Exploring U-shaped relationships between Corporate Environmental Management Performance and Corporate Financial Performance

Abstract:

This exploratory paper studies whether the relationship between Corporate Environmental Management Performance (EMP) and Corporate Financial Performance (CFP) can be explained by using non-linear U-shaped models and time-lagged measures of EMP. This paper argues that the linear approach that is often used in the literature, has contributed to the mixed results on the relationship in the literature and that the drawn out effects of EMP may have further contributed to the mixed results. By combining existing theories in a new non-linear framework, this paper aims to provide evidence of non-linearity in the relationship between EMP and CFP. Using a panel dataset of yearly data of 1076 public companies for the period 2006-2015, and two measures of CFP, i.e., Total Stock Return (TSR) and Return on Assets (ROA), the results show evidence of non-linearity in the form of a U-shaped relationship between EMP and ROA. Furthermore, although there is some evidence of non-linearity between EMP and TSR, the results of this paper do not support an inverted U-shaped or U-shaped relationship between EMP and TSR. Additionally, this paper does not find evidence that time lagged measures of EMP help in explaining the relationship between EMP and CFP. These findings extend the literature on the EMP-CFP relationship by showing that EMP can have positive or negative effects on ROA, depending on the level of EMP of a firm. In particular, the financial benefits from EMP only seem to appear after a certain threshold of EMP has been reached. The results also show that linear models may not be appropriate for explaining the relationship between EMP and CFP. The paper also supports prior literature by showing that the effect of EMP on CFP is different for different dimensions of CFP. Therefore it is not always possible to generalize conclusions from one measure of CFP to another. In particular, this paper supports the notion that accounting-based measures (ROA) are more, and differently, affected by EMP than market-based measures (TSR) as proposed by Albertini (2013).

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1: Introduction

During the last 130 years, the world has been warming, leading up to a total average increase of 0.85 degrees Celsius by 2014. As a result, each of the last three decades has been successively warmer than any preceding decade since 1850 (IPCC, 2014). The majority of scientists (Busch & Hoffmann, 2011) agree that human business activities and in particular the burning of fossil fuels have led to this increase in global temperature. The World Health Organization (WHO) now expects climate change to cause an additional 250,000 deaths each year, between the years 2030-2050, from various climate change-induced effects such as malnutrition, malaria, diarrhea and heat stress (World Health Organization, 2016).

Corporations are responsible for much of this emission and although there have been many large corporations that have adopted green strategies, there are still plenty that have not. The reason for this might be that these firms still see environmental practices as costly and profit-reducing. Since firms are, in essence, profit-seeking entities, under this vision most will not engage in environmental practices. However, if corporations can be convinced that environmentally friendly practices are in fact profit increasing, then even the most environmentally indifferent, but profit-seeking firm would go green. To state that firms only care about their financial state is perhaps too strong of a statement and there are other reasons for engaging in environmental activities such as boosting their image, trying to legitimize its actions or meeting stakeholders demands but arguably the main argument against environmental activities is that it is too costly. Disproving this argument may be more effective than promoting other reasons for engaging in environmental activities and reporting.

Theoretically, both a negative relationship as well as a positive relationship between green management and financial performance are plausible (Ambec & Lanoie, 2008; Porter & van der Linde, 1995b). A negative relationship can occur because firms may incur significant incremental costs while implementing environmental practices, and these can surpass any financial benefits gained from these practices. The manager that agrees with the notion that the only social responsibility of a firm is to increase its profits (Friedman, 1970), will not see adopting these environmental practices as desirable when this is the case. A positive theoretical

relationship can be established when the benefits of implementing environmental policies exceed the costs. For instance, if the environmental practices are geared towards decreasing production inputs such as energy and raw material, then this can reduce operational costs (King & Lenox, 2002) and in this way lead to an increase of profitability of the firm. Other benefits can entail being able to ask a premium price for environmentally aware customers, differentiating your product, or even selling developed pollution control technology (Ambec & Lanoie, 2008). In addition to this, the implementation of green management practices is often associated with organizational learning and an improvement of organizational capabilities in line with the natural-resource-based view of the firm (Hart & Dowell, 2011).

Theoretical arguments can also be made for the fact that there is a difference in timing of benefits and costs of EMP (Hart & Ahuja, 1996). Implementing new environmental management systems or technologies will have costs that are often front-loaded while their benefits can often accrue over extended periods of time. Sometimes these benefits can be quantified, think of energy savings, but more often than not, these benefits might be harder to quantify and observe. Implementing time-lags of the EMP measure into a regression can help disentangle some of these different effects, such that a more nuanced picture of the total effect can emerge. Another problem with much of the literature is that the time periods observed have been relatively short, and thus were only able to incorporate the initial effects. Some researchers claim that this way, only the negative effects that occur first are captured, and not the positive effects that may take longer to realize (Ambec & Lanoie, 2008; Riillo, 2017; Horváthová, 2010). However, others claim that easy wins and ‘’low hanging fruit’’ when starting environmental programs mean that the initial effects are mostly positive with these effects decreasing over time (Albertini, 2013).

Unfortunately, systematic reviews of quantitative studies in the empirical literature conclude that evidence is mixed, (Albertini, 2013; Gunathilaka, Gunawardana, & Pushpakumari, 2015; Horváthová, 2010; Ambec & Lanoie, 2008) on whether the positive effects of green activities prevail over the negative effects (Riillo, 2017). Meta-studies have found that studies that find a positive relationship between environmental performance and financial performance, outnumber those finding a negative relationship however (De Vries, Bayramoglu, & Wiele, 2012; Dixon-

Fowler, Slater, Johnson, Ellstrand, & Romi, 2013; Molina-Azorín, Claver-Cortés, López-Gamero, & Tarí, 2009; Orlitzky, Schmidt, & Rynes, 2003).

Some researchers have pointed out that many of the studies that report a positive impact of some form of environmental management and/or performance and higher financial valuation/performance, suffer from reverse causality (Heras-Saizarbitoria, Arana, & Boiral, 2015). The possibility of reverse causality is especially problematic since theory is not clear on which direction the relationship should flow. In addition, unobserved heterogeneity is often a problem in many studies (Telle, 2006; Nawrocka & Parker, 2009). Finally, measurement problems, small samples, differences in research methods, variables and constructs used are all causing problems in research on the subject and can explain the occurrence of mixed results (Riillo, 2017; Ullmann, 1985; Ambec & Lanoie, 2008; Martínez-Ferrero & Frías-Aceituno, 2013; Busch & Hoffmann, 2011; Trumpp & Guenther, 2015). Some of these problems, such as the lack of consensus on a definition of CEP, are subject-wide and cannot be solved by a single paper. Others such as small sample sizes, a short observed time period, and the issue of reverse causality, will be addressed in this paper.

In recent years, there has been a call for a contingency approach (Dixon-Fowler, Slater, Johnson, Ellstrand, & Romi, 2013; Albertini, 2013; Heras-Saizarbitoria, Molina-Azorín, & Dick, 2011) and some researchers have tried to incorporate this in their papers. The recent papers of Riillo (2017) and Trumpp & Guenther (2015) try to do this. Both test non-linear models and find a U-shaped relationship between Corporate Financial Performance (CFP), and some measure of either green management or a direct measure of environmental performance. To be specific, Riillo (2017) uses survey results to classify the green management system of the firms researched, and measured their effect on productivity and innovation. Trumpp & Guenther (2015) evaluate the effect of carbon performance and waste intensity on profits and stock price. Both papers make a distinction between services and manufacturing industries. However, while both these authors find U-shaped relationships, some researchers have found inverted U-shaped relationships (Wagner & Blom, 2011; Fujii, Iwata, Kaneko, & Managi, 2013), showing that non-linear models by itself cannot explain all the mixed results and these results are mixed themselves as well.

Although these papers offer some interesting new explanations for the mixed results on the relationship between environmental performance and CFP, they also showcase the problem with much of the literature regarding financial and environmental performance. The papers use very different measures of both financial and environmental performance. As Trumpp et al. (2015) explain in their paper, despite the significance of Corporate Environmental Performance (CEP) in several research streams, a clear and generally accepted definition of CEP is still lacking and as long as different definitions are used, empirical results cannot be compared in a reliable manner (Trumpp, Endrikat, Zopf, & Guenther, 2015). In their paper, Trumpp et al. (2015) conduct factor analyses on previous academic research and then explain how CEP is composed out of multiple distinct dimensions, namely Environmental Management Performance (EMP) and a large number of different Environmental Operational Performance (EOP) dimensions. Their literature review showed that most of the reviewed studies did not take the multidimensional nature of CEP into account (Trumpp, Endrikat, Zopf, & Guenther, 2015). They claim that this constitutes a serious problem. As they have found that CEP constitutes a multidimensional aggregate construct, conceptual arguments and conclusions that are made based on research carried out at the dimension level, do not necessarily hold on the construct level and vice versa (Trumpp, Endrikat, Zopf, & Guenther, 2015; Law, Wong, & Mobley, 1998; Wong, Law, & Huang, 2008). The implications of their study are that researchers should clearly state what dimensions they research and not simply equate a single dimension to the larger CEP construct. In order to further build on the empirical literature on the CEP-CFP relationship, while not confounding different measures and dimensions of CEP, the EMP dimension is the subject of this study.

This study aims to contribute to the understanding of the relationship between EMP and CFP by further exploring the possibility of non-linearity, in the form of either U-shaped or inverted U-shaped curves, and implementing time lags. This paper expands on the contingency-research of Trumpp & Guenther (2015) and Riillo (2017), while adhering to the implications of the research by Trumpp et al. (2015). In this way, it offers a scientific contribution on the long-debated issue of CEP and CFP, by focusing on the EMP component of CEP. As the EOP part of CEP consists of a very large amount of dimensions that are each very different for different companies, the EMP

dimension is better suited to research that aims to provide generalizable conclusions on a large diverse set of firms. Furthermore, as explained in chapter 2, EMP is believed to have more potential to affect the financial performance of firms (Albertini, 2013). If the relationship between EMP and CFP turns out be U-shaped, then some of the mixed results in the literature might no longer be contradictory; as the theory behind the U-shaped models explains how for different levels of EMP, the effect on CFP might be positive or negative.

In addition to the U-shape, the timing of effects of EMP implementation on CFP might also be an additional distorting factor. This paper adds a theoretical explanation for why this different timing of effects might occur and this is tested with time-lags of EMP of 1, 2, and 3 years. If EMP has a different effect on CFP in the year it was implemented versus the following years, then conclusions of research that uses no time lags and/or non-longitudinal data will be different from those that use longitudinal data and/or time lags, thereby generating mixed results in the literature. Previous research has not addressed this issue much, making it a relevant contribution. The fact that the methodology of the paper is aimed at uncovering a non-linear relationship, also strengthens the contribution of this paper. This is important since research methods that assume a linear relationship are not able to uncover non-linear relationships well. Furthermore, to the author's best knowledge, this paper is the first to use the ASSET4 database for data on EMP in order to research the EMP-CFP relationship. This is useful, since this database also collects data on the EOP dimensions, thereby making comparisons between dimensions in future research for the same companies easier with potentially better results.

In sum, this paper tests whether the combination of non-linear models, a time component, and a clear distinction between CEP as a construct and its components, can provide additional evidence on the EMP-CFP relationship. By doing this, it hopes to shed more light on the relationship. As of now, the mixed results in the literature mean that firms cannot be shown that green management pays off, and a convincing argument for them to adopt green management practices cannot be made.

The rest of the paper is structured as follows: Chapter 2 will deal with the background literature and theoretical framework after which some hypotheses will be formulated. Chapter 3 will then go into more detail on the method through which the hypotheses will be tested. The results will then be presented and discussed in chapter 4. Finally a discussion of the limitations of the results followed by a conclusion will end this research.

2: Theoretical framework and literature review

2.1: Environmental Management Performance within Corporate Environmental Performance

First and foremost, this paper is about the relationship between EMP and CFP. However, much of the theory on green performance simply talks about CEP and does not further distinguish between different forms of CEP such as EMP and EOP. For this reason, this chapter will first explain what Environmental Management Performance entails in the broader context of Corporate Environmental Performance.

Research into the relationship between CEP and CFP has often failed to acknowledge the importance of measurement methods, and the actual choice of measurement variables. The fact that there is not one agreed upon definition of CEP, means that various research carried out on CEP cannot be reliably compared. For this reason, a significant degree of the mixed results can also be explained by what measures of both CEP and CFP are used, and in what combinations.

Trumpp et al. (2015) try to solve the problem of a lacking, broadly agreed upon definition by evaluating the construct validity and content validity of various definitions of CEP. They go on to perform factor analyses and contrast their findings with the use of CEP in previous empirical work. They find that CEP is a multidimensional construct that can be divided into two distinct main dimensions of Environmental Management Performance (EMP) and Environmental Operational Performance (EOP) where EMP was conceptualized to have five sub-dimensions, and EOP was found to be made up of a multitude of dimensions itself. Trumpp et al. (2015) explain that EMP focuses on management principles and activities with regard to the natural environment, and build their definition of EMP around the ISO 14001 and ISO 14031 standard

on Environmental Management Systems (EMS). Their newly formed measure of EMP consists of five sub-dimensions that will be explained further in the next chapter.
The EOP dimension refers to the operational level of environmental performance and explicitly focuses on the outcomes of a firms environmental management activities (Trumpp, Endrikat, Zopf, & Guenther, 2015). In other words: EOP can be used to measure the effect of EMP activities on the environment since it is the output variable of EMP. The aim of this research however, is not to assess the effect of green management on actual green performance. Instead this paper is interested in the effect of green management on financial performance. For this, the EMP dimension is better suited, since it can also capture the effects of the organizational learning on CFP that was induced by EMP. The dimension of EOP however, fails to measure and correctly allocate this. This is supported by the meta-analysis of Albertini (2013) who distinguishes between the same categories of CEP as Trumpp et al. (2015), albeit with different names[1] and with the addition of environmental disclosures as a separate category of CEP. In her meta-analysis, Albertini finds that her counterpart of CEP is more positively related with CFP when EMP is measured instead of EOP. This seems to suggest that EMP captures more of the positive effects of CEP on CFP. In addition to this, the EMP dimension has not received much attention in the literature leading to a relative knowledge gap on the influence of EMP on CFP as compared to EOP-CFP. This is shown by Trumpp et al. (2015) who found that only 6% of studies focused solely on the EMP dimension, while of the studies that evaluated EMP and EOP, 34% of total, only 10% kept them separate. This might be because researchers sometimes do not like the subjectivity that is involved in EMP valuations. EOP measures are easier to objectively quantify and may therefore be preferred by researchers (Trumpp & Guenther, 2015). Additionally, some of the mixed results in the literature might be down to researchers treating EMP and EOP as being the same. However, by clearly focusing on just EMP without confounding it into CEP, better results can be attained.

This section now continues with the theoretical background on the relationship between CEP and CFP. Even though it may seem like some arguments are based solely on EOP affecting CFP, it is

[1] Corporate Environmental Management instead of CEP, Environmental Performance measures instead of EOP and Environmental Management measures for EMP.

important to remember that EOP is viewed as the outcome of EMP and thus, whatever EOP affects, EMP also affects. The same cannot be said about EMP, since it does not only affect CFP via the EOP channel. EOP and EMP together form CEP.

2.2: Theories explaining a positive relationship between CEP and CFP:

Theory of value creation:

The theory of value creation encompasses several arguments that have in common that they suppose that CEP has a positive effect on CFP, as they suppose CEP creates real value for the company (Hassel, Nilsson, & Nyquist, 2005). However, there is consensus in the literature on how to fit these arguments together in a single theoretical model (Clemens & Bakstram, 2010; Guenther & Hoppe, 2014). Porter and van der Linde are two strong supporters of the positive influence of CEP on CFP and extensively write on this in their two 1995 papers (Porter & Van der Linde, 1995a; Porter & van der Linde, 1995b). Their argumentation was later described in the literature as the win-win hypothesis (Guenther & Hoppe, 2014; King & Lenox, 2002; Wagner & Schaltegger, 2004; Hart & Ahuja, 1996). They reason that governmental regulation can induce technological innovation, and even give firms a first-mover advantage when this innovation leads to new technologies and production approaches that can be sold to other companies (Ambec & Lanoie, 2008). They also state that pollution is a measurable sign of economic waste and inefficiency. By being more efficient with resources, both lower emissions and better economic performance is achieved, hence a win-win situation. In addition, if firms incorporate environmental aspects into their product, then this might also lead to product differentiation, where they are able to earn a premium on their product or where a competitive advantage is achieved by means of a first mover advantage (Albertini, 2013; Ambec & Lanoie, 2008). Researchers have also asserted that when firms engage in environmental management activities, they improve their organizational capabilities. According to the natural-resource-based view of the firm, this would lead to further improvements in day to day operations, which in turn also lead to increased profitability of a firm. This is especially true for proactive pollution prevention over reactive end-of-pipe activities (Hart & Dowell, 2011). This is because pollution prevention

activities usually rely on continuous-improvement methods focused on environmental goals, that enhance managerial capabilities and create competitive advantage. End-op-pipe activities on the other hand often involve expensive capital investments with not further benefits besides emission reduction (Hart, 1995). The previous argument is especially true for accounting based measures of financial performance such as ROA, but arguments can also be made for market-based measures such as stock performance. In particular, the instrumental stakeholder theory suggests that when firms engage in environmental activities over the required compliance level, they increase their reputation with concerned stakeholders and by better integrating the expectations of these stakeholders in their decisions, the stock becomes more valuable (Trumpp & Guenther, 2015).

Slack resources/available funds theory:

The slack resources/available funds theory works in the opposite direction and assumes that better CFP will translate into better CEP (Guenther & Hoppe, 2014). This is because firms that have slack resources can afford to invest in improving their CEP (Ambec & Lanoie, 2008; Molina-Azorín, Claver-Cortés, López-Gamero, & Tarí, 2009; Hassel, Nilsson, & Nyquist, 2005; Waddock & Graves, 1997). The slack resources theory has been tested by means of a meta-analysis and the results point towards there being a positive relationship between CEP and three different types of slack resources (Daniel, Lohrke, Fornaciari, & Turner, 2004).

2.3: Theories explaining a negative relationship between CEP and CFP:

Trade-off hypothesis:

The trade-off hypothesis is based on Friedman’s statement regarding social responsibility, and argues that engaging in environmental activities lowers the financial performance of a firm. This is because environmental activities require financial, and other resources that could have been used for more value creating investments (Waddock & Graves, 1997). The costs of these activities are thought to outweigh the benefits (Preston & O'Bannon, 1997). Put differently, these

resources are shifted away from the core activities of the firm, thereby generating relative disadvantages compared to less environmentally active competitors (Trumpp & Guenther, 2015). This argument is particularly strongly related to end-of-pipe technologies for improving CEP that only generate costs and negatively affect profits (Lankoski, 2008). In addition to this, regulation can induce improvements in CEP, which usually come with compliance costs that also increase costs and reduce profits (Palmer, Oates, & Portney, 1995). Firms that only engage in CEP as new compliance requirements arise and mainly use end-of-pipe technologies and pollution control measures to improve their CEP are deemed to pursue more reactive environmental strategies (Trumpp & Guenther, 2015). This generates extra costs and therefore also leads to a negative relationship between CEP and CFP (King & Lenox, 2002; Fujii, Iwata, Kaneko, & Managi, 2013; Clarkson, Li, Richardson, & Vasvari, 2011; Aragón-Correa & Sharma, 2003).

Managerial opportunism:

The managerial opportunism theory/hypothesis supposes a negative relationship between CFP and CEP. The core of this argument rests on the fact that manager's compensation schemes are often linked to short-term shareholder value (McGuire, Dow, & Argheyd, 2003). Since that the voluntary reduction of environmental impact is in conflict with the firms primary objective of maximizing short-term shareholder value (King & Lenox, 2002), managers may attempt to slash CEP expenditures when financial performance is strong, in order to maximize their private profits. However, when performance is weak, managers might try and engage in conspicuous environmental programs in order to hide their weak performance (Moore, 2001; Preston & O'Bannon, 1997). In short, this theory supposes that CFP has a negative influence on CEP.

2.4: Intermediate positions and channels:

A mix of some of the previous theories is a synergetic relationship between CFP and CEP. In this case, the positive relationships work in both directions and in this way they are mutually reinforcing each other. This would lead to a 'virtuous cycle' as first proposed by Waddock & Graves (1997) and Hart & Ahuja (1996). Several other authors such as Orlitzky et al. (2003) and

Allouche and Laroche (2005) also supported such a ‘bidirectional’ relationship that acknowledges both the slack resources theory and the instrumental stakeholder theory. However, a vicious circle might also occur when either CFP or CEP drops and takes the other down with it.

Some have noted that there might not be a relationship between CEP and CFP at all (Guenther & Hoppe, 2014). For instance, Waddock and Graves (1997) claim that there are so many intervening variables, that there is no logical reason for a relationship to exist, blaming any potential relationship on chance. Stewardship theory also suggests that there should not be a relationship between CEP and CFP by asserting that managers improve CEP for moral reasons, rather than financial ones, and thus the two move separately (McWilliams, Siegel, & Wright, 2006). Others have asserted that positive and negative relationships can exist for companies in such a way that their effects cancel each other out meaning that no relationship/a neutral relationship can be observed between CEP and CFP even though there are some effects at work (Guenther & Hoppe, 2014). Some other researchers have also asserted that it is impossible to prove that environmental activities increase profitability, because of measurement problems of the effects of these activities (Albertini, 2013).

Guenther and Hoppe (2014) find the relationship between CEP and CFP to be mixed. Meaning that the relationship between the two does not simply flow in a single direction nor does it have a standard linear form. Instead it is theorized to have an inverted U-shaped form as supported by multiple researchers (Guenther & Hoppe, 2014; Moore, 2001; Wagner & Blom, 2011; Wagner & Schaltegger, 2004). In the first part of the inverted U, the win-win CEP-CFP is dominant and the curve moves upwards until a tipping point is reached after which the curve moves downward (Schaltegger & Synnestvedt, 2002). This mixed relationship with a non-linear (inverted) U-shape has received some more attention recently.

A number of researchers now support more complex theories incorporating multiple theories combining into a non-linear relationship (Moore, 2001; Lankoski, 2008; Orlitzky, Schmidt, & Rynes, 2003; Guenther & Hoppe, 2014). However, if one looks at the recent literature on this subject, it seems like researchers have only spent time researching the positive association and

have failed to properly acknowledge the possible trade-offs that sometimes have to be made (Hahn, Figge, Pinkse, & Preuss, 2010). As a result, theoretical frameworks that incorporate neutral, positive and negative results in one framework have not been properly explored.

The paper by Trumpp & Guenther (2015) tries to overcome this flaw by proposing two different new frameworks, that incorporate several of the theories explained in the previous paragraphs. They call the first of these two theories the meta-theory of the too-much-of-a-good-thing, or TMGT theory (Trumpp & Guenther, 2015). This theory starts from the viewpoint that most management research is based on the assumption that more is always better (Pierce & Aguinis, 2013). This assumption then leads to linear relationships as seen in the previous theories. Unlike these theories, Trumpp & Guenther's theory does not assume that more of something good is always better. Instead, it is based on the law of diminishing marginal returns. This works as follows: At first, the benefits of improving CEP outweigh the costs, however, as increasingly more money is spent on improving CEP, the marginal return of this spending decreases until it is equal to the marginal financial benefit of the extra CEP. At this point, the relationship tips into a negative one, with marginal costs of increasing CEP outweighing the financial benefits of this CEP. In other words, there is a sort of ''context-specific maximum'', after which a previously positive relationship turns into a negative relationship (Pierce & Aguinis, 2013). The consequence of this relationship is that there is a theoretically maximum CFP (to be achieved by improvements of CEP) after which additional spending on CEP lowers financial performance. The shape of the function that is produced by this, is that of an inverted U-shape (Trumpp & Guenther, 2015). The analogy of low hanging fruit can also be made, where after some initial investment and green activities, many easy improvements are made after which this low hanging fruit has been plucked and more gains are increasingly difficult.

The second theory that is developed in order to account for a mixed relationship, is the 'too-little-of-a-good-thing' or TLGT theory (Trumpp & Guenther, 2015). This theory supposes a U-shaped curve where the relationship starts off negatively, but eventually transforms to a positive one. The logic for this is that some antecedents might not realize their potential benefit unless they accrue to a certain threshold. Before this threshold has been reached, the negative effects or costs

outweigh any possible benefits. After the threshold has been reached, the relationship changes into a positive one, thereby generating the second part of the U-shaped that is associated with this theory. Much like the previous relationship, this one incorporates several positive and negative relationships. Fuji et al. (2013) propose another explanation of the U-shaped relationship by means of the strategy employed by firms. In their research, they found that firms with a reactive environmental strategy experience a negative relationship between CEP and CFP, while firms with a proactive strategy experience a positive relationship. As firms with a proactive environmental strategy perform better on CEP than firms with a reactive strategy, they each form one leg of the U thereby leading to this functional form. Another explanation might be that positive reputational-based effects only accrue to a firm once it has shown considerable effort through CEP. In this reasoning, firms are rewarded only after the threshold has been reached, as stakeholders require a certain credible commitment to be made.

In conclusion, regarding the theoretical relationship between the CEP and CFP, the paper finds that there are actually four different kinds of functional shapes that can be found. Table 1 illustrates the different forms the relationship can take with the accompanying theories. The non-linear shapes incorporate all theories that produce positive and negative linear curves. The difference between the U-shaped and inverted U-shaped curve, is that the U-shaped curve supposes that a threshold needs to be reached before the positive effects of CEP spending outweigh the negative effects, while the inverted U-shaped curve supposes that the benefits first outweigh the costs and a tipping point is reached because of diminishing marginal returns that lead to costs outweighing benefits after some level of CEP spending. In addition, two theories suppose a relationship of CEP affecting CFP and two suppose the relationship working from CFP on CEP.

Functional shape:	Negative linear curve	Positive linear curve	U-shaped curve (non-linear)	Inverted U-shaped curve (non-linear)
Associated theories:	Managerial opportunism and trade-off hypothesis	Win-win hypothesis, slack resources, (natural) resource based view, instrumental stakeholder theory	Combination of theories into the too-little-of-a-good-thing effect.	Combination of theories into the too-much-of-a-good-thing effect.

Table 1:
Functional shapes & theories

All of these relationships are also applicable to the EMP dimensions and by regressing EMP variables on CFP, this paper should be able to provide more evidence on what effect EMP has on the financial performance of a firm. Furthermore, since some theories also support causality of CFP on CEP, this option of reverse causality will be tested by means of a regressions with CEP as the dependent variable.

2.5: Time component:

Implementing Environmental Management Systems (EMS) and engaging in environmental management activities does not happen overnight. The effects and implementation of these systems take time and after starting with these systems, they might lead to more green behavior and activities, such as the purchase of factory machines that are more efficient and pollute less. Purchases such as these can lead to resource savings for example and therefore provide financial benefits as long as they last, which may be a large number of years. The costs of these machines however, will often be paid once the deal come through. This discrepancy between the timing of costs and benefits may help to produce mixed results in literature if it is not accounted for. In addition, the benefits that accrue through organization learning and the organization skills that are

learned after implementing EMS will also take time to fully develop, leading to different effects of EMP in different years. Both these things might lead to EMP having initial negative effects with benefits that are spread out over potentially many years.

However, it might also be that initial environmental management activities have a large potential effect due to the occurrence of low hanging fruit (Albertini, 2013). At first there might be a large number of things that strongly affect financial performance after which additional green activities have less potential. Improving an inefficient process might yield strong initial results after which it is difficult to further optimize it. This may lead to the opposite effect of the other theories mentioned in this section in that at first, more positive effects are realized and after a while, the negative effects outweigh the small incremental gains made.

As with the other theories mentioned earlier in this chapter, it is more likely that reality is a combination of the theories presented rather than one being true and the rest false. The question however is which effect is dominant and has a stronger influence.

2.6: When does it pay?:

The previous paragraphs have shown some possible theories and relationships that might be present together with some moderating factors. This paragraph will now present some typical cases in which a firm is expected to exhibit a positive/negative/neutral relationship and/or a non-linear form.

A typical firm that is expected to exhibit a negative relationship between EMP and CFP, is expected to have a reactive environmental policy. This means that mostly end-of-pipe solutions are used in order improve the environmental performance. This firm would face a market that is not willing to pay for eco-products and where process and resource efficiency gains are not very important. A typical firm that is expected to exhibit a positive relationship between EMP and CFP is expected to have a proactive environmental policy, have many slack resources and implement

comprehensive EMS programs. Additionally, this firm would operate in a market where customers care about the environmental properties of a product/firm and are willing to pay a premium or prefer an eco-differentiated product. A market that is highly competitive would also encourage efficiency gains in the form of more efficient use of resource and this also supports a positive relationship (Ambec & Lanoie, 2008). Some case-studies have also shown that when firms produce products that are aimed for the public sector, they are more likely to profit from green activities (Ambec & Lanoie, 2008).

Since engaging in EMP is considered to have some costs, a neutral relationship or no relationship could only come to be when benefits equal costs and therefore firms somewhere in between the two extremes mentioned above might fall into this category. If EMP is not expected to have any positive effects, then the relationship between EMP and CFP would be negative.

Additionally, some research has found that energy-intensive sectors would also exhibit a negative relationship between EMP and CFP (Riillo, 2017), while others found that the sector does not work as a moderator (Albertini, 2013; Dixon-Fowler, Slater, Johnson, Ellstrand, & Romi, 2013) so this effect is not clear yet.

2.7: Hypotheses:

In order to adequately answer the research questions of this paper, some hypotheses were formed. Most research assumes a linear shape so this will be the null-hypothesis.

H0: The relationship between EMP and financial performance takes a linear form.

This hypothesis either supports a negative or positive relationship and the accompanying theories of table 1. The alternative hypothesis H1 assumes the opposite namely a non-linear form

H1: The relationship between EMP and financial performance takes a non-linear form.

If H1 is accepted, hypotheses H2a and H2b will be tested.

> *H2a: The relationship between EMP and financial performance follows an inverted U-shaped pattern.*

This would be visible in the form of a positive coefficient for the regular EMP variable and negative coefficient for the quadratic EMP variable.

> *H2b: The relationship between EMP and financial performance follows a U-shaped pattern.*

This would be visible in the form of a negative coefficient for the regular EMP variable and a positive coefficient for the quadratic EMP variable.
Since it is not clear whether EMP only affects the current year or subsequent year(s), a time-lag of EMP is implemented on the model that fits the best. This is done with a time lag variable of one, two and three years. Due to data limitations, this paper only used three years, thereby not decreasing the sample size too much.

> *H3: The relationship between EMP and financial performance is better explained by adding time lags of EMP.*

3: Research method, variables & descriptive statistics

3.1 Sample description

The sample's EMP data was taken from the ASSET4 database which is available through Thomson Reuters Datastream Worldscope. Additionally, financial data was taken from Thomson Reuters Datastream Worldscope. This paper focuses on European firms and is limited by the availability of EMP data from ASSET4. Therefore, the sample taken consists of all the European companies of which there is ESG data in the ASSET4 database (ASSET4 series code: LA4RGNEU).

Unlike much of the literature, this paper also includes the services industries in its analysis. Most previous research has mainly focused on manufacturing industries because they are arguably causing more environmental pollution/damage. However, ignoring the large group of firms in the services sector produces a gap in the literature. Additionally, it seems unwise to exclude these firms as they have a significant impact on the environment and also form a large part of the economy.

The original dataset consists of 537 firms from the manufacturing industry and 539 from services industry with 10 years of data for each. Missing values for certain variables means that regressions are run on fewer firm-years. The sample description table uses the sample that was used for the regressions without the time lags. Table 2 shows the number of firm-year observations for ROA and TSR for all industries. For both ROA and TSR, manufacturing industries make up most of the sample, with roughly 66% of all firm-years used in the regressions. Table 3 shows the countries for both the used samples with the number of observations per year per country.

Manufacturing industries	***Observations ROA sample***	***Percent % ROA sample***	***Observations TSR sample***	***Percent % TSR sample***
Oil and Gas (ICB 1)	*497*	*7,51*	*488*	*7,49*
Basic materials (ICB 1000)	*628*	*9,49*	*612*	*9,40*
Industrials (ICB 2000)	*1.836*	*27,76*	*1.816*	*27,88*
Consumer goods (ICB 3000)	*887*	*13.41*	*874*	*13,42*
Utilities (ICB 7000)	*362*	*5.47*	*357*	*5,48*
Computer hardware (ICB 9570)	*144*	*2,18*	*144*	*2,21*
Total	*4.354*	*65,82*	*4.291*	*65,88*
Services industries				
Health care (ICB 4000)	*438*	*6,62*	*426*	*6,54*
Consumer services (ICB 5000)	*1.173*	*17,73*	*1.156*	*17,75*
Telecommunications (ICB 6000)	*250*	*3,78*	*245*	*3,76*
Financials (ICB 8000)	*188*	*2,84*	*186*	*2,86*
Computer services (ICB 9530)	*212*	*3,20*	*209*	*3,21*
Total	*2.261*	*34,18*	*2.222*	*34,12*
Combined total	*6.615*	*100,00*	*6.513*	*100,00*

Table 2: *Sample description.*

Country	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total:
Austria (AT)	9	11 (10)	11	11	11	10	11	11	12	12	109 (108)
Belgium (BE)	12	12	13	14	15	15	15	16	17	18	147
Bermuda (BM)	3	3	3	4	4	4	4	3	4	5	37
British Virgin Islands (VG)	0	0	1	1	1	1	1	1	1	1	8
Cyprus (CY)	1	1	1	1	1	1	1	1	1	1	10
Czech Republic (CZ)	0	1	2	2	2	2	2	2	2	2	17
Denmark (DK)	14	17	17	17	20 (18)	20	20	19	20 (19)	22 (21)	186 (182)
Finland (FI)	21 (19)	21	21	22	23	23	22	24	24	22	223 (221)
France (FR)	57 (55)	66 (65)	70 (69)	71	74	76	78	79	79	84	734 (730)
Germany (DE)	50 (48)	55 (53)	62	63	65 (63)	68	67 (66)	68 (66)	74 (73)	75 (73)	647 (635)
Gibraltar (GI)	0	0	0	0	0	0	0	0	0	1	1
Great Britain (GB)	178 (170)	184 (177)	186 (184)	206 (204)	206 (203)	217	221	221	226 (223)	257 (246)	2.102 (2.066)
Greece (GR)	11	12	12	12	12	12	12	13	13	13	122
Hungary (HU)	0	0	1	2	3	3	3	3	3	2	20
Ireland (IE)	10	10	10	10	11	11	13	13	13	14	115
Isle of Man (IM)	0	0	0	0	0	1	1	1	2	3	8
Italy (IT)	17	20 (19)	22	22	23	24	24	23	24	26	225 (224)
Jersey (JE)	5	5	5	5	7 (6)	9 (7)	9	10	10	11 (10)	76 (72)
Luxemburg (LU)	2	2	2	2	3	4 (3)	4	4	4	5 (4)	32 (30)
Netherlands (NL)	21	24	24	24	25	27 (26)	28	30 (28)	31 (30)	31 (30)	265 (260)
Norway (NO)	14 (13)	14	14	14	14	14	14	14	15 (14)	16	143 (141)
Poland (PL)	0	1	4	6 (5)	12 (11)	14 (13)	15	15	18	17	102 (99)

Portugal (PT)	8 (7)	8	8	8	7	8	8	8	7	7	77 (76)
Spain (ES)	28 (25)	28 (27)	29 (27)	29 (27)	31 (29)	34 (31)	34 (33)	34	35 (34)	34 (32)	316 (299)
Sweden (SE)	32 (31)	32	33	33	34	34	32	34	38	49	351 (350)
Switzerland (CH)	31	34	37 (36)	41 (40)	42	43 (42)	45 (44)	47 (46)	48 (47)	48	416 (410)
Turkey (TR)	0	0	8 (7)	10	16	17	17	19	20	19	126 (125)
Total:	524 (504)	561 (548)	596 (589)	630 (624)	662 (651)	692 (683)	701 (698)	713 (708)	741 (732)	795 (776)	6615 (6513)

Table 3: *Observations per country per year for ROA and TSR. TSR in brackets when different from ROA.*

3.2 Measurement and list of variables

This section provides an overview of the measurement of the variables used. Table 4 below provides all the variables along with their measurement at a glance, while the following section expands on them.

Variables:	**Measurement/description:**	**Expected sign of coefficient:**
Dependent variables:		
Return on assets (ROA)	(Net Income – Bottom Line + ((Interest Expense on Debt-Interest Capitalized) * (1-Tax Rate))) / Average of Last Year's and Current Year's Total Assets * 100	NA
Total Stock price return (TSR)	((Market Price Year End + Dividends Per Share + Special Dividend -Quarter 1 + Special Dividend-Quarter 2 + Special Dividend-Quarter 3 + Special Dividend-Quarter 4) / Last Year's Market Price-Year End - 1) *100	NA
Independent variables:		
EMP	Composite measure 31 survey questions on five EMP sub dimensions. See table 4.	+/-
Control variables:		
R&D expenses	Research and Development Expense / Net Sales or Revenues * 100	+/-

Size	Measured as the natural logarithm of total assets.	+/-
Capital intensity	Capital expenses/ total assets*100	+/-
Leverage	(Short Term Debt & Current Portion of Long Term Debt + Long Term Debt) / Total Assets * 100	-
Growth	(Current Year's Total Assets / Last Year's Total Assets - 1) * 100	+
Cash flow	Funds from Operations / Net Sales or Revenues * 100	+

Table 4: *Variable definitions & measurement.*

Dependent variables:

The dependent variable is CFP in the regressions. In order to account for differences in measurement methods, regressions are run with a market-based measure of CFP and an accounting based measure of CFP. This is done because in the literature it is claimed that these different measures capture different dimensions of CEP (Hamann, Schiemann, Bellora, & Guenther, 2013; Guenther & Hoppe, 2014). For the accounting based measure, ROA is used. This is taken directly from Datastream (Code: WC08326) and is roughly calculated as net sales/revenue, divided by the average of last year's and current year's assets. Consistent with Trumpp and Guenther (2015), the market-based measure of CFP is captured by the stock market performance as measured by the total stock price return (TSR). Again, this is taken directly from Datastream (Code: WC08801) and is roughly calculated by adding the yearly dividends to the annual stock price gains/losses. The two measures of CFP reflect different aspects of organizational performance. ROA represents more of the efficiency and organizational performance itself, as well as intangible that are not visible to stakeholders, while the stock price performance also captures the stakeholders valuation of CEP that are not reflected in the ROA, such as reputation effects (Trumpp & Guenther, 2015).

Independent variable:

The measure representing EMP is derived from the five sub dimensions of EMP that Trumpp et al. (2015) presented in their paper which in turn, is based on ISO 14001 standard, the international benchmark for Environmental Management Systems (Trumpp et al., 2015). The sub-dimensions with accompanying descriptions are taken directly from Trumpp et al. (2015) and are:

- Environmental policy: This constitutes an organization-wide pledge for responsibility towards the natural environment and states the organization's philosophy regarding improvements of the EOP
- Environmental objectives: This refers to specific environmental goals and targets to translate the environmental policy into actions.
- Environmental processes: This refers to concrete organization procedures designed to enhance environmental operation performance.
- Organizational structure: This refers to formal management structures implemented to realize the environmental goals.
- Environmental monitoring: This refers to review procedures and corrective actions that should ensure continuous improvements of environmental operation performance.

Each of these sub dimensions is measured by aggregating multiple indicators, which are based on survey questions about these dimensions. The specific indicators used can be found in table 5 and were based on the paper by Trumpp et al. (2015). For all these questions, firms could answer either yes, no or NA. For each of these sub dimensions, a score was calculated by dividing the number of Y by the total number of questions answered either Y or N meaning that this score ranges from 0-1. This also means that all sub dimensions are considered to be of equal importance to the total EMP dimension. These five scores were then summed and this score was then standardized in order to arrive at the final EMP measure.

ASSET4 code:	Question description:	Possible answers:
Environmental policy:		
ENRRDP0011	Does the company have a policy to improve its water efficiency?	No, NA and yes
ENRRDP0012	Does the company have a policy to improve its energy efficiency?	No, NA and yes
ENRRDP0013	Does the company have a general, all-purpose policy regarding resource efficiency?	No, NA and yes
ENRRDP0014	Does the company have a policy to improve its use of sustainable packaging?	No, NA and yes
ENRRDP0015	Does the company have a policy to lessen the environmental impact of its supply chain?	No, NA and yes
ENPIDP0011	Does the company have a product life-cycle assessment policy?	No, NA and yes
ENPIDP0012	Does the company have an eco-design policy?	No, NA and yes
ENPIDP0013	Does the company have a dematerialization policy?	No, NA and yes
ENPIDP0014	Does the company have a general, all-purpose policy regarding environmental product innovation?	No, NA and yes
Environmental objectives:		
ENRRDP0191	Has the company set targets or objectives to be achieved on water efficiency?	No, NA and yes
ENRRDP0192	Has the company set targets or objectives to be achieved on energy efficiency?	No, NA and yes
ENRRDP0193	Has the company set targets or objectives to be achieved on general resource efficiency?	No, NA and yes
ENRRDP0194	Has the company set targets or objectives to be achieved on its use of sustainable packaging?	No, NA and yes
ENRRDP0195	Has the company set targets or objectives to be achieved on the environmental impact of its supply chain?	No, NA and yes
Environmental processes:		
ENRRDP029	Does the company describe, claim to use environmental criteria (e.g., life-cycle assessment) to source or eliminate materials?	No, NA and yes
ENRRDP058	Does the company use environmental criteria (ISO 14000, energy consumption, etc.) in the selection process of its suppliers or sourcing partners?	No, NA and yes
ENRRDP0121	Does the company describe, claim to have or mention processes in place to improve its water efficiency?	No, NA and yes
ENRRDP0122	Does the company describe, claim to have or mention processes in place to improve its energy efficiency?	No, NA and yes
ENRRDP0123	Does the company describe, claim to have or mention processes in place to improve its resource efficiency in general?	No, NA and yes
ENRRDP0124	Does the company describe, claim to have or mention processes in place to improve its use of sustainable packaging?	No, NA and yes

ENRRDP0125	Does the company describe, claim to have or mention processes in place to include its supply chain in the company's efforts to lessen its overall environmental impact?	No, NA and yes
Organizational Structure:		
ENRRDP004	Does the company have an environmental management team?	No, NA and yes
ENRRDP008	Does the company train its employees on environmental issues?	No, NA and yes
ENERDP0053	Does the company describe, claim to have or mention processes in place to maintain an environmental management system?	No, NA and yes
ENERDP074	Does the company claim to have an ISO 14000 or EMAS certification?	No, NA and yes
Environmental monitoring:		
ENRRDP066	Does the company conduct surveys of the environmental performance of its suppliers?	No, NA and yes
ENRRDP0131	Does the company claim to use key performance indicators (KPI) or the balanced scorecard to monitor water efficiency?	No, NA and yes
ENRRDP0132	Does the company claim to use key performance indicators (KPI) or the balanced scorecard to monitor energy efficiency?	No, NA and yes
ENRRDP0133	Does the company claim to use key performance indicators (KPI) or the balanced scorecard to monitor resource efficiency in general?	No, NA and yes
ENRRDP0134	Does the company claim to use key performance indicators (KPI) or the balanced scorecard to monitor its use of sustainable packaging?	No, NA and yes
ENRRDP0135	Does the company claim to use key performance indicators (KPI) or balanced scorecard to monitor the environmental impact of its supply chain?	No, NA and yes

Table 5: *ASSET4 EMP survey questions.*

Control variables:

The control variables for the regression are consistent with the literature and specifically, Trumpp & Guenther (2015). This paper therefore uses six control variables. These are:

1: The level of R&D as measured by R&D expenses divided by sales. R&D expenses/investments are often necessary for a firm in order to stay competitive. Literature has found that R&D spending can have a positive influence on long term financial performance. However, as R&D benefits can take time to materialize, a negative relationship on financial performance in the short run has also been observed in the literature (Hart & Ahuja, 1996; Iwata

& Okada, 2011; Fujii, Iwata, Kaneko, & Managi, 2013). For these reasons, the expected coefficient sign of R&D spending is unclear (+/-).

2: Company size is measured as the natural logarithm of total assets. Previous literature has argued that company size is of influence on the company's profitability with arguments being made for either a positive or a negative relationship (King & Lenox, 2002; Iwata & Okada, 2011; Wang, Li, & Gao, 2013). For this reason, the expected coefficient sign is unclear (+/-).

3:. Capital intensity is measured by dividing capital expenses by beginning-of-the-year total assets. Research has been inconclusive on what effect capital intensity has on the financial performance of a firm (Hart & Ahuja, 1996; King & Lenox, 2002; Wang, Li, & Gao, 2013). However, research has concluded that it is a determinant of financial performance in some way and therefore it is included as a control variable with an expected sign of the coefficient of +/-.

4: Leverage indicates how much debt a firm has compared to its assets. A higher leverage generally indicates more risk and therefore it is considered to have a negative effect on CFP (Martínez-Ferrero & Frías-Aceituno, 2013; Iwata & Okada, 2011; Wang, Li, & Gao, 2013). Leverage is measured by dividing total debt of a firm by total assets and the corresponding expected coefficient is negative (-).

5: Growth of a firm can indicate that they have entered new markets successfully or that they have successfully introduced new products. According to the literature this can lead to higher returns and thus have a positive effect on CFP with a corresponding expect sign (+) (Iwata & Okada, 2011; King & Lenox, 2002; Al-Tuwaijri, Christensen, & Hughes, 2004). Growth is measured as: (Current Year's Total Assets / Last Year's Total Assets - 1) * 100.

6: A large free cash flow is considered beneficial to CFP, while also being a consequence of strong financial performance (Clarkson, Li, Richardson, & Vasvari, 2011). Therefore this variable is considered to have a positive influence on CFP, and a corresponding positive sign (+).

It is measured as net cash flow divided by sales. Table 6 shows the descriptive statistics of the full dataset.

Variable	*Observations*	*Mean*	*Std. dev.*	*Minimum*	*Maximum*
CFP (ROA)	*9,987*	*6,46*	*10,91*	*-122,06*	*269,11*
CFP (TSR)	*9,645*	*14,22*	*53,56*	*-99,69*	*1598,28*
EMP	*8,484*	*0,42*	*0,25*	*0*	*1*
R&D	*3,995*	*5,27*	*21,12*	*-0,58*	*825,42*
SIZE	*7,975*	*13,92*	*1,64*	*6,82*	*19,31*
CAPIN	*9,510*	*4,88*	*6,23*	*0*	*119,05*
LEV	*10,203*	*25,16*	*20,28*	*0*	*269,79*
GRO	*9,976*	*10,26*	*31,48*	*-93,17*	*591,47*
CF	*10,156*	*15,20*	*44,39*	*-1461,16*	*654,39*

Table 6: *Descriptive statistics of variables.*

These descriptive statistics show that R&D has signficantly less observations than all the other variables, which would severely limit the sample size, therefore this variable is dropped.

Table 7 shows the descriptive statistics of variables for the samples used for the ROA and TSR regressions for the models without time lags.

Variables for ROA regressions:	***Observations***	***Mean***	***Std. dev.***	***Minimum***	***Maximum***
CFP (ROA)	*6.615*	*7,21*	*10,78*	*-122,06*	*269,11*
EMP	*6.615*	*0,44*	*0,25*	*0*	*1*
SIZE	*6.615*	*14,18*	*1,53*	*7,89*	*19,31*
CAPIN	*6.615*	*5,42*	*5,63*	*0*	*104,07*
LEV	*6.615*	*25,76*	*19,25*	*0*	*253,79*
GRO	*6.615*	*8,94*	*29,91*	*-93,05*	*591,47*
CF	*6.615*	*13,75*	*37,31*	*-1461,16*	*160,05*
Variables for TSR regressions:	***Observations***	***Mean***	***Std. dev.***	***Minimum***	***Maximum***
CFP (TSR)	*6.513*	*14,15*	*54,16*	*-94,06*	*1598,28*
EMP	*6.513*	*0,44*	*0,25*	*0*	*1*
SIZE	*6.513*	*14,19*	*1,53*	*7,89*	*19,31*
CAPIN	*6.513*	*5,40*	*5,62*	*0*	*104,07*
LEV	*6.513*	*25,61*	*18,91*	*0*	*253,79*
GRO	*6.513*	*8,64*	*28,24*	*-93,05*	*591,47*
CF	*6.513*	*13,72*	*37,52*	*-1461,16*	*160,05*

Table 7: *Descriptive statistics of variables for regression samples.*

Table 8 shows the values of ROA, TSR and EMP over the observed years for the full dataset. It can be seen that EMP has been increasing up until 2012 after which a decline sets in.

Variable/year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
ROA	8,57	9,23	5,59	4,50	7,51	6,35	5,60	6,15	5,99	5,41
TSR	34,62	11,55	-38,08	45,74	25,36	-8,75	20,15	32,25	8,21	12,17
EMP	0,20	0,32	0,40	0,43	0,44	0,46	0,49	0,48	0,47	0,43

Table 8: Average of selected variables.

Table 9 provides a summary of pairwise Pearson correlations and shows that the majority of correlations are very small and below the 0.01 significance level. This means that these correlations do not pose a problem for the further analysis.

Measure:	***CFP(ROA)***	***CFP(TSR)***	***EMP***	***R&D***	***SIZE***	***CAPIN***	***LEV***	***GRO***	***CF***
CFP (ROA)	*1*								
CFP (TSR)	*0,168****	*1*							
EMP	*-0,068****	*-0,031***	*1*						
R&D	*-0,245****	*0,004*	*-0,116****	*1*					
SIZE	*-0,096****	*-0,061****	*0,499****	*-0,158****	*1*				
CAPIN	*0,131****	*0,006*	*-0,062****	*-0,107****	*-0,103****	*1*			
LEV	*-0,096****	*-0,097****	*0,048****	*-0,154****	*0,057****	*0,061****	*1*		
GRO	*0,169****	*0,121****	*-0,121****	*0,011*	*-0,063****	*0,25****	*-0,022***	*1*	
CF	*0,226****	*0,028****	*-0,024****	*-0,671****	*0,045****	*0,069****	*0,046****	*-0,002*	*1*

Table 9: *Summary of pairwise correlations.* *The stars represent the level of significance where:* **<0.10 **<0.05 ***<0.01*

3.3 Econometric model

The econometric model takes the following shape:

$$CFP_{ROA/TSR} = \beta_0 + \beta_1 EMP_{it-n} + \beta_2(EMP_{it-n})^2 + \beta_3 R\&D_{it} + \beta_4 SIZE_{it} + \beta_5 CAPIN_{it} + \beta_6 LEV_{it} + \beta_7 GRO_{it} + \beta_8 CF_{it} + Year\_Controls + e$$

The subscript of i in this model stands for firms, while the t stands for the year. Subscript n is incorporated in order to account for time lags. The regression is run for both TSR and ROA as the dependent variable. The quadratic term allows for a non-linear relationship and the model for the linear relationship simply loses this term. Similarly, testing for reverse causality is achieved by switching the EMP and CFP variables. For testing for a time lag effect, lagged variables of EMP are added.

For analyzing the data, the choice between a fixed-effects model or a random-effects model is made. Theoretically, the fixed-effects model seems more appropriate, because it captures the firm specific time-invariant characteristics that each firm has. This enables us to isolate the effects of the other variables included. Still, a Hausman-Taylor test will also be done in order to see which model is more appropriate. When a fixed-effects model is more appropriate, then this means that industry-control dummy variables are not possible or necessary. Since the industry variable is constant within the firm variable and since the fixed effects estimator takes out all the variance at the group level, there is nothing left for industry control dummies to explain. The same can be said about different country-control variables.

3.4: Regression steps

In order to uncover whether the data is better explained by a non-linear equation or a linear one, both models are tested by means of a panel-data regression. All variable were standardized for easier interpretation. Additionally, reverse causality was tested for by switching EMP and CFP. Finally, all steps were done separately for both ROA and TSR as the CFP variable.

The following steps were undertaken
1: R&D expenses was dropped as a control variable.
2: A Hausman Taylor test is conducted for both the linear and non-linear model to see which model is preferred for the panel data, random-effects or fixed-effects. The preferred model is used in the following steps.
3: The linear regression is compared to a non-linear one.

4: Reverse causality is tested by switching EMP and CFP. This is done for both a non-linear and linear model.
5: Three time lags of EMP are incorporated to see if a time component can help better explain the results.
6: Finally, a conclusion on the best model is made.

Chapter 4: Results

4.1 Description of tests of hypotheses and models:

Tables 10 & 11 summarize the main results of the regressions. Table 10 shows the results for ROA and table 11 for TSR. The hypotheses formed from the theory that were subsequently tested are:

H0: The relationship between EMP and financial performance takes a linear form.
H1: The relationship between EMP and financial performance takes a non- linear form.
H2a: The relationship between EMP and financial performance follows an inverted U-shaped pattern.
H2b: The relationship between EMP and financial performance follows a U-shaped pattern.
H3: The relationship between EMP and financial performance is better explained by adding time lags of EMP.

In the tables below, M1 is the base model, linear or non-linear, this is used to answer H0, H1, H2a and H2b. M2 is the model that tests for reverse causality and M3 is the base model expanded with time lags. Furthermore, for all models, the Hausman Taylor test showed the fixed effects model to be the best model for our data.

H0 and H1 are viewed as two mutually excluding opposites. This means that if H0 is accepted, H1 must be rejected and vice versa. The coefficient of EMP in the linear model will be compared to the coefficients of EMP and EMP2 of the non-linear model. The model that yields the best

results in the form of significance levels of these variables will lend support to the corresponding hypothesis. If H1 is accepted then the coefficient signs, positive or negative, of EMP and EMP2 will determine if H2a or H2b is accepted or rejected. With these hypotheses, the rejection of one does not mean the acceptance of another as there are other non-linear shapes than U-shapes.
H3 is accepted when the three time lag variables are significant at any of the three significance levels. If one or two out of three variables are significant then this hypothesis is partly supported.

4.2 Results of tests of hypotheses for ROA:

The results of the base model (M1) regressions show that the non-linear model explains the data better. The EMP coefficients of the non-linear model are more significant with EMP2 being significant at all levels and EMP just missing the significance level of 0,1 with a value of 0,107 while the coefficient of EMP for the linear model is not significant at any level. This means that H0 is rejected and H1 is accepted.
Furthermore, the coefficient of EMP is negative, while that of EMP2 is positive. These results support the theory that the relationship between EMP and ROA is non-linear and U-shaped as posited by hypothesis H2b; meaning that H2b is accepted and H2a rejected.
The last hypothesis that was tested, checks whether the incorporation of time lags improves the model. M3 is the model that has a time lag variable of EMP of 1, 2 and 3 years. All these variables are insignificant for both the linear and non-linear models, suggesting they do not improve the model and H3 is therefore rejected.
Finally, the possibility of reverse causality is tested by comparing M1 to M2. In both the linear and non-linear model, the results of the base model are better than that of M2, suggesting that reverse causality is not applicable here. Finally, the size of the coefficient of EMP is not very large with most control variables affecting ROA more. However, it is not small enough to be ignored and there seems to be reasonable potential for improving ROA in this way.

ROA results:						
	Linear model	Linear model	Linear model	Non-linear model	Non-linear model	Non-linear model
Model:→	**M1**	**M2**	**M3**	**M1**	**M2**	**M3**
EMP	-0,411		-0,918*	-0,471#		-1,074*
EMP2				0,415***		0,643**
EMP L1			0,229			0,246
EMP L2			-0,416			-0,451
EMP L3			-0,299			-0,416
ROA		-0,002			-0,0006	
ROA2					-0,0003**	
Control var.						
Size	0,295	0,005	-0,891	0,31	0,004	-0,881
Capital Intensity	0,745***	-0,0005	0,028	0,727***	0,004	0,015
Leverage	-3,672***	-0,003	-4,721***	-3,68**	-0,0006	-4,752***
Growth	1,120***	0,001	2,032***	1,117***	-0,0003	2,042***
Cash Flow	2,205***	-0,003*	7,766***	2,21***	0,004*	7,717***
N of obs.	6.615	6.615	4.341	6.615	6.615	4.341
N of groups	821	821	720	821	821	720
Within R^2	0,1304	0,6354	0,1629	0,1315	0,6357	0,1640
Table 10: results for ROA	*The stars represent the level of significance where:*	**<0,10* ***<0,05* ****<0,01*		Note #:M1 for non-linear has a significance of 0,107		

4.3 Results of tests of hypotheses for TSR:

The results of the base model (M1) regressions show that the non-linear model explains the data better. The linear model does not reach any significance level while the non-linear model has a significant coefficient for EMP2. This provides some support for H1 and H0 is rejected. However, the coefficient of EMP for the non-linear model is not significant at any level either, furthermore, both EMP and EMP2 are positive. These results do not support any U-shaped form and do not support hypothesis H2a or H2b. Additionally, all the coefficients of the lagged EMP variables are insignificant for both the linear and non-linear models, meaning that H3 is also rejected. Lastly, in both the linear and non-linear model, the results of the base model are better than that of M2 suggesting that reverse causality is not applicable here. Finally, the size of the

coefficient of EMP is a bit small with all control variables affecting TSR much more. This seems to indicate that the potential of EMP to affect the TSR is small.

TSR results:						
	Linear model	Linear model	Linear model	Non-linear model	Non-linear model	Non-linear model
Model:→	**M1**	**M2**	**M3**	**M1**	**M2**	**M3**
EMP	0,452		5,012*	0,171		4,1
EMP2				1,888**		3,761*
EMP L1			-0,433			-0,331
EMP L2			2,361			2,155
EMP L3			3,288			2,606
ROA		-0,0003			0,0002	
ROA2					0,0001**	
Control var.						
Size	-25,215***	0,005	-30,611***	-25,161***	0,005	-30,554***
Capital Intensity	-4,276***	-0,001	-8,137	-4,361***	-0,001	-8,212***
Leverage	-12,832***	-0,001	-8,386***	-12,879***	-0,001	-8,573***
Growth	5,923***	-0,001	5,454***	5,912***	-0,001	5,512***
Cash Flow	4,26***	-0,004*	22,681***	4,281***	-0,004*	22,395***
N of obs.	6.513	6.513	4.328	6.513	6.513	4.328
N of groups	801	801	719	801	801	719
Within R^2	0,2383	0,6321	0,1384	0,2388	0,6321	0,1391

Table 11: results for TSR *The stars represent the level of significance where:* **<0,10* ***<0,05* ****<0,01*

4.4: Summary and discussion of results:

Table 12 below summarizes the results of the regression. The results of the regressions seem to indicate that causality in the data is moving from EMP to CFP and not the other way around. Furthermore, a time lag does not help in explaining the data for either measure of CFP, so H3 is rejected in both cases. However, the regressions do show that non-linear models are better suited for explaining the EMP-CFP relationship, disproving H0 for both measures of CFP and accepting H1. However, for TSR both H2a and H2b are rejected, meaning that there is no evidence for either an inverted U-shaped curve or a U-shaped curve. For ROA there is evidence for a U-shaped curve and H2b is accepted.

The fact that the EMP-ROA non-linear relationship receives more support than that of the EMP-TSR relationship contradicts researchers that believe EMP affects different measures of CFP similarly. However, it is in line with the meta-analysis of Albertini (2013) who finds that accounting-based indicators are more positively affected by EMP than market-based indicators. According to Albertini (2013), this is because organizational capabilities developed through environmental management activities are hard to measure and consist mostly out of tacit knowledge that is difficult to incorporate in stock prices and cannot be traded easily between firms. Therefore, much of the positive effects of EMP only translate into factors that improve accounting-based indicators and not market-based indicators. Another explanation might be that investors do not view environmental performance relevant for the firms profitability or long term survival and therefore not include a premium on firms who perform well in this regard.

Regarding H3, the results of this paper do not support the notion that the effects of EMP are spread out in the three years after implementation. However, these results are somewhat in line with Albertini (2013) who finds that the relationship of the overall construct of CEP (CEM in her paper) is significantly stronger when measured by papers that are non-longitudinal in nature as opposed to longitudinal studies. Referring back to the theory in this paper, it seems that most of the effects of EMP are felt in the year of implementation, which may suggest that there is more low hanging fruit or immediate improvements versus effects over longer time periods.

CFP variable:	ROA	TSR
H0: The relationship between EMP and financial performance takes a linear form.	✘	✘
H1: The relationship between EMP and financial performance takes a non- linear form.	✓	✓
H2a: The relationship between EMP and financial performance follows an inverted U-shape pattern.	✘	✘
H2b: The relationship between EMP and financial performance follows a U-shape pattern.	✓	✘
H3: The relationship between EMP and financial performance is better explained by adding time lags of EMP.	✘	✘

Table 12: Hypotheses either rejected ✘, or accepted ✓.

Chapter 5: Conclusion & discussion

This paper expands on the literature on Corporate Environmental Performance and Corporate Financial Performance by examining the link between Environmental Management Performance and Return on Assets and Total Stock Return. It evaluates if there is evidence for a non-linear relationship in the form of an U-shaped or inverted U-shaped curve. Additionally, the occurrence of time lagged effects of EMP on CFP was investigated and reverse causality was addressed. The aim of this study is to contribute to the understanding of the relationship between EMP and CFP by further exploring the possibility of non-linearity in the form of either U-shaped or inverted U-shaped curves and evaluating a time component.

The results of the paper support a non-linear U-shaped relationship between EMP and ROA. The paper does not find evidence for either an inverted U-shaped relationship or a U-shape

relationship between EMP and TSR, although there seems to be some support for non-linearity over a linear relationship. For ROA, the results of the regressions support the theory that a certain threshold of EMP needs to be reached, before the positive effects outweigh the negative effects. For the CFP measure of TSR however, this is not the case. The additional hypothesis of EMP having a different effect on CFP in different years after implementation does not find any support either. Causality does seem to flow in the direction supposed by this paper, however.

The results of the paper support some of the results found by researchers such as Riillo (2017) and Trumpp & Guenther (2015), who both find a U-shaped non-linear relationship for their CEP data and CFP. The research of Trumpp & Guenther (2015) is similar in their methodology, but uses measures of EOP instead of EMP while using the same measures for CFP. However, unlike this paper, they also find a U-shaped relationship for the TSR measure of CFP. A possible explanation for this might be that investors are better able to see the EOP, measures as opposed to the EMP ones and that therefore, the U-shaped relationship does occur when EOP is used over EMP.

Furthermore, although this paper does present some theory on why market-based measures such as TSR might be affected by EMP, some researchers such as Albertini (2013) posit that EMP mostly or even only affects accounting based measures such as ROA. A stronger relationship between EMP-ROA vs EMP-TSR is also supported by the natural-resource based view of the firm, since this supports the acquisition of tacit skills and competencies that are hard to see by the market, but do affect daily operations and profitability in the form of ROA. This might explain some of the results found in this paper. Additionally, some researchers, (Albertini, 2013; Dixon-Fowler, Slater, Johnson, Ellstrand, & Romi, 2013) have found firms from the USA to profit more from CEP than their international counterparts, so future research with a dataset from this country might provide more evidence on whether the results of this paper hold. Additional future research could try and incorporate some EOP dimensions of CEP and evaluate whether these actually relate the same way towards CFP and if not, what causes these differences. More research on TSR and EMP could also shed more light on the questions whether EMP can improve TSR.

Different measures of both EMP and CFP could also be tested in order to see if the results of this paper hold under different measures.

A limitation of this study is that it does not test the theories that work in the EMP-CFP relationship separately and that it only views the net results of the variables included. Further research might explore the different theoretical underpinnings of this paper separately. It might be useful to see what theories work in practice and qualitative research might be better suited for this. In addition, the dataset used depended on what firms ASSET4 had data on and these tended to be large corporations which leaves the question open if smaller firms benefit the same from EMP. Previous research (Albertini, 2013) has shown that the relationship between CEP and CFP is weaker in Europe, than in the USA or Canada. The reason for this is thought to be, that more stringent environmental regulation in Europe means that firms have less room for improving their environmental performance (Albertini, 2013; Riillo, 2017). Research in the future might explore whether the conclusions of this paper hold in those countries. The relationship between TSR and EMP in particular might be different for those countries.

For practitioners in business, it can be useful to know what parts of an EMS or what parts and sub-dimensions of EMP have the largest influence on financial performance of a firm. Follow-up research could evaluate sub-dimensions separately to answer this question. Furthermore, this paper provides more evidence that engaging in environmental activities and improving EMP can make sense from a ROA-focused standpoint. However, a firm has to be willing to invest enough time and resources into improving EMP until the threshold and tipping point is reached, as before this point the relationship between EMP and ROA is negative and only after this point does improving EMP yield increases in ROA. However, it seems that firms who perform poorly at EMP are not punished financially and perform better financially than those companies scoring an average EMP value. For this reason this paper does not succeed in providing a strong argument why profit-driven firms should engage in EMP, as refraining from it seems a viable option. Further research may find different results and perhaps build a convincing argument for profit-driven managers to engage in EMP. For a manager seeking to affect the stock price, the potential of EMP seems to be very limited which seems to indicate that investors either do not care about

EMP or are not able to see this performance well and further research might find out which one is applicable here.

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