-analysis for the CEP–CFP relation. Data are split according to the number of lagged years *j* between the two constructs. *n* is the number of studies, and *k* is the number of effect sizes. Besides, the random-effects mean effect sizes and their standard errors are shown. Because mean correlation coefficients are accepted as remarkable in meta-analysis when they exceed 0.10 (Cohen, 1992), mean correlation coefficients are highlighted in a bold font when they are equal to or larger than 0.10. CEP: corporate environmental performance; CFP: corporate financial performance.

[a]Due to the small number of observed effect estimates, the calculations cannot be performed completely for this subgroup.

*Significant at 10% level;

**Significant at 5% level;

***Significant at 1% level.

be desirable from the perspective not only of the stakeholders but also of the firm itself, to invest financial slack more wisely. In contrast, our results confirm that if a firm proactively increases CEP, it may achieve long-term economic benefits starting after 2 years, as proposed by the Porter hypothesis (Porter & van der Linde, 1995). Due to the time lag resulting from the development and realization of environmental innovations induced by environmental regulation, the positive financial effects delay. In the same way, firms might profit in the long term from additional knowledge and resources as proposed by the NRBV (Hart, 1995) as well as from enhanced stakeholder relations following the instrumental stakeholder theory (Davis, 1973) and the social impact hypothesis (Latané, 1981). As a robustness test, all HOMA results are recalculated using *z*-transformed effect sizes. As presented in Table 2, the results remain stable.

4.2 | Publication bias test

In order to examine the robustness of our results, we perform a publication bias test as routinely employed in meta-analysis. As a first graphical impression, we consult the so-called funnel plots. Therein, the effect sizes (partial correlations *r*) are plotted against their precision (1/*SE* (*r*)). As an example, Figure 2 shows the funnel plots of the effect sizes measuring the relation between CEP and CFP for the different major (sub)samples. An unbiased sample should lead to a symmetric-inverted funnel, indicating that the deviations of the single effect sizes from their mean value decrease with an increasing precision of their estimation. Figure 2 tends not to reject this hypothesis, as effect sizes are quite symmetrically distributed around the mean effect sizes. Solely for the last subsample of effect sizes measuring CFP as lagged independent variable, effect sizes are slightly underrepresented on the left side. However, this might be reasoned by the small sample size but could also be an indicator of publication bias.

For a more objective test of publication bias, we perform the Egger test (Egger et al., 1997) for all subsamples of effect sizes, for which a mean effect size is calculated. The results are displayed in Table 3. Accordingly, there are no significant effects, which point to the presence of publication bias. Solely for the full subsample of effect sizes measuring CEP and lagged independent variable, the publication bias test reveals an estimate of 1.142, which is weakly significant at the 10% level. Hence, the choice of time lag is no means for selective reporting of results. Overall, the analysis provides no evidence for publication selection bias.

As a robustness test, all publication bias tests are recalculated using *z*-transformed effect sizes. As presented in Table 4, the results remain stable.

4.3 | Robustness test and of heterogeneity

As already noted, hitherto unobserved heterogeneity (as incorporated in the random effects component τ^2 in previous analyses) is present in the field of the CEP–CFP relation. This is also empirically confirmed by the statistically significant heterogeneity test statistics displayed in Tables 1 and 2. The subsequent analysis of heterogeneity sheds light on the main reasons of differences across studies. Therefore, we first derive various moderating variables based on information from primary studies, which might cause the heterogeneity among the effect sizes. For the choice and design of variables, we follow prior meta-analyses

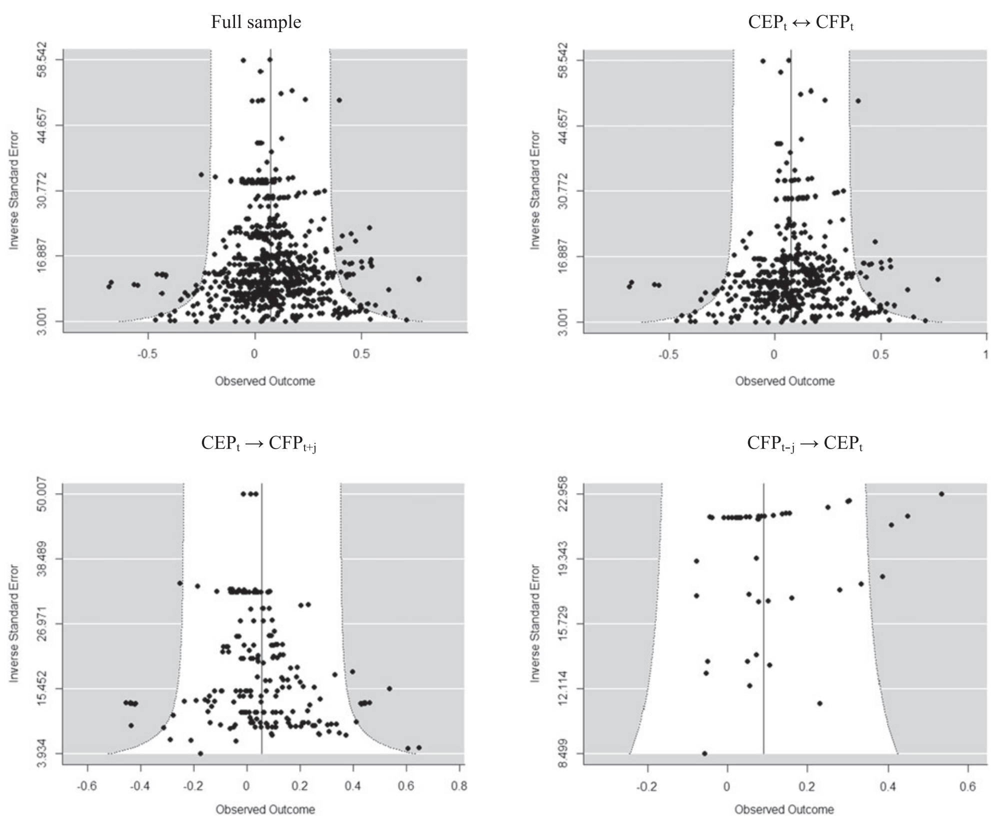

FIGURE 2 Funnel plots. CEP: corporate environmental performance; CFP: corporate financial performance

TABLE 3 Results of publication bias test

Subsample	n	k	β_0	SE (β_0)	Results of publication bias test β_1	SE (β_1)
Full sample						
Total	142	893	0.065*	0.032	0.105	0.416
$CEP_t \leftrightarrow CFP_t$						
Total	106	569	0.114**	0.038	−0.422	0.488
$CEP_t \rightarrow CFP_{t+j}$						
Total	46	260	−0.022	0.017	1.142*	0.377
j = 1	42	186	0.003	0.028	0.420	0.693
j = 2	9	54	−0.087	0.330	3.165	3.520
j = 3	5	18	0.086	0.033	0.891	0.368
j = 5[a]	1	2	-	-	-	-
$CFP_{t\text{-}j} \rightarrow CEP_t$						
Total	12	64	0.357	0.393	−4.562	5.395
j = 1	10	59	0.397	0.444	−5.395	6.403
j = 2[a]	1	1	-	-	-	-
j = 3[a]	1	4	-	-	-	-
j = 5[a]	0	0	-	-	-	-

Note. This table shows the results from the publication bias test for the CEP–CFP relation. Data are split according to the number of lagged years j between the two constructs. n is the number of studies, and k is the number of effect sizes. Besides, the estimates and their standard errors are shown for β_0 and β_1. The observations are weighted by inverse standard errors. Standard errors of the meta-analysis are clustered at the study level. CEP: corporate environmental performance; CFP: corporate financial performance.

[a]Due to the small number of observed effect estimates, the calculations cannot be performed completely for this subgroup.

*Significant at 10% level;

**Significant at 5% level;

***Significant at 1% level.

TABLE 4 Results of publication bias test using z-transformed effect sizes

Subsample	n	k	β_0	SE (β_0)	Results of publication bias test β_1	SE (β_1)
Full sample						
Total	142	893	0.057*	0.030	0.219	0.382
$CEP_t \leftrightarrow CFP_t$						
Total	106	569	0.106**	0.037	−0.305	0.460
$CEP_t \rightarrow CFP_{t+j}$						
Total	46	260	−0.021	0.016	1.087*	0.353
j = 1	42	186	0.004	0.029	0.386	0.697
j = 2	9	54	−0.084	0.272	2.997	2.834
j = 3	5	18	0.086	0.037	0.839	0.343
j = 5[a]	1	2	-	-	-	-
$CFP_{t\text{-}j} \rightarrow CEP_t$						
Total	12	64	0.174	0.418	−1.184	5.946
j = 1	10	59	0.155	0.507	−0.796	7.898
j = 2[a]	1	1	-	-	-	-
j = 3[a]	1	4	-	-	-	-
j = 5[a]	0	0	-	-	-	-

Note. This table shows the results from the publication bias test for the CEP–CFP relation. Data are split according to the number of lagged years j between the two constructs. n is the number of studies, and k is the number of effect sizes. Besides, the estimates and their standard errors are shown for β_0 and β_1. The observations are weighted by inverse standard errors. Standard errors of the meta-analysis are clustered at the study level. CEP: corporate environmental performance; CFP: corporate financial performance.

[a]Due to the small number of observed effect estimates, the calculations cannot be performed completely for this subgroup.

*Significant at 10% level;

**Significant at 5% level;

***Significant at 1% level.

(Albertini, 2013; Dixon-Fowler et al., 2013; Endrikat et al., 2014; Guenther et al., 2012; Horváthová, 2010). The set of variables is listed in the first column of Table 5 together with their descriptive statistics in columns two and three. After selecting the relevant moderating variables, these are included as additional explanatory variables in a meta-regression analysis as an extension of Equation (6).

Based on the primary studies in our sample, we designed the following moderating factors including measurement differences, study quality characteristics, temporal differences, regional differences, industrial differences, data characteristics, and estimation characteristics. Following previous meta-analyses, among the measurement differences, we classify financial performance measures in market-based (Tobin's Q, stock return, or market value of a firm) and accounting-based (return on assets, return on equity, or return on sales). The two measures especially differ in terms of their forward-looking properties, which are more present in market-based measures compared with the backward-looking properties of accounting-based measures. *Market-based CFP* takes on the value of one if a study uses a market-based CFP measure and zero otherwise. Furthermore, the CEP measurement is categorized by its strategic level and quantifiability. Process-based measures refer to CEP on a management or process level. These measures cover management practices, environmental policies, or environmental innovation. On the other hand, outcome-based measures refer to real impacts of these efforts by measuring the amount of emissions, the ratio of recycled waste to total waste, or energy consumption. *Process-based CEP* takes on the value of one if a study uses a process-based CEP measure and zero otherwise. Additionally, proactive measures refer to pollution prevention through green process design, special capabilities, or resource combinations of the firm (Walls, Phan, & Berrone, 2011). On the contrary, "end-of-pipe solutions" such as air filters or water clearers to comply with regulations and laws in order to minimize costs, risks, and liabilities are classified as reactive measures. *Proactive* CEP and *reactive CEP* take on the value of one for the corresponding measures. The *number of citations* as derived from Google Scholar serve as a proxy for study quality. In order to capture temporal effects, the mean year of the observation period in a primary study is included, and 1950 is used as base year (*mean sample year—1950*). Because a major part of the literature analyzes U.S. firms and E.U. firms, we incorporate two corresponding dummy variables to capture regional differences (*U.S. data* and *E.U. data*). Similarly, large parts of the literature examine manufacturing and service firms in order to reveal industrial differences. The dummy variables *manufacturing sector* and *service sector* take on the value

TABLE 5 Results of meta-regression analysis

Dependent variable: partial correlation coefficient of CEP–CFP *r*			Bayesian model averaging			WLS		
Independent variables	Mean	Standard deviation	Posterior mean	Posterior standard deviation	Posterior inclusion probability (PIP)	Coefficient	Standard error	*t*-value
Standard error of *r*	0.091	0.054	−0.011	0.057	0.07			
Process-based CEP	0.432	0.495	−0.007	0.014	0.24	−0.023	0.021	−1.069
Market-based CFP	0.308	0.462	0.011	0.018	0.32	0.031	0.020	1.556
Proactive CEP	0.408	0.491	0.000	0.004	0.05			
Reactive CEP	0.068	0.252	−0.082	0.036	0.91	−0.091***	0.027	−3.359
Number of citations	155.046	321.549	0.000	0.000	0.14			
Mean sample year−1950	50.232	7.453	−0.006	0.001	1.00	−0.005***	0.002	−3.021
U.S. data	0.340	0.474	0.015	0.024	0.33	0.032	0.032	0.986
E.U. data	0.199	0.399	−0.007	0.017	0.20	−0.017	0.029	−0.570
Manufacturing sector	0.402	0.490	0.001	0.006	0.07			
Service sector	0.382	0.486	−0.005	0.013	0.20	−0.023	0.022	−1.049
Small firms	0.233	0.423	0.019	0.024	0.44	0.050*	0.027	1.876
OLS estimation	0.321	0.467	0.004	0.011	0.17			
Endogeneity considered	0.429	0.495	0.000	0.003	0.04			
Constant	0.074	0.186	0.351	NA	1.00	0.319***	0.085	3.750
Observations	893			893			893	

Note. Besides the explanatory (moderator) variables and their descriptive statistics (columns 1 to 3), this table presents the results from Bayesian model averaging (columns 4 to 6) and metaregression analysis via WLS (columns 7 to 9). In the WLS regression, we only include explanatory variables with PIP > 0.2. Standard errors are clustered at the study level. CEP: corporate environmental performance; CFP: corporate financial performance.

*Significant at 10% level;

**Significant at 5% level;

***Significant at 1% level.

of one for the corresponding studies as suggested by Fujii, Iwata, Kaneko, and Managi (2013). The same also holds for small firms compared with large companies (*small firms*).[4] In order to cover potential differences in the effects due to estimation differences, *OLS estimation* distinguishes simple OLS techniques (=1) from more sophisticated approaches (=0). Finally, the dummy variable *endogeneity considered* indicates if the used estimation procedure considers potential endogeneity between CEP and CFP.

For the selection of the moderating variables, we face the problem that there is no underlying theory to derive the best set of variables. Thus, we collect a broad set of variables. If we would include all explanatory variables in the same regression model, we would probably face two problems: multicollinearity and high model uncertainty. To address these issues, we follow recent developments in meta-regression research and employ Bayesian model averaging (BMA; see, e.g., Babecky & Havranek, 2014; Zigraiova & Havranek, 2016). Instead of selecting just one of the possible regression specifications, the general idea behind BMA is to run regressions with different subsets of possible combinations of explanatory variables. Thus, BMA can be thought of a robustness check with many subsets of explanatory variables. As a full enumeration of all possible subsets of explanatory variables would require too much computing capacity, a Monte Carlo chain algorithm is applied to consider the most promising models. The distribution of the model parameters over the individual models is captured by the posterior means and standard deviations. Furthermore, we can compute the posterior inclusion probability (PIP) for each explanatory variable, which is the sum of the posterior probabilities across all regression specifications including this variable. The PIP denotes the probability that a variable is included in the "true" regression model. Table 5 reports the numerical results for the BMA in the central three columns. The posterior mean, standard deviation, and the PIP are shown in the first three columns.[5] In the next step, we add all moderator variables with a PIP greater than 0.2 into the multiple WLS model following Equation (6), as these variables are identified to have explanatory power for heterogeneity. The results from the WLS regression are presented in the right three columns of Table 5.

The BMA results show that *mean sample year—1950* crucially affects the CEP–CFP relation with the highest PIP of 1.00 (posterior mean = −0.006). Moreover, the analysis reveals a strong impact for *reactive CEP* (PIP = 0.91, posterior mean = −0.082). All other moderator variables do not even reach a weak level. In the subsequent

[4]If the mean market capitalization is less than 1 billion U.S. dollars or a firm has fewer than 1,000 employees, we classify a firm as small. Approximately, these are the lower limits of the S&P 500 constituents.

[5]Thereby, we follow the classification by Eicher, Papageorgiou, and Raftery (2011) and categorize an effect as "weak" if the PIP is between 0.5 and 0.75, "substantial" if the PIP is between 0.75 and 0.95, "strong" for values between 0.95 and 0.99, and "crucial" for values above 0.99.

TABLE 6 Results of subgroup analysis

Subsample	n	k	Random effects mean effect size	Standard error	Results of heterogeneity test: Q statistic (df)	I^2 (%)	τ
Full sample							
Total	142	893	0.072***	0.006	5217.99***(892)	85.68	0.144
CEP strategy							
Reactive							
$j = 0$	20	39	0.039*	0.021	115.57***(38)	66.24	0.089
$j \neq 0$	6	22	0.021	0.014	42.23***(21)	37.40	0.039
Non-reactive							
$j = 0$	103	530	0.080***	0.007	2527.71***(529)	82.70	0.142
$j \neq 0$	52	302	0.069***	0.010	2333.61***(301)	89.86	0.155
Time							
Mean sample year ≤ 2000							
$j = 0$	51	203	0.098***	0.013	974.81***(202)	82.56	0.154
$j \neq 0$	31	157	0.103***	0.012	1001.39***(156)	82.97	0.127
Mean sample year ≥ 2001							
$j = 0$	56	366	0.067***	0.008	1721.47***(365)	81.51	0.130
$j \neq 0$	23	167	0.030**	0.014	1223.30***(166)	92.04	0.163

Note. This table shows the results from Hedges and Olkin-type meta-analysis for the CEP–CFP relation. Data are split according to the CEP strategy applied and the mean sample year of the analyzed data, while simultaneously splitting the sample according to the number of lagged years *j* between the two constructs. *n* is the number of studies, and *k* is the number of effect sizes. Besides, the random-effects mean effect sizes and their standard errors are shown. CEP: corporate environmental performance; CFP: corporate financial performance.

[a]Due to the small number of observed effect estimates, the calculations cannot be performed completely for this subgroup.

*Significant at 10% level;

**Significant at 5% level;

***Significant at 1% level.

WLS model, *mean sample year—1950* and *reactive CEP* also show the most striking effects with coefficients of −0.005 and −0.091, which are significant at any level. This means that the CEP–CFP relation decreases over time and that there is a weaker dependency between reactive investments in environmental activities and a firm's financial performance. The latter stands in opposition with the result from Cordeiro and Sarkis (1997), who document that financial analysts expect lower earnings-per-share especially for environmentally proactive investments. Additionally, the results show a weakly significant effect for *small firms* with a coefficient of 0.050. Accordingly, for small firms, the CEP–CFP relation shows higher values.

Overall, Table 5 indicates that the sign and the size of the regression coefficients from the WLS model are consistent with the posterior means from the BMA results. Variables with a high PIP are in most cases statistically significant. As BMA does not allow clustering standard errors, we can conclude from the WLS estimation that the findings are robust to error-clustering.

Finally, we split our sample of effect sizes according to the most significant moderator variables of the MRA *reactive CEP*, and *mean sample year—1950*, while simultaneously distinguishing between concurrent and lagged effects, in order to calculate the mean effects for the related subsamples. The results of this subgroup analysis in Table 6 show that, compared with the mean CEP–CFP effect of the full sample (0.072), the concurrent ($j = 0$) and lagged ($j \neq 0$) effects between CEP and CFP are especially small and insignificant for reactive investments ($j = 0$: 0.039; $j \neq 0$: 0.021). Furthermore, the effect is slightly greater than the overall mean and statistically significant for non-reactive investments ($j = 0$: 0.080; $j \neq 0$: 0.069). However, the difference between reactive and non-reactive investments is fairly the same for the concurrent and the lagged effect. Continuing with the temporal differences, the mean effects are slightly above the overall mean for the period until the year 2000 ($j = 0$: 0.098; $j \neq 0$: 0.103). After the year 2000, the effects seem to decrease with a mean concurrent effect of 0.067 and a mean lagged effect of 0.030. Here, the temporal difference is slightly greater for the period after 2000. Overall, we can conclude that our main results concerning the temporal structure of the CEP–CFP causality are robust to differences in the CEP strategy and temporal effects, because the differences in the mean concurrent and lagged effects are relatively small between the two pairs of subsamples.

5 | CONCLUSION

Extending existing meta-studies on the relation between CEP and CFP (Albertini, 2013; Dixon-Fowler et al., 2013; Endrikat et al., 2014; Guenther et al., 2012; Hang et al., 2018; Horváthová, 2010), the aim of this paper is to shed light on the reverse causality between both constructs by applying meta-analysis on a sample of 893 effect sizes.

Our findings suggest that in the short term (1 year), financial resources can increase a firm's environmental performance as proposed by the slack resources hypothesis; however, the effects disappear in the long term (more than 1 year). Conversely, increasing environmental performance has no short-term effect on a firm's financial performance, whereas a firm significantly benefits in the long term following the Porter hypothesis. In contrast, the concurrent/synergetic effect is significantly positive but economically insignificant. Overall, our results imply that the causality between environmental performance and financial performance depends on the time horizon. This result is not affected by publication bias. However, meta-regression analysis reveals that the CEP–CFP relation decreases over time and is significantly smaller for reactive environmental investments. To sum up, our results should encourage managers to stick to a proactive environmental policy and not to abandon the investments if the financial success is not immediately visible.

Future research might especially point to the temporal structure of causal effects for different environmental practices on a fine-grained level. For a more detailed understanding (also on a meta-level), additional studies examining long-term effects are also needed. Moreover, future studies might investigate the causality between CEP and CFP assuming non-linear relations (Fujii et al., 2013).

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