Radboud Universiteit Nijmegen

The influence of environmental performance disclosures on firms' financial performance

Master Thesis Economics

Specialization: International Business

By Nicky Bruyn

s4482794

Thesis supervisor: Dr. A. Fytraki

Summary

This study investigated the relationship between environmental performance disclosures by companies and their financial performance, measured as the Return On Assets. The research employed yearly data from the ASSET4 database and included 2,440 observations from 223 different companies over a time span of 10 years, ranging from 1 January 2007 until 31 December 2017. Previous literature indicates that there is a lack of detailed measurement of environmental performance disclosures and that, in general, research on this topic is scarce. Therefore, this study employed detailed dimensions of environmental performance disclosures, where a distinction was made between hard and soft environmental performance indicators, based on the indicators as proposed by Clarkson, Fang, Li, and Richardson (2013). The main results as presented by this study are as follows: First, the results indicated that there is a significant, though small, positive relationship between the disclosure of environmental spending and Return On Assets, as predicted by Hypothesis 5. However, for the rest, no overall significant results were found for the rest of the dimensions, which were with regard to the disclosure of an environmental governance structure, the implementation of environmental management systems (such as EMAS and ISO certifications), the credibility of the company and the pooled soft environmental performance indicators. Moreover, it was concluded that soft environmental performance disclosures have a stronger effect on Return On Assets than hard environmental performance disclosures, but no concluding remarks could be given as to the direction of these relationship, so whether there is an overall negative or positive influence of the environmental performance indicators on financial performance. Overall, no overarching one-directional relationship between environmental performance disclosures and financial performance was found.

Table of contents

1) Introduction

This research investigates the relationship between environmental performance disclosure and financial performance of firms, measured by the Return on Assets. Environmental performance disclosure is the disclosure of information by a firm on how they perform environmentally, such as specific environmental impacts or policies for improvement. In order to tackle this century's problem of climate change, it is necessary to have more insight in the extent environmental performance of companies. Therefore, there has been an increasing interest in the literature in firms' disclosure of their environmental performance and its determinants and effects (e.g. Lee, Park, & Klassen, 2013; Hahn, Reimsbach, & Schiemann, 2015). One avenue of research on this topic is the influence of environmental information disclosure on financial performance of firms, to see how the market reacts to the disclosure of this information (e.g. Clarkson, Li, Richardson, & Vasvari, 2008). One type of environmental information disclosure is voluntary information disclosure, where firms can choose whether or not to disclose, the extent of disclosure and the content they disclose themselves (Hahn et al., 2015). It is a relatively new field of study, since environmental reporting has gained popularity in interest only in the recent decade (Hahn et al., 2015). This research contributes to this debate with an empirical analysis that tries to answer the following research question:

"How does environmental performance disclosure influence financial performance?"

Within the literature, a distinction is made between hard and soft disclosure, where hard performance disclosures are easily measured by third parties and can be verified, such as disclosing the implementation of a certified environmental management system (ISO, EMAS) and environmental expenditure (Clarkson, Fang, Li, and Richardson, 2013). Soft performance disclosure indicators are much harder to verify (Clarkson et al., 2013). In line with the need for more diverse measures of information disclosure (Hahn et al., 2015), this research contributes to this research gap, as well as a practical contribution to firms on how more detailed types of information disclosure can affect their financial performance. This leads to the following subquestions:

1. *What is the influence of hard environmental performance disclosure on financial performance?*
2. *What is the influence of soft environmental performance disclosure on financial performance?*
3. *What is the difference between the effect of hard and soft environmental performance disclosure on financial performance?*

1.1) Research problem and motivation

Lee, Park, and Klassen (2013) confirm that previous studies on the relationship between environmental information disclosure and firm performance are still limited in general, for the following reasons: First, the area of research in general is still relatively new. Second, previous studies have focused on Western countries in considering market responses to the information disclosure. Few addressed information disclosure in a more diverse set of countries. Third, different studies have produced mixed results, which entails that the relationship is still unclear.

In addition, Hahn, Reimsbach, and Schiemann (2015) indicate that research on the effects of environmental disclosure in general is still scarce and underrepresented. Moreover, they indicate that in these studies there is a lack of detailed measures of environmental performance disclosures and that future research should assess more detailed dimensions of disclosure in relationship to financial performance.

It is evident that more research is needed on the different dimensions of environmental performance disclosure, to deepen the insights of the market effects of information disclosure and type of information disclosure. This research contributes to the limited previous research on the relationship between environmental performance disclosures and financial performance and also includes more diverse measures and subdimensions of hard and soft environmental performance disclosures. This study also employs more detailed measures of these two types of environmental performance disclosure, by also testing the relationships between subdimensions of these types and financial performance.

1.2) Overview research methodology

As is a common method within the environmental performance information disclosure research, this study performed a random effects time regression, using yearly panel data for 223 companies over a time span of 10 years, from 1 January 2007 until 31 December 2017. The environmental performance disclosure indicators were grouped in hard and soft reporting measures, as classified by Clarkson et al. (2013), who made a distinction between soft and hard information disclosure items based on the General Reporting Initiative standards. Financial performance indicators were reviewed from prior research (e.g. Gerschewksi & Shufeng Xiao, 2015) and eventually, Return on Assets was chosen as the dependent variable, in line with much of the previous research. Several control variables were employed: Firm size, book value per share, earnings per share, industry and country (Magness, 2006). The data was collected from the ASSET4 database, where for each of the specific indicators as posed by Clarkson et al. (2013), similar variables within this database were searched for.

2) Literature review and hypothesis development

2.1) Environmental performance disclosure

Firms engage in environmental performance disclosure for two main reasons: First, when it is mandated by legislation, so the firm is obliged to disclose information and does not have a choice as to whether or not to report. Second, firms can choose to voluntarily disclose environmental information.

There are two main streams of literature on why firms would voluntarily disclose this kind of information: First, Voluntary Disclosure Theory (VDT) proposes that information disclosure is used as a mechanism for reducing information asymmetry between managers and investors and other stakeholders (Guidry & Patten, 2012). Moreover, it proposes that firms will, in general, be more likely to disclose positive information and withhold negative information (Bewley & Li, 2000). In this line of thinking, it is expected that firms that do environmentally well are the firms that disclose the most information (Silva-Gao, 2012) and do so in order to increase their market value (Hummel & Schlick, 2016). Legitimacy Theory perspective proposes the opposite of VDT, in that the firms that perform poorly environmentally are the ones that disclose the most information and use the information disclosure to influence the public's and other stakeholders' perception of the firm's environmental performance (Hummel & Schlick, 2016). This is usually the case when there is external political and social pressure from different stakeholders on the firm and their legitimacy is threatened and therefore, they choose to disclose environmental information to change the perceptions of these stakeholders in favor of the firm (Clarkson et al., 2008). Despite the differences between the perspectives in motivation for information disclosure, both have in common that they indicate that firms try to create a positive reputation through environmental performance disclosure, since investors value environmental information disclosure in assessing the environmental risk and future firm value, which contributes to their decision to invest or not (Moneva & Cuellar, 2009). Qiu, Shaukat, and Tharyan (2016) agree and indicate that environmental performance disclosure can enhance reputation and consequently also firm value.

Key to this view on environmental disclosure is the link with actual underlying environmental disclosure. From the perspective of VDT, much and detailed information disclosure reflects a good underlying environmental performance (e.g. Guidry & Patten, 2012). On the other hand, Legitimacy Theory describes that much and detailed information disclosure might reflect a bad underlying environmental performance (e.g. Hummel & Slick, 2016).

In general, there are three broad categories of studies on environmental performance disclosure (Clarkson et al., 2008): Studies that examine the valuation relevance of environmental performance information, studies that research managerial decision-making with regard to disclosing potential environmental risks and liabilities and studies that explore the relationship between environmental performance disclosure and environmental performance. As is most relevant for this research, the studies researching the valuation relevance of environmental reporting are reviewed in this section.

2.2) Hard and soft environmental performance disclosure

Within the information disclosure literature, a distinction can be made between “hard” and “soft” environmental performance disclosure (Clarkson et al., 2008, p. 7). Hard performance disclosure pertains to objective measures of environmental indicators that cannot easily be computed by environmentally poorly performing firms, meaning that the hard disclosure items are measurable, quantifiable and credible (Clarkson et al., 2008). These performance disclosures are also reliable, in that third parties are able to check whether the information provided on the performance is true or not. In contrast, soft information items are harder to verify than hard disclosure items and consist of claims of commitment to the environment and include firms’ environmental policies and reported initiatives, such as initiatives for waste reduction, better energy efficiency and green building policies (Qiu, Shaukat, & Tharyan, 2016). When considering the actual underlying environmental performance, hard information disclosure on performance is more likely to reflect the actual performance of the firm, since it can be checked by third parties, so it is discouraging for firms to disclose hard information that is not true. In contrast, soft disclosures do not necessarily need to reflect the true underlying performance, since it is harder to check whether firms really do what they say they do and what the quality is of their efforts. Even though environmental performance disclosure is usually closely related to actual performance, the distinction between soft and hard disclosure describes that there can be a varying degree to which the disclosure actually reflects the real performance.

2.3) Hard environmental performance disclosure and financial performance

Clarkson et al. (2013) researched the influence of hard and soft disclosure items on firm valuation for public companies in five polluting industries in the USA and indicate that if the information disclosures are perceived as credible by investors and provide additional information as to what investors already know, it will increase firm value. They provide a classification on hard and soft disclosure performance, based on the standards of the Global Reporting Initiative.

They employed three models for determining the effect of environmental disclosure on firm value: The first is the firms’ stock price at the end of the years 2004 and 2007, the second is the cost of capital for the firm and the third measures the long term financial performance, measured as the Return On Assets over a longer time span. For all models, they used as a control variable an aggregate variable on actual environmental performance. They found a significant positive relationship between hard environmental performance disclosure and stock price and Return On Assets, but no relation to cost of capital. The literature on hard performance disclosure is reviewed along the dimensions presented by Clarkson et al., 2013) in the following order: Governance structure and management systems, credibility, environmental performance indicators and environmental spending.

2.3.1) Governance structures and management systems

Concerning the firm value relevance of environmental governance structures, Iatridis (2013) did a study on 529 listed Malaysian companies and his empirical findings indicate that firms with effective environmental governance structures have increased likelihood to face less capital constraints, so have less difficulty obtaining funding and capital. Moreover, he indicates that firms with a special auditing committee or independent auditors within their board of directors for these topics reduce information asymmetries, which also decreases the average capital constraints. In addition, Iatridis (2013) indicates that usually the environment reporting quality is higher within firms that have internal audits or audits by independent agents, which is valuable for investors and increases stock valuation.

One example of the creation of environmental governance structures is the implementation of Environmental Management Systems (EMS), where the system is certified according to the ISO 14001 guidelines for environmental organization and integrates environmental protection policies, programs and operations (Morrow & Rondinelli, 2002). Morrow and Rondinelli (2002) point out potential benefits to implementing such an EMS, including cost saving due to improved efficiency and reduced cost of energy, materials and fines due to environmental incidents, but also benefits in terms of increased investor confidence and it can serve as a competitive edge over other who have not implemented such a system. However, Bansal and Bogner (2002) indicate that even though the EMS implementation can earn its costs back multifold over time, the initial investment to change to the EMS is very high and it takes much time to earn it back. In addition, there are ongoing costs of maintaining documentation, especially when wanting to have it approved by, for example, the ISO 14001 or (Bansal & Bogner, 2002). Moreover, implementing an EMS will automatically expose environmental risk to the outside world, because it often sheds light on areas where environmental impacts were not yet considered before (Bansal & Bogner, 2002). However, they indicate that, still, the benefits can outweigh the costs, but that depends per firm. In addition, Bansal and Bogner (2002) emphasize that having the firm's EMS certified is important, since it adds credibility to the quality of the EMS. That being said, one study by Cañón-de-Francia and Garcés-Ayerbe (2009) indicates a negative relationship between certification and market value. They performed an event study on 32 Spanish firms, to which belonged 80 plant certifications by the ISO 14001 guidelines in the years 199602002. They found a negative relationship between the announcement of ISO 14001 certification and market value. This indicates that in the perception of investors, the expected profits that they associate with the ISO 14001 standards are smaller than the expected costs. The authors add that it also might be the case that investors see the adoption of the ISO 14001 standards as a response to institutional pressures and not because the firm is motivated in itself to improve its environmental performance and efficiency. In contrast, Nishitani (2011) performed a study on the effect of EMS systems' quality and the added value of the firm and found a positive relationship in a sample of 871 Japanese manufacturing firms in the period 1996-2007. This explained through the improvement of

productivity, since excessive environmental impact can be a sign of inefficient manufacturing processes. In addition, Nishitani (2011) indicates that there also can be a demand effect, where more environmentally conscious customers start buying more of the firm's products or services. However, Nishitani (2011) agrees with Bensal and Bogner (2002) that there can be a substantial lag between the start of a firm's efforts to increase environmental performance and the start of getting positive economic returns. Based on the insights of the literature reviewed, it is expected the following relationships exist: First, having a special environmental department or auditing committee is positively related to firm value, is explained by Iatridis (2013), which leads to the first hypothesis:
H1: There exists a positive relationship between disclosing the implementation of an environmental governance structure and financial performance.

Moreover, there seems to be a relationship between the implementation of an EMS and the adherence to ISO 14001 or other certified guidelines, but the direction of the effect is not yet clear. Therefore, in this hypothesis, no directional expectation is adopted.
H2: There exists a relationship between disclosing the implementation of an Environmental Management System and financial performance.

2.3.2) Credibility

The credibility category within the framework of Clarkson et al. (2013) is mainly concerned with how convincing the environmental information disclosure is to different stakeholders. One indicator is the participation in voluntary environmental programs (VEPs), which can be either organized by a public institution (f.e. the Environmental Protection Agency in the USA) and as a unilateral initiative between companies set up by a non-governmental entity, such as the CERES program, which is a national network of environmental organizations and other interest groups that collaborate with firms and investors to address sustainability challenges (Fisher-Vanden & Thorburn, 2011). In addition, the voluntary programs can be bilateral, so between only two companies (Borck & Coglianese, 2009). Fisher-Vanden and Thorburn (2011) performed an event study on the shareholder wealth effects of both a non-governmental program, the CERES program, where they studied all 72 firms in the USA that joined the program. In addition, they performed an event study on the participation in a governmentally aided program, Climate Leaders, in the USA, where they studied 181 firms. They found no effect on the participation in the CERES program, which was probably due to the fact that the CERES program aids companies in more than just environmental challenges, which makes it hard to distinguish the effect of the environmental part of the CERES participation. In contrast, the authors found a negative relationship between the announcement of participation in Climate Leaders and subsequent abnormal stock returns. However, Borck and Coglianese (2009) performed a literature review on VEPs indicate that there are still mixed findings on value and effectiveness of the VEPs and that there might be economic gains for firms, but even if they are present, the magnitude will be low. They further state that the evidence provided by the studies in their literature review is not convincing on the relationship between participation in VEPs and economic and environmental performance. In contrast, Moon, Bae, and Jeong (2014) found a positive relation between the participation in a public VEP called Green Lights, constructed by the Environmental Protection Agency in the US, where signing into the program entails adjusting lighting technologies to reduce environmental impact. They investigated the effect of participation in the Green Lights program on the Return on Assets (ROA) of 500 high polluting firms in the US and found a positive, significant relationship with the ROA.

On the dimension of the inclusion in a Sustainability Index, Robinson, Kleffner, and Bertels (2011) have researched the impact of getting included in the Dow Jones Sustainability Index (DJSI) and changes in stock price. They performed an event study on 48 companies whose stocks were added to the DJSI in the time period 2003-2007 and 43 companies whose stocks were deleted from the listing in this time period. They found a significant positive relationship between stock price change and the addition to the DJSI and found no significant negative relationship between stock price change and the deletion on the DJSI.

In addition, Clarkson et al. (2013) found the credibility category to be significantly positively related to financial performance, measured as the future cash flows and stock price changes. The analogy here is that if the company's intentions are deemed credible due to the fact that they receive external audits to verify their policies and environmental management systems or are adopted in a sustainability index, this enhances the reputation of the firm and therefore the value of the firm. This expected positive relationship leads to the next hypothesis:

H3: There exists a positive relationship between the credibility of the company and financial performance

2.3.3) Environmental Performance Indicators (EPIs)

A large portion of environmental performance disclosure is the reporting about the actual environmental impact of the firm. The key difference between other hard disclosure items is that these indicators measure the actual impact of the firm on different environmental terrains, such as greenhouse gas emissions, energy use, water use or impact on biodiversity. In contrast to for example the participation in a VEP, which is also traceable by third parties, the EPI disclosure item is an even more concrete indication on the environmental performance of the firm. Therefore, it is expected that this dimension is the closest proxy to actual environmental performance when compared to the other hard performance disclosure dimensions. However, most of the existing body of the literature is written about general environmental performance and there are few articles written about the specific types of environmental impact with regard to financial performance (except for greenhouse gas emissions, which are written about more). One article that does describe such a specific relationship is done by Fan, Pan, Liu, and Zhou (2017), who studied the relation between energy use intensity of firms and their financial performance of 17 Chinese companies from the electricity, steel, chemical and aviation sector. They found a significant negative relationship to the following financial performance indicators: Return on Equity, Return on Assets, Return on Investment, Return on Invested Capital, Return on Sales and Tobin's Q.

Masumura, Prakash, and Vera-Muñoz (2014) found for all S&P 500 firms in the years 2006-2008 a negative relationship between the amount of carbon emission and firm value, defined as the market value of common equity, which is calculated as the number of outstanding stocks multiplied by the price per share of the firm's common stock at the end of each calendar year. In addition, Konar and Cohen (2001) researched 321 S&P 500 firms, which mostly belonged in the manufacturing sector. They studied the relationship between environmental performance and market value of the firm, which they differentiated in the change in market value of tangible and intangible assets and found a positive relationship between environmental performance, measured as the amount of carbon emissions, and the market value of intangible assets, which are "factors of production or specialized resources that allow the firm to earn profits over and above the return on its tangible assets" (p. 282), such as patents, trademarks and the reputation of the firm. In the cases of bad performance, the main source of the value loss was the toxic release reporting, so the reporting on CO^2 emissions and other emissions and an additional small portion of the value loss stemmed from environmental litigation processes.

In general, the literature reviewed indicates that there is a positive relationship between environmental performance and financial performance. This leads to the third hypothesis:

H4: There exists a positive relationship between key indicators of environmental performance and financial performance.

2.3.4) Environmental spending

Kim and Kim (2018) found a negative pure relationship between environmental expenditure and the firms' and firm profitability, which they defined as the Return On Assets (ROAs) for 100 American manufacturing firms from 13 different industries. They explain that this is because environmental expenditure adds to the operation costs of the firm, which puts more pressure on their profit margin and thus their financial performance. However, they also found that a greater R&D intensity of the firm (not only focused on environmental R&D, but general R&D intensity) mitigates the negative effect between environmental expenditure and the firm's ROA and turns into a positive effect. Johnston (2005) found a positive relationship between voluntary Environmental Capital Expenditure

(ECE) and abnormal future returns for 107 different S&P 500 firms, which implies a positive relation between the hard disclosure item of environmental expenditure and firm value, which he measured as the stock price three months after the fiscal year. Clarkson, Li and Richardson (2004) measured the impact of ECEs in the pulp and paper industry of the USA in the years 1989-2000. They found a positive relationship between ECEs and the market value of common equity, but only for firms that are low in pollution in general. For high-polluting firms, the disclosure of ECEs does not have a significant effect on their market value. In contrast, Sueyoshi and Goto (2009) found for US electric utility firms that annual expenditure of firms on environmental protection decreases the financial performance, measured as the firm's ROA.

In summary, in general, the results on environmental expenditure and financial performance are mixed. Therefore, the hypothesis does not contain a directional expectation.

H5: There exists a relationship between environmental expenditure and financial performance.

Table 1 provides a summary table of the above reviewed literature on the hard disclosure items in relationship to financial performance:

Hard disclosure items (independent variable)	**Literature**	**Result**	**Financial performance (dependent variable)**
Governance structure and Environmental Management Systems			
As an aggregate category including all subdimensions	Clarkson et al. (2013)	(+)	Stock price, Return on Assets and cash flow from operations
Existence of a Department for pollution control and/or management positions for environmental management	Iatridis (2013)	(-) (+)	Capital constraints through Kaplan and Zingales index Stock price, market value of equity scaled by book value of equity
Existence of an Environmental and/or Public Issues committee in the board	-	-	-
Existence of terms and conditions applicable to suppliers and/or customers regarding environmental practices	-	-	-
Stakeholder involvement in setting corporate environmental policies	-	-	-
Implementation of ISO 14001 at the plant and/or firm level	Morrow & Rondinelli (2002); Bansal & Bogner (2002) Cañon-de-Francia & Garcés-Ayerbe (2009) Nishitani (2011)	(+) (?) (-) (+)	Cost savings Cost savings Return on securities Firm's value added
Executive compensation is linked to environmental performance	-	-	-

Credibility	-	-	-
As an aggregate category including all subdimensions	Clarkson et al. (2013)	(+)	Stock price, Return on Assets and cash flow from operations
Adoption of GRI sustainability reporting guidelines or provision of a CERES report	Fisher-Vanden & Thorburn (2011)	(x)	Stock price
Independent verification/assurance about environmental information disclosed in the EP report/Web	-	-	-
Periodic independent verifications/audits on environmental performance and/or systems	-	-	-
Certification of environmental programs by independent agencies	-	-	-
Product certification with respect to environmental impact	-	-	-
External environmental performance awards and/or inclusion in a Sustainability Index	Robinson, Kleffner & Bertels (2011)	(+)	Stock price
Stakeholder involvement in the environmental disclosure process	-	-	-
Participation in voluntary environmental initiatives endorsed by EPA or Department of Energy	-	-	-
Participation in industry specific associations/initiatives to improve environmental practices	-	-	-
Participation in environmental organizations/associations to improve environmental practices	Fisher-Vanden & Thorburn (2011) Moon, Bae, & Jeong (2014)	(x) (+)	Stock price Return on Assets
Environmental Performance Indicators (EPI)	Konar & Cohen (2001)	(+)	Market value tangible and intangible assets
As an aggregate category including all subdimensions	Clarkson et al. (2013)	(+)	Stock price, Return on Assets and cash flow from operations
EPI on energy use and/or energy efficiency	Fan, Pan, Liu, Zhou (2017)	(-)	ROE, ROA, ROI, ROIC, ROS, Tobin's Q
EPI on water use and/or water use efficiency	-	-	-
EPI on greenhouse gas emissions	Masumura, Prakash, & Vera-Muñoz (2014)	(-)	Market value of common equity
EPI on on other air emission	-	-	-
EPI on TRI (land, water, air)	-	-	-
EPI on other discharges, releases and/or spills (not TRI)	-	-	-
EPI on waste generation and/or management (recycling, reuse, reducing, treatment, and disposal)	-	-	-

EPI on land and resources use, biodiversity and conservation	-	-	-
EPI on environmental impacts of products and services	-	-	-
EPI on compliance performance (e.g. exceedances, reportable incidents)	-	-	-
Environmental spending	-	-	-
As an aggregate category including all subdimensions	Clarkson et al. (2013)	(+)	Stock price, Return on Assets and cash flow from operations
Summary of dollar savings arising from environmental initiatives to the company	-	-	-
Amount spent on technologies, R&D and/or innovations to enhance environmental performance and/or efficiency	Kim & Kim (2018) Johnston (2005) Sueyoshi & Goto (2009)	(?) (+) (-)	Return on Assets Stock price Return on Assets
Amount spent on fines related to environmental issues			

Table 1. Summary table literature review hard disclosure items; (+) positive relationship; (-) negative relationship, (?) mixed relationship; (x) no relationship.

2.4) Soft environmental performance disclosure and financial performance

The classification of soft information items as presented by Clarkson et al. (2013, p. 418) is as follows:

Soft disclosure items
Vision and strategy claims
CEO statement on environmental performance in letter to shareholders and/or stakeholders
A statement of corporate environmental policy, values and principles, environmental codes of conduct
A statement about formal management systems regarding environmental risk and performance
A statement that the firm undertakes periodic reviews and evaluations of its environmental performance
A statement of measurable goals in terms of future environmental performance
A statement about specific environmental innovations and/or new technologies
Environmental profile
A statement about the firm's compliance with specific environmental standards
A high level overview of environmental impact of the industry
A high level overview of how the business operations and/or products and services impact the environment
A high level overview of corporate environmental performance relative to industry peers
Environmental initiatives
A substantive description of employee training in environmental management and operations
Existence of response plans in case of environmental accidents

Internal environmental awards
Internal environmental audits
Internal certification of environmental program
Community involvement and/or donations related to environment

Table 2. Summary table classification hard performance disclosure (Clarkson et al., 2013)

Clarkson et al. (2013) themselves found that among US companies from five polluting industries, for all three categories there existed a positive and significant relationship between the soft information items and financial performance, measured as the stock price at the end of fiscal years 2004 and 2007. However, further literature on this type of disclosure is very scarce. In general, only a few studies make a distinction on soft and hard disclosure items in relation to financial performance (e.g. Clarkson et al., 2008; Plumlee et al., 2015), which makes it hard to make predictions on this relationship based on previous literature. One other study that found a relationship between soft information disclosure and financial performance was by Plumlee et al. (2015). They found a significant positive relationship between soft information that conveyed positive information about the environmental efforts of the company and stock price. In summary, the literature on soft information disclosure is still underrepresented, which makes it difficult to predict a direction in the hypothesis. However, the only studies found that tested soft performance disclosures in relation to financial performance have found a significant positive effect, which leads to the expectation that there is indeed a positive relationship, described in hypothesis 6:

H6: There exists a positive relationship between soft performance disclosure and financial performance.

2.5) Hard versus soft environmental performance disclosure

Clarkson et al. (2013) found a significant difference in the effectiveness of soft and hard disclosure items, where soft disclosure items had a larger positive impact on stock prices than hard information items. Clarkson et al. (2008) found that poor environmentally performing firms make more use of soft information disclosure, in line with the Legitimacy Theory perspective on information disclosure, using the same definitions of hard and soft disclosure items as Clarkson et al. (2013).

Qiu, Shaukat, and Tharyan (2016) classify hard and soft information disclosure in line with Clarkson et al. (2013). Hard information is defined as quantifiable data such as “carbon and GHG emission, energy and water consumption, waste recycled, investments in sustainability and ISO certification” (p. 107). Soft information include “firms’ environmental policies and initiatives such as a waste reduction policy, energy efficiency policy and green building policy” (p.107). They found that most of the information disclosure in their sample of the constituents of the FTSE350 index in the years 2005-2008 consisted of these hard information items, where 80% of the total disclosure items were hard information items and only 20% of the items were soft information items. However, when considering the total information disclosure (which was, thus, mostly hard information), they did not find a significant relationship between environmental reporting and financial performance, which they measured as profitability and share price. However, they indicate that this might be the case due to their measurement of environmental disclosure, where they neglect the differences between positive environmental information disclosure and negative environmental information disclosure in their effect on firm value. The study Plumlee, Brown, Hayes, and Marshall (2015) accounted for this differences and included the "disclosure nature" (p. 342) of the items in their regression model. They introduce hard and soft information combined with the nature of the information, so relating to positive, neutral or negative environmental issues. Moreover, they found a significant relationship between the interaction term of disclosure type (hard/soft) and nature (positive/neutral/negative) and expected future cash flows. They indicate that other empirical research is needed that takes into account such finer measures of environmental information disclosures. What these studies have in common is that they all indicate that there is a differential effect between soft and hard disclosure and financial performance, which leads to the next hypothesis:

H7: The effect of soft performance disclosure on financial performance is stronger than the effect of hard performance disclosure.

2.6) Financial performance measures

In the literature that is reviewed, different measures of financial performance have been used, which have been summarized in table 2. The changes in stock price are the most commonly used (e.g. Fisher-Vanden & Thorburn, 2011; Johnston, 2005). In addition, the cost savings have been predominant in some studies, as well as the Return on Assets (e.g. Bansal & Bogner, 2002; Kim & Kim, 2018). In addition, Dragomir (2010) proposes some other financial performance measures in relation to environmental performance disclosure (p. 375): First, Tobin's Q, which is a ratio of the firm's market value, divided by the cost of replacing its assets. Second, share returns consist of the ratio of the share price in a given year divided by the share price in the previous year. Third, the Return on Equity (ROE) measures the rate of return on the shareholders' equity of the common stock owners and is measured as the ratio of the fiscal year's net income divided by the total equity (not the preferred shares). Fourth, Leverage is the ratio of total debt divided by total assets. Fifth, the change in Return on Assets (ROA) is the percentage change in the ratio of the total assets divided by the total net income of the firm. Last, growth in earnings per share is the percentage change in the ratio of income from continuing operations divided by the weighted average of common shares. Table 3 summarizes the main financial performance indicators used by the reviewed literature.

Financial performance indicator	Authors
Return on Assets	Kim & Kim (2018), Clarkson et al. (2013), Fan, Pan, Liu, & Zhou (2017), Moon, Bae & Jeong (2014), Dragomir (2010), Sueyoshi & Goto (2009).
Stock price	Clarkson et al. (2013), Iatridis (2013), Robinson, Kleffner & Bertels (2011), Fisher-Vanden & Thorburn (2011), Johnston (2005).
Return on Equity	Dragomir (2010), Fan, Pan, Liu, & Zhou (2017).
Return on Investment	Fan, Pan, Liu, & Zhou (2017).
Return on Invested Capital	Fan, Pan, Liu, & Zhou (2017).
Tobin's Q	Dragomir (2010), Fan, Pan, Liu, & Zhou (2017).
Return on Securities	Cañon-de-Francia & Garcés-Ayerbe (2009)
Market value of equity	Itatridis (2013), Masumura, Prakash, & Vera-Muñoz (2014).
Market value of assets	Konar & Cohen (2001)
Cost savings	Morrow & Rondinelli (2002), Bansal & Bogner (2002).
Firm's value added	Nishitani (2011)
Cash flow from operations	Clarkson et al. (Clarkson et al. (2013)2013)

Table 3. Summary financial performance indicators

3) Methodology

3.1) Research design

The research design employed in this study is a quantitative random effects regression analysis. As Hahn et al. (2015) indicate, most research that studies the disclosure of environmental performance indicators uses either an event study or a time regression with mostly binary dummy variables that indicate whether the firm discloses the particular disclosure item or not. This study employs a panel data regression using yearly data from 223 different randomly chosen companies over a time span of ten years, from January 2007 until December 2017. This period was chosen because it contains the most recent data on all variables. The sample consists of all the listed firms within the ASSET4 universe that provide information on all indicators. The companies were selected based on whether or not there was enough data on all the indicators to be able to compare them. If the firms have too many missing data on several indicators, the results might be skewed, so therefore, companies were only included if they have data on all indicators. As for the predictors within the regression model, the indicators as presented by Clarkson et al. (2013) were used as a base to search for similar variables within the ASSET4 universe, to include as many detailed indicators on performance disclosure as possible.

3.2) Dependent variable

Following Clarkson et al. (2013), this study uses different measures of financial performance to test the influence of environmental performance disclosure. Clarkson et al. (2013) use the following indicators of financial performance: Stock price, Cost of Capital and Return on Assets (ROA). This study also employs ROA as the main dependent variable. ROA is a ratio variable and is calculated as the ratio of net income, divided by total assets. As described in the literature review, much of the research on environmental performance disclosure uses this measure for financial performance.

3.3) Independent variables

3.3.1) Hard environmental performance indicators

As for the predictors within the regression model, the indicators as presented by Clarkson et al. (2013) were used as a base to search for similar variables within the ASSET4 universe. Appendix 1 presents the different indicators from Clarkson et al. (2013) with the accompanying variables within the ASSET4 database, as well as the ASSET4 code for the variable and how the variable is measured. As mentioned before, most of the variables used in this study are binary dummy variables that describe whether a firm discloses a certain item or not. If a firm discloses the item, the dummy variable has a value of 1. If not, it has a value of 0. Only the key performance indicators with regard to environmental performance and environmental expenditures are ratio variables. Table 4 provides an overview of the indicators used in the analysis, as well as their measurement and the variable names within the analysis for further reference.

Hard indicators by Clarkson et al. (2013)	ASSET4 variable	Measurement	Variable name in analysis
Governance structure and Environmental management systems			
Existence of a Department for pollution control and/or management positions for environmental management	Does the company have a policy to maintain an effective and independent CSR committee? Does the company have a CSR committee or team?	Binary dummy variable	PolicyCSRcom SeparateCSRcom
Existence of terms and conditions applicable to suppliers and/or customers regarding environmental practices	Does the company use environmental criteria (ISO 14000, energy consumption, etc.) in the selection process of its suppliers or sourcing partners?	Binary dummy variable	Criteriasuppliers
Implementation of ISO 14001 at the plant and/or firm level	Does the company claim to have an ISO 14001 certification? Does the company claim to have an EMAS certification?	Binary dummy variable	ISO EMAS
Credibility			
Adoption of GRI sustainability reporting guidelines or provision of a CERES report	Is the company endorsing the CERES principles (or Valdez principles)?	Binary dummy variable	CERES
External environmental performance awards and/or inclusion in a Sustainability Index	Has the company received product awards with respect to environmental responsibility?	Binary dummy variable	EnvAward
Participation in environmental organizations/associations to improve environmental practices	Does the company report on partnerships or initiatives with specialized NGOs, industry organizations, governmental or supragovernmental organizations that focus on improving environmental issues?	Binary dummy variable	EnvOrganization
Environmental Performance Indicators			
EPI on energy use and/or energy efficiency	Total direct and indirect energy consumption in gigajoules.	Ratio variable	EnergyUse
EPI on water use and/or water use efficiency	Total water withdrawal in cubic meters.	Ratio variable	WaterUse
EPI on greenhouse gas emissions	Total CO2 and CO2 equivalents emission in tonnes.	Ratio variable	CO2Emissions
EPI on on other air emission	Total amount of NOx emissions emitted in tonnes. Total amount of SOx emissions emitted in tonnes.	Ratio variable	NOxEmissions SOxEmissions

EPI on waste generation and/or management (recycling, reuse, reducing, treatment, and disposal)	Total amount of waste produced in tonnes. Total recycled and reused waste produced in tonnes.	Ratio variable	TotalWaste TotalRecycled
Environmental spending	Total amount of environmental expenditures	Ratio variable	EnvExpenditure
Amount spent on technologies, R&D and/or innovations to enhance environmental performance and/or efficiency	Total amount of environmental R&D costs (without clean up and remediation costs).	Ratio variable	EnvRD

Table 4. Overview hard performance disclosure predictors.

3.3.2) Soft environmental performance indicators

The soft performance indicators employed in this study are all binary dummy variables. On the dimension of environmental profile, no suitable variables were found within the ASSET4 universe. Therefore, in this study, the relation between this dimension, as described by Clarkson et al. (2013), and financial performance is not tested. Table 5 provides an overview of all the soft performance indicators used in this study.

Soft indicators by Clarkson et al. (2013)	ASSET4 variable	Measurement	Variable name in analysis
Vision and strategy claims			
A statement of corporate environmental policy, values and principles, environmental codes of conduct	Does the company describe, claim to have or mention processes in place to improve emission reduction? Does the company describe, claim to have or mention processes in place to reduce its impact on biodiversity? Does the company describe, claim to have or mention processes in place to improve its resource efficiency in general?	Binary dummy variable	C_Emissions C_Biodiversity C_Resources
A statement about formal management systems regarding environmental risk and performance	Does the company describe, claim to have or mention processes in place to maintain an environmental management system?	Binary dummy variable	C_EMS
A statement that the firm undertakes periodic reviews and evaluations of its environmental performance	Does the company claim to use key performance indicators (KPI) or the balanced scorecard to monitor energy efficiency? Does the company claim to use key performance indicators (KPI) or the balanced scorecard to monitor emission reduction? Does the company claim to use key performance indicators (KPI) or the balanced scorecard to monitor its impact on biodiversity?	Binary dummy variable	KPIenergy KPIemissions KPIbiodiversity

A statement of measurable goals in terms of future environmental performance	Does the company set specific objectives to be achieved on emission reduction? Does the company set specific objectives to be achieved on environmental product innovation?	Binary dummy variable	T_Emissions T_Emissions
A statement about specific environmental innovations and/or new technologies	Does the company describe, claim to have or mention the processes it uses to accomplish environmental product innovation?	Binary dummy variable	C_Innovation
Environmental initiatives	Does the company report on initiatives to restore or protect native ecosystems or the biodiversity of protected and sensitive areas?	Binary dummy variable	In_Biodiversity
Existence of response plans in case of environmental accidents	The company reports on initiatives to reduce, avoid or minimize the effects of spills (environmental crisis management system, or disaster recovery plan).	Binary dummy variable	In_Spills

Table 5. Overview soft performance disclosure predictors.

3.4) Control variables

One control variable employed by Clarkson et al. (2013) is the book value per share at the beginning of the estimation quarter. In addition, Qiu et al. (2016) also researched the influence of disclosures on financial performance and they included “book value per share, earnings per share and proxies for firm size” (p. 108) as control variables. These controls are also included in this analysis. The book value per share is calculated as the difference between total shareholder equity and preferred equity, divided by the total number of outstanding shares. The earnings per share are calculated as the difference between net income and preferred dividends, divided by the average of outstanding common shares. The proxy for firm size used in this study is number of employees.

Clarkson et al. (2013) also control with the TRI performance of the firms, which is the percentile ranking of emissions. However, this data is not available for the companies within the ASSET4 universe, so therefore this control variable is not included. A critique on the analysis of Clarkson et al. (2013) is that they only included firms that came from the five most polluting industries, which does not account for differences in underlying environmental performance of the industry. Therefore, the results might be biased due to the sample selection from only highly polluting industries. Plumlee et al. (2015) also criticize Clarkson et al. (2013) for not including firms from a more diverse set of industries. Therefore, in this study, the sample is comprised from companies from all types of industries and industry is controlled for in the sample, because for some industries, the effects of performance disclosure might be more severe than in others. Moreover, since the sample is comprised from companies from different countries, country of origin should also be controlled for.

3.5) Econometric models

For the first hypothesis, "*there exists a positive relationship between disclosing the implementation of an environmental governance structure and financial performance"* it is expected that the beta coefficients are positive. Environmental governance structure is measured as follows: Whether or not the company has a policy to maintain an effective and independent CSR committee and the presence of a separate CSR committee or team, as well as the use of environmental criteria in the selection process of suppliers or sourcing partners. Therefore, model 1 is the following:

Return On Assets = β 0 + β 1*PolicyCSRcom + β 2* SeparateCSRcom + β 3*Criteriasuppliers + β 4*Employees + β 5*Bookvalue + β 6*EarningsPerShare + β 7*Country + β 8*Industry + ε

Regarding the second hypothesis, *"there exists a relationship between disclosing the implementation of an Environmental Management System and financial performance",* the Environmental Management System is measured by the dummy variables that describe whether or not the company claims to have an ISO 14001 or EMAS certification. Model 2 looks as follows:

Return On Assets = β 0 $\pm$ β 1*EMAS $\pm$ β 2* ISO + β 3*Employees + β 4*Bookvalue + β 5*EarningsPerShare + β 6*Country + β 7*Industry + ε

Model 3 tests the hypothesis *"there exists a positive relationship between the credibility of the company and financial performance",* where credibility is measured with the following variables: Whether or not the company is endorsing the CERES principles, whether or not the company has received an award with respect to environmental responsibility and participation in partnerships or initiatives with respect to improving environmental issues. Since a positive relationship with ROA is expected, the beta coefficients are expected to be positive as well. Model 3 is calculated as follows:

Return On Assets = β 0 + β 1*CERES+ β 2* EnvAward + β 3*EnvOrganization + β 4*Employees + β 5*Bookvalue + β 6*EarningsPerShare + β 7*Country + β 8*Industry+ ε

The fourth hypothesis is *"there exists a positive relationship between key indicators of environmental performance and financial performance",* where key performance indicators on energy, water, CO2 emissions, other air emissions, waste production and recycled materials are used to measure the key indicators of environmental performance. It is expected that good performance has a positive relationship with ROA. However, for all the indicators except recycled materials, good performance means that the value of the variables should be as low as possible, since these are environmentally unfriendly indicators. Therefore, it is expected that the coefficients for these variables are negative, whereas the coefficient for recycled materials is expected to be positive. Model 4 is as follows:

Return On Assets = β 0 - β 1*EnergyUse - β 2* WaterUse- β 3*CO2Emissions - β 4*NOxEmissions- β 5*SOxEmissions -β 6*TotalWaste + β 7*TotalRecycled + β 8*Employees + β 9*Bookvalue + β 10*EarningsPerShare + β 11*Country + β 12*Industry+ ε

Model 5 tests the hypothesis *"there exists a relationship between environmental expenditure and financial performance".* Since the impact of environmental expenditure on Return on Assets is not yet clear, there is not yet an expectation on the direction of the coefficient, so whether it is positive or negative. Environmental expenditure is measured as total environmental R&D costs and total amount of environmental expenditures in general. Model 5 is the following:

Return On Assets = β 0 ± β 1*EnvRD ± β 2*EnvExpenditure + β 3*Employees + β 4*Bookvalue + β 5*EarningsPerShare + β 6*Country + β 7*Industry+ ε

To control for the influence on the coefficients when all hard performance disclosure indicators are included in the analysis, model 6 was constructed, which looks like the following:

Return On Assets = β 0 + β 1*PolicyCSRcom + β 2* SeparateCSRcom + β 3*Criteriasuppliers ± β 4*EMAS ± β 5* ISO + β 6*CERES+ β 7* EnvAward + β 8*EnvOrganization - β 9*EnergyUse - β 10* WaterUse - β 11*CO2Emissions- β 12*NOxEmissions - β 13*SOxEmissions -β 14*TotalWaste + β 15*TotalRecycled ± β 16*EnvRD ± β 17*EnvExpenditure + β 18*Employees + β 19*Bookvalue + β 20*EarningsPerShare + β 21*Country + β 22*Industry + ε

Hypothesis 6, *"there exists a positive relationship between soft performance disclosure and financial performance",* is tested in model 7, where all soft performance indicators are included to explain the variance in ROA. The model looks as follows:

Return On Assets = β 0 + β 1*C_Emissions + β 2*C_Biodiversity + β 3*C_Resources + β 4*C_EMS + β 5*KPIenergy + β 6*KPIemissions + β 7*KPIbiodiversity + β 8*T_Emissions + β 9*T_Innovation + β 10*C_Innovation + β 11*In_Biodiversity + β 12*In_Spills + β 13*Employees + β 14*Bookvalue + β 15*EarningsPerShare + β 16*Country + β 17*Industry+ ε

For hypothesis 7, "*The effect of soft performance disclosure on financial performance is stronger than the effect of hard performance disclosure",* the coefficients of model 6 are used for the indicators of hard performance disclosure and these are compared with the coefficients of model 7, which contains all soft performance indicators together in a random effects regression, and looks as follows.

3.6) Summary statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
ReturnOnAs~s	2,440	4.756557	6.681909	-57.36	128.42
PolicyCSRcom	2,440	.4909836	.5000212	0	1
SeparateCS~m	2,440	.9094262	.2870609	0	1
Criteriasu~s	2,440	.8795082	.3256025	0	1
CERES	2,440	.0106557	.1026962	0	1
EnvAward	2,440	.2307377	.4213913	0	1
EnvOrganiz~n	2,440	.8258197	.3793422	0	1
EnergyUse	2,440	.0004122	.9749947	-.2861064	24.98169
WaterUse	2,440	1.14e+07	6.86e+07	-.1598651	4.26e+08
CO2Emissions	2,440	197524.5	1530332	-.4250637	1.20e+07
NOxEmissions	2,440	1925.594	6463.206	-.3729645	23610.29
SOxEmissions	2,440	3060.525	9183.456	-.2033606	30605.25
TotalWaste	2,440	1130321	5647953	-.1603645	2.93e+07
TotalRecyc~d	2,440	108294.3	247957.4	-.250802	675800.6
EnvExpendi~e	2,440	2.50e+09	5.46e+09	-.2592052	1.44e+10
EnvRD	2,440	3.49e+09	2.91e+09	-.3862467	5.92e+09
C_Emissions	2,440	.9819672	.1330972	0	1
C_Biodiver~y	2,440	.7545082	.4304666	0	1
C_Resources	2,440	.8520492	.355124	0	1
EMAS	2,440	.2040984	.4031238	0	1
ISO	2,440	.9377049	.2417403	0	1
KPIenergy	2,440	.5663934	.4956739	0	1
KPIemissions	2,440	.7102459	.4537412	0	1
KPIbiodive~y	2,440	.0704918	.2560265	0	1
T_Emissions	2,440	.8971311	.3038498	0	1
T_Innovation	2,440	.3959016	.4891437	0	1
C_Innovation	2,440	.7163934	.4508405	0	1
In_Biodive~y	2,440	.7659836	.4234693	0	1
In_Spills	2,440	.2881148	.4529776	0	1
Bookvalue	2,440	1798.616	12138.39	-1585.458	257222
EarningsPe~e	2,440	172.8378	1434.138	0	32142
Employees	2,440	56651.83	75622.85	156	626715
Industry	2,440	4713.198	1978.479	1610	8580
Country	2,440	12.68156	4.923339	1	22

Table 6. Summary statistics.

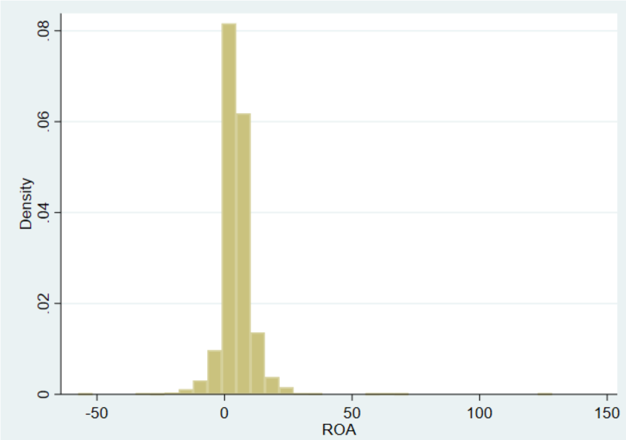
Table 6 displays the summary statistics for all the variables used in this study. Here, only the ratio variables are discussed, because for dummy variables, the summary statistics do not provide insightful information, since the values can only be 0 or 1. The total analyzed sample consists of 2440 observations from 223 companies, where the companies originate from 22 different countries and from 203 different industries.

Return On Assets has a mean of 4.76 and a standard deviation of 6.68, where the lowest observed value was -57.36 and the highest was 128.42. The mean of the total direct and indirect energy consumption is 1.11e+08 gigajoules, with a standard deviation of 3.90e+08, with the minimum observed value is 7304 gigajoules and the maximum observed value is 9.82e+09 gigajoules, which is a fairly large range of observations. The mean of water consumption in cubic meters is 4.27e+08 with a standard deviation of 2.67e+09. The minimum observed value is 2981 cubic meters and the maximum value is 5.08e+10 cubic meters. Here, the range of observations is also large. For CO^2 emissions in tonnes, the mean is 1.21e+07 with a standard deviation of 2.84e+07, ranging from 845 tonnes to 4.12e+08 tonnes. The total amount of NOx emissions in tonnes is 23651.12, with a rather large standard deviation of 63410.38. The minimum observed value is 0, so in this case the company emits no NOx emissions, and the maximum is 561048.6 tonnes. For SOx emissions in tonnes, the mean is 30654.48 tonnes with a standard deviation of 150747.7. The lowest observed value is also 0 and the highest observed value is 2093410 tonnes. The amount of waste produced has a mean of 2.86e+07 with a standard deviation of 1.79e+08, ranging from 0 to 1.96e+09 tonnes. Recycled and reused waste produced in tonnes has a mean of 676982.5 tonnes with a standard deviation of 2699287, ranging from 0 to 4.25e+07 tonnes. Environmental expenditures have a mean of 1.44e+10 and a standard deviation of 5.56e+10. The minimum observed value is 0 and the maximum is 1.79e+11. Environmental R&D costs have a mean of 5.92e+09 and a standard deviation of 1.53e+10, ranging from 0 to 1.79e+11.

As for the control variables, number of employees has a mean of 56651.83, with a large standard deviation of 75622.85 and ranging from 156 employees to 626715 employees. The book value per share has a mean of 1798.616 and a standard deviation of 12138.39, ranging from -1585.458 to 257222. The earnings per share have a mean of 172.8378 with a standard deviation of 1434.138, where the lowest observation is 0 and the highest is 32142.

What can also be read from the table, is that for the variables Energy, Water, Co, NOx, SOx, Waste, Recycled materials, environmental expenditures and environmental R&D costs, there are missing values. In order to make sure that the missings do not skew the results, these variables were standardized, which means they have been given a mean of zero and a standard deviation of 1. Next, the missings are given the value of the mean of the variables, which is in this case zero, so that the missings do not influence the results of the analyses.

To check whether there might be problem with multicollinearity, a correlation matrix was computed, displaying all the correlation coefficients between the variables. These matrices can be found in Appendix 1. As a rule of thumb, if the correlation coefficient exceeds 0.8, this is an indication of severe multicollinearity. However, there are no large correlation coefficients, so multicollinearity should not be much of a problem in the analyses.



Graph 1. Histogram ROA.

Graph 1 displays the distribution of the dependent variable, ROA. If the observations are too much skewed into one direction, the variable might have to be log-transformed. However, the observations seem normally distributed, so the original variable is used for the analyses.

In addition, the data was inspected for the presence of serial correlation. A Wooldridge test for autocorrelation in panel data was computed for all the different models, where the null-hypothesis is tested that there is no autocorrelation present. The test results for all models can be found in Appendix 2. Only for model 4, the test is significant at P<0.05, with a p-value of 0.0475, so there might be autocorrelation present here. However, for the other models, the tests were not significant, so no problems with regard to autocorrelation are expected.

4) Results

4.1) Model 1

ROA	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
PolicyCSRcom	.7011067	.351158	2.00	0.046	.0128497	1.389364
SeparateCSRcom	-1.195096	.4811175	-2.48	0.013	-2.138069	-.2521227
Criteriasuppliers	-1.663171	.4654537	-3.57	0.000	-2.575443	-.7508984
Employees	-3.17e-06	3.00e-06	-1.06	0.290	-9.04e-06	2.70e-06
Bookvalue	-.0000332	.0000339	-0.98	0.327	-.0000997	.0000332
EarningsPerShare	.0003169	.0002618	1.21	0.226	-.0001961	.0008299
Country	-.0158654	.0474987	-0.33	0.738	-.108961	.0772303
Industry	-.0002309	.0001199	-1.93	0.054	-.0004659	4.02e-06
_cons	8.433617	1.045965	8.06	0.000	6.383564	10.48367
sigma_u	2.982967					
sigma_e	5.7234843					
rho	.21360703	(fraction of variance due to u_i)				

Table 7. Results model 1.

Table 7 summarizes the results of the estimated model, which looks as follows:

Return On Assets = 8.433617 + 0.7011067*PolicyCSRcom - 1.195096* SeparateCSRcom - 1.663171*Criteriasuppliers – (3.17e-06)*Employees - 0.00*Bookvalue + 0.00*EarningsPerShare - 0.0158654*Country - 0.0002309*Industry+ ε

This model was estimated based on 2440 observations from 223 companies and has an overall R^2 of 0.0169, which is very low. However, this is not surprising, as there are numerous predictors influencing ROA, so it was not expected that the indicators in these analyses predict a large portion of the variance in ROA. When comparing this R^2 to that of Clarkson et al. (2013), where in all their models the R^2 varied around 0.180, this R^2 of this study is also low. However, this could be explained by the fact that they include many more indicators in their study, which provides a better explanation of movements in ROA than the fewer variables considered here, due to data (un)availability. To test if the random effects model is appropriate for this regression, a Breusch and Pagan Lagrangian multiplier test for random effects was computed. This is a post-regression test and if this test is significant, the random effects model is preferred over a pooled OLS regression. For the test of significance, a criterion of α equal to 0.5 is used, so the p-values should be lower than 0.5. The results are summarized in table 8 and here, for the significance, the criterion of □ equal to 0.5 also applies, so for the coefficients to be significant, the accompanying p-value should be lower than 0.5.

```
Breusch and Pagan Lagrangian multiplier test for random effects

        ROA[ISINb,t] = Xb + u[ISINb] + e[ISINb,t]

        Estimated results:
                         |       Var     sd = sqrt(Var)
                ---------+-----------------------------
                     ROA |   44.64791       6.681909
                       e |   32.75827       5.723484
                       u |   8.898092       2.982967

        Test:   Var(u) = 0
                             chibar2(01) =   718.89
                          Prob > chibar2 =   0.0000
```

Table 8. Breusch and Pagan Lagrangian multiplier test for random effects model 1.

Since the test is significant at p=0.00, it is concluded that the random effects model is indeed an appropriate method for the analysis of model 1.

Moreover, it was hypothesized that there would be a positive relationship between governance structure and ROA. However, the results from this analysis seem mixed. On the one hand, having a policy to maintain an effective and independent CSR committee has a positive coefficient and is significant at z=2.00 and p=0.46, so in this sample and over this time span, if a company has such a policy, the return on assets increased with 0.70 (SE=0.35), with a 95% Confidence Interval between 0.13 and 1.39. However, having a separate CSR committee or team has a negative effect on return assets, where having a separate CSR committee decreases return on assets with 1.20 (SE=0.48) and is significant at z=-2.48 p=0.13, with a 95% Confidence Interval between -2.14 and -0.25. This is in contrast with hypothesis 1, where a positive coefficient was hypothesized. This is also the case for using environmental criteria in the selection process of suppliers and sourcing partners, where doing so decreases return on assets with 1.66 (SE=0.47). This coefficient is significant at z=-3.57 and p=0.000, with a 95% Confidence Interval between -2.58 and -0,75. One explanation can be that it is more costly for companies to have a separate CSR committee and using more strict selection criteria for partners, which costs time and effort and thus money, decreasing the return on assets. However, due to these mixed results, H1 cannot be accepted.

4.2) Model 2

ROA	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
EMAS	-.8363961	.5077164	-1.65	0.099	-1.831502	.1587098
ISO	-.9359679	.7034615	-1.33	0.183	-2.314727	.4427914
Employees	-3.90e-06	2.96e-06	-1.32	0.187	-9.70e-06	1.89e-06
Bookvalue	-.0000414	.000034	-1.22	0.223	-.000108	.0000252
EarningsPerShare	.0003723	.0002635	1.41	0.158	-.0001441	.0008887
Country	-.018546	.0473203	-0.39	0.695	-.1112921	.0742
Industry	-.0001829	.0001174	-1.56	0.119	-.000413	.0000472
_cons	7.129756	1.106037	6.45	0.000	4.961963	9.297549
sigma_u	2.8772481					
sigma_e	5.7399129					
rho	.20081323	(fraction of variance due to u_i)				

Table 9. Results model 2.

Table 9 describes the results of model 2, which is estimated as follows:

Return On Assets = 7.129756 - 0.8363961*EMAS - 0.9359679* ISO - (3.90e-06)*Employees - 0.0000414*Bookvalue + 0.0003723*EarningsPerShare -0.018546*Country -0.0001829*Industry + ε

The model has an overall R^2 of 0.0156, which is still relatively low. To check whether for this model, a random effects model for panel data is appropriate, the Breusch and Pagan Lagrangian multiplier test was performed, which is significant at p=0.00 and which indicates that a random effects model is also appropriate for model 2 (see table 10).

```
Breusch and Pagan Lagrangian multiplier test for random effects

        ROA[ISINb,t] = Xb + u[ISINb] + e[ISINb,t]

        Estimated results:
                         |       Var     sd = sqrt(Var)
                ---------+-----------------------------
                     ROA |   44.64791       6.681909
                       e |   32.75827       5.723484
                       u |   8.898092       2.982967

        Test:   Var(u) = 0
                             chibar2(01) =   718.89
                          Prob > chibar2 =   0.0000
```

Table 10. Breusch and Pagan Lagrangian multiplier test for random effects model 2.

Hypothesis 2 proposes that there exists a relationship between disclosing the implementation of an Environmental Management System and financial performance, measured as ROA. Considering this soft performance disclosure dimension, no direction was yet expected, since the literature provided mixed results. According to the results of model 2, for the disclosure of the implementation of an EMAS certified management system, the β-coefficient is -0.84 (SE=0.51), but is insignificant at z=-1.65 and p=0.099, with a 95% Confidence Interval between -1.83 and 0.16. Therefore, it cannot be confirmed that there exists a relationship between the disclosure of an EMAS system and ROA. For the disclosure of implementation of an ISO certified environmental management system, the β-coefficient is -0.94 (SE=0.70), but this coefficient is also not significant at z=-1.33 and p=0.183, with a 95% Confidence Interval between -2.31 and 0.44. Since both variables are insignificant, H2 cannot be accepted and for this study, no relationship between the disclosure of implementation of an environmental management system and ROA could be confirmed.

4.3) Model 3

ROA	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
CERES	2.265106	1.451246	1.56	0.119	-.5792832	5.109496
EnvAward	-.1051054	.3503619	-0.30	0.764	-.7918021	.5815913
EnvOrganization	-1.042739	.379196	-2.75	0.006	-1.78595	-.2995289
Employees	-3.88e-06	3.06e-06	-1.27	0.204	-9.88e-06	2.11e-06
Bookvalue	-.0000361	.000034	-1.06	0.289	-.0001027	.0000306
EarningsPerShare	.0003513	.0002624	1.34	0.181	-.000163	.0008655
Country	-.0043603	.0476823	-0.09	0.927	-.0978159	.0890953
Industry	-.0001886	.0001208	-1.56	0.118	-.0004254	.0000481
_cons	6.783238	.9463388	7.17	0.000	4.928448	8.638028
sigma_u	2.9962655					
sigma_e	5.7297795					
rho	.21473429	(fraction of variance due to u_i)				

Table 11. Results model 3.

Based on the results of the random effects regression, model 3 is estimated as follows:

Return On Assets = 6.783238 + 2.265106*CERES+ -0.1051054*EnvAward - 1.042739*EnvOrganization -(3.88e-06)*Employees - 0.00*Bookvalue + 0.00*EarningsPerShare - 0.0043603*Country -0.0001886*Industry+ ε

The overall R^2 of the model is 0.0050, which is even lower than the previous two models. However, due to the variety of factors influencing ROA, it is still not surprising that the R^2 is low for the model. The Breusch and Pagan Lagrangian multiplier test for random effects is significant at p=0.00, which means the random effects method is appropriate for this model as well (see table 12).

```
Breusch and Pagan Lagrangian multiplier test for random effects

        ROA[ISINb,t] = Xb + u[ISINb] + e[ISINb,t]

        Estimated results:
                         |       Var     sd = sqrt(Var)
                ---------+-----------------------------
                     ROA |   44.64791       6.681909
                       e |   32.83037        5.72978
                       u |   8.977607       2.996265

        Test:   Var(u) = 0
                             chibar2(01) =    702.20
                          Prob > chibar2 =    0.0000
```

Table 12. Breusch and Pagan Lagrangian multiplier test for random effects model 3.

Hypothesis 3 describes that there is a positive relationship between the credibility of a company in disclosing information and financial performance, measured as ROA. The β-coefficient for adherence to the CERES principles is 2.27 (SE=1.45), which seems a bit large coefficient. However, this coefficient is also not significant with z=1.56 and p=0.119, with a 95% Confidence Interval ranging from -0.58 to 5.11. Having received an environmental award has, surprisingly, a negative β-coefficient of -0.11 (SE=0.35). This is surprising, since this result would mean that receiving an environmental award decreases ROA with -0.11. Therefore, it is not surprising that the coefficient is insignificant at z=-0.30 and p=0.764, with a 95% Confidence Interval between -0.79 and 0.58.

If a company participates in an environmental organization with other organizations, the ROA decreases with -1.04 (SE=0.38) which is a rather large effect. This coefficient is significant with z=-2.75 and p=0.006, with a 95% Confidence Interval ranging from -1.79 to -0.30. This could be due to the extra costs of participating in the environmental organization, due to the costs regarding the extra environmental actions required within the environmental organizational initiative. However, due to these results, where the first two variables are insignificant and the third coefficient is significant, but with the wrong direction, hypothesis 3 can also not be accepted.

4.4) Model 4

ROA	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
EnergyUse	-.1361325	.1510648	-0.90	0.368	-.432214	.159949
WaterUse	2.23e-09	2.12e-09	1.05	0.293	-1.92e-09	6.38e-09
CO2Emissions	-3.48e-08	9.36e-08	-0.37	0.710	-2.18e-07	1.49e-07
NOxEmissions	-3.44e-06	.0000394	-0.09	0.930	-.0000808	.0000739
SOxEmissions	.0000138	.0000306	0.45	0.652	-.0000462	.0000738
TotalWaste	6.39e-08	2.84e-08	2.25	0.024	8.25e-09	1.20e-07
TotalRecycled	2.37e-07	6.99e-07	0.34	0.734	-1.13e-06	1.61e-06
Employees	-5.08e-06	3.07e-06	-1.66	0.098	-.0000111	9.31e-07
Bookvalue	-.0000348	.0000341	-1.02	0.307	-.0001016	.000032
EarningsPerShare	.00034	.0002627	1.29	0.196	-.0001748	.0008548
Country	-.0031302	.0489593	-0.06	0.949	-.0990887	.0928282
Industry	-.0002206	.000124	-1.78	0.075	-.0004636	.0000224
_cons	5.972411	.935999	6.38	0.000	4.137887	7.806936
sigma_u	3.0984427					
sigma_e	5.7379702					
rho	.22575959	(fraction of variance due to u_i)				

Table 13. Results model 4.

Based on the results described in table 13, model 4 is estimated as follows:

Return On Assets = 5.972411 - 0.1361325*EnergyUse + (2.23e-09)*WaterUse - (3.48e-08)*Co2Emissions - (3.44e-06)*NOxEmissions +0.00*SOxEmissions + (6.39e-08)*TotalWaste + (2.37e-07)*TotalRecycled - (5.08e-06)*Employees - 0.0000348*Bookvalue + 0.00034*EarningsPerShare - 0.00*Country - 0.00*Industry + ε

The overall R^2 is 0.0059, which is comparable with the R^2 of model 3 and is a bit lower than model 1 and 2. The Breusch and Pagan Lagrangian multiplier test for random effects is significant at p=0.0000, which means the random effects method is appropriate for this model as well (see table 14).

```
Breusch and Pagan Lagrangian multiplier test for random effects

        ROA[ISINb,t] = Xb + u[ISINb] + e[ISINb,t]

        Estimated results:
                         |       Var     sd = sqrt(Var)
                ---------+-----------------------------
                     ROA |   44.64791       6.681909
                       e |    32.9243        5.73797
                       u |   9.600347       3.098443

        Test:   Var(u) = 0
                             chibar2(01) =   762.47
                          Prob > chibar2 =   0.0000
```

Table 14. Breusch and Pagan Lagrangian multiplier test for random effects model 4.

Hypothesis 4 predicts that there is a positive relationship between environmental performance indicators and ROA. The β -coefficient for energy consumption is -0.14 (SE=0.15) and is insignificant at z=-0.90 and p=0.368, with a 95% Confidence Interval ranging from -0.43 and 0.16. Therefore, no relationship was found between energy consumption and ROA. The β -coefficient for water consumption is 2.23e-09 (SE=2.12e-09), which is a small, but positive coefficient and is in contrast to what was hypothesized, since this coefficient means that with every cubic meter water consumption increase, ROA increases with 2.23e-09. However, this coefficient is also not significant with z=1.05 and p=0.293, with a 95% Confidence Interval ranging between -1.92e09 and 6.38e-09. In addition, according to the β -coefficient of CO^2 emissions, for each additional CO^2 tonne emitted, ROA decreases with -3.48e-08 (SE=9.36e-08). The direction is in line with the hypothesis, but the coefficient is not significant at z=-0.37 and p=0.710, with a 95% Confidence Interval between -2.18e-07 and 1.49e-07. For NOx emissions, the β -coefficient is -3.44e-06 (SE=0.00) and is not significant with z=-0.09, p=0.930 and a 95% Confidence Interval ranging from -0.0000808 to 0.0000739. The coefficient for SOx emission is 0.0000138 (SE=0.0000306) and is also not significant with z=0.45 and p=0.652, where the 95% Confidence Interval is between -0.0000462 and 0.0000738. For each additional waste produced in tonnes, the ROA increases with 6.39e-08 (SE=2.84e-08), which is a very small, but significant amount, with z=2.25 and p=0.024 and a 95% Confidence Interval between 8.25e-09 and 1.20e-07. The direction of the coefficient is surprising, because it means that the more waste a company produces in tonnes, the more the ROA is increased, which is not the same as described in the literature. Total recycled and reused waste produced in tonnes has a positive, small β -coefficient of 2.37e-07 (SE=6.99e-07), which has the hypothesized direction, but is insignificant with z=0.34 and p=0.734, with a 95% Confidence Interval ranging from -1.13e-06 to 1.61e-06.

Since only the β -coefficient for waste generation is significant, but has the opposite direction of what was hypothesized in hypothesis 4, this hypothesis can also not be accepted.

4.5) Model 5

ROA	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
EnvRD	2.92e-10	6.29e-11	4.64	0.000	1.69e-10	4.15e-10
EnvExpenditure	5.58e-11	2.83e-11	1.97	0.049	3.60e-13	1.11e-10
Employees	-5.06e-06	2.97e-06	-1.70	0.088	-.0000109	7.58e-07
Bookvalue	-.0000346	.0000338	-1.02	0.306	-.0001009	.0000316
EarningsPerShare	.0003253	.0002613	1.24	0.213	-.0001869	.0008375
Country	.0073206	.0473677	0.15	0.877	-.0855184	.1001596
Industry	-.0001882	.0001192	-1.58	0.114	-.000422	.0000455
_cons	4.681551	.9292158	5.04	0.000	2.860321	6.50278
sigma_u	2.9880923					
sigma_e	5.7436026					
rho	.21300555	(fraction of variance due to u_i)				

Table 15. Results model 5.

Based on the results of the random effects regression described in table 15, model 5 is estimated as follows:

Return On Assets = 4.681551 + (2.92e-10)*EnvRD + (5.58e-11)*EnvExpenditure - (5.06e-06)*Employees - 0.0000346*Book + 0.0003253*EarningsPerShare + 0.0073206*Country - 0.0001882*Industry+ ε

The overall R^2 is 0.0406, which is relatively high and means that 4.06% of the variance in ROA is explained by model 5. The Breusch and Pagan Lagrangian multiplier test for random effects is significant at p=0.0000, which means the random effects method is appropriate for this model as well (see table 16).

Breusch and Pagan Lagrangian multiplier test for random effects

ROA[ISINb,t] = Xb + u[ISINb] + e[ISINb,t]

Estimated results:

	Var	sd = sqrt(Var)
ROA	44.64791	6.681909
e	32.98897	5.743603
u	8.928696	2.988092

Test: Var(u) = 0

chibar2(01) = 612.77

Prob > chibar2 = 0.0000

.

Table 16. Breusch and Pagan Lagrangian multiplier test for random effects model 5.

Hypothesis 5 proposes that there exists a relationship between environmental expenditures and ROA, with no previous expectations on the direction of the β-coefficients, since the literature provided mixed insights. The β-coefficient for environmental R&D costs is 2.92e-10 (SE=6.29e-11), which is a very small, but significant coefficient, with z=4.64 and p=0.000. The 95% Confidence Interval ranges from 1.69e-10 to 4.15e-10. This means that, even though the effect on ROA is very small, there exists a positive relationship between environmental R&D costs and ROA. For the total amount of environmental expenditures, the β-coefficient is 5.58e-11 (SE=2.83e-11), which also has a very small magnitude. However, even though this effect is also small, it is significant with z=1.97 and p=0.049, with a 95% Confidence Interval ranging from 3.60e-13 to 1.11e-10. Since both of the coefficients are significant, H5 can be accepted and there exists a statistically significant relationship between environmental expenditures and ROA.

4.6) Model 6

ROA	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
PolicyCSRcom	.4604214	.3484954	1.32	0.186	-.222617	1.14346
SeparateCSRcom	-.7887622	.4945796	-1.59	0.111	-1.758121	.1805961
Criteriasuppliers	-1.214841	.4737568	-2.56	0.010	-2.143387	-.2862946
EMAS	-.6494504	.4980353	-1.30	0.192	-1.625582	.3266809
ISO	-.3046985	.7061438	-0.43	0.666	-1.688715	1.079318
CERES	1.500277	1.436627	1.04	0.296	-1.31546	4.316014
EnvAward	.025176	.3517509	0.07	0.943	-.6642432	.7145951
EnvOrganization	-.6836257	.391212	-1.75	0.081	-1.450387	.0831357
EnergyUse	-.1187228	.1490875	-0.80	0.426	-.4109289	.1734833
WaterUse	5.51e-10	2.13e-09	0.26	0.796	-3.62e-09	4.72e-09
CO2Emissions	-5.53e-08	9.29e-08	-0.59	0.552	-2.37e-07	1.27e-07
NOxEmissions	-.0000156	.0000386	-0.40	0.686	-.0000913	.0000601
SOxEmissions	.0000172	.0000297	0.58	0.561	-.0000409	.0000754
TotalWaste	5.14e-08	2.82e-08	1.83	0.068	-3.77e-09	1.07e-07
TotalRecycled	-5.05e-08	6.87e-07	-0.07	0.941	-1.40e-06	1.30e-06
EnvExpenditure	2.83e-11	2.88e-11	0.98	0.325	-2.81e-11	8.48e-11
EnvRD	2.95e-10	6.30e-11	4.67	0.000	1.71e-10	4.18e-10
Employees	-2.77e-06	2.95e-06	-0.94	0.347	-8.55e-06	3.01e-06
Bookvalue	-.0000352	.0000337	-1.04	0.296	-.0001013	.0000309
EarningsPerShare	.000317	.0002631	1.20	0.228	-.0001988	.0008327
Country	-.0203601	.0458433	-0.44	0.657	-.1102113	.0694912
Industry	-.0001943	.0001151	-1.69	0.091	-.00042	.0000313
_cons	7.443001	1.255906	5.93	0.000	4.98147	9.904532
sigma_u	2.7071774					
sigma_e	5.6844669					
rho	.184875	(fraction of variance due to u_i)				

Table 17. Results model 6.

Table 17 summarizes the results of model 6, where all hard performance indicators are pooled together in a random effects regression. The estimated model is as follows:

Return On Assets = 7.443001 + 0.4604214*PolicyCSRcom - 0.7887622*SeparateCSRcom - 1.214841*Criteriasuppliers - 0.6494504 *EMAS - 0.3046985* ISO + 1.500277*CERES+ 0.025176* EnvAward - 0.6836257*EnvOrganization - 0.1187228*EnergyUse+ (5.51e-10)* WaterUse - (5.53e-08)*CO2Emissions -0.0000156*NOxEmissions + 0.0000172*SOxEmissions+ (5.14e-08)*TotalWaste - (5.05e-08)*TotalRecycled + (2.95e-10)*EnvRD + (2.83e-11)*EnvExpenditure - (2.77e-06)*Employees - 0.0000352*Bookvalue + 0.000317*EarningsPerShare -0.0203601*Country - 0.0001943*Industry + ε

The overall R^2 in this model is 0.0463, which means that 4.63% of the variance of ROA is explained by model 7. The Breusch and Pagan Lagrangian multiplier test for random effects is significant at p=0.0000, which means the random effects method is appropriate for this model as well (see table 20).

```
Breusch and Pagan Lagrangian multiplier test for random effects

        ROA[ISINb,t] = Xb + u[ISINb] + e[ISINb,t]

        Estimated results:
                         |       Var     sd = sqrt(Var)
                ---------+-----------------------------
                     ROA |   44.64791       6.681909
                       e |   32.31316       5.684467
                       u |    7.32881       2.707177

        Test:   Var(u) = 0
                             chibar2(01) =   475.65
                          Prob > chibar2 =   0.0000
```

Table 18. Breusch and Pagan Lagrangian multiplier test for random effects model 6.

The first thing noticed when looking at these results is that, even though having a policy for a separate CSR committee was significant in the results of model 1, it loses its significance in model 6. The β-coefficient of this variable is 0.05 (SE=0.35) and is insignificant with z=1.32 and p=0.186, where the 95% Confidence Interval ranges from -0.22 to 1.14. In addition, having a separate CSR committee also loses significance in model 6, where the β-coefficient is -0.79 (SE=0.49), which is not significant at z=-1.59 and p=0.111. The 95% Confidence Interval ranges from -1.76 to 0.18. Using environmental criteria in the selection of suppliers and sourcing partners has a β-coefficient of -1.21 (SE=0.47) and remains significant with z=-2.56 and p=0.010, with a 95% Confidence Interval between -2.14 and -0.29.

As for the disclosure of implementation of an EMAS certified environmental management system, it remains not significant, where the β-coefficient is -0.65 (SE=0.49) and z=-1.30, p=0.192 and the 95% Confidence Interval ranges from -1.63 and 0.33. Also the disclosure of implementation of an ISO certified environmental management system remains insignificant, with a β-coefficient of -0.30 (SE=0.71) and z=-0.43 and p=0.666. The 95% Confidence Interval ranges from -1.69 and 1.08.

Adherence to the CERES-principles has a β-coefficient of 1.50 (SE=1.44) and is, in line with the findings in model 3, not significant with z=1.04 and p=0.296 and a 95% Confidence Interval that ranges from -1.31546 and 4.316014. Having received an environmental award has a positive effect on ROA, with a β-coefficient of 0.02 (SE=0.35), but remains not significant, with z=0.07 and p=0.943 and a 95% Confidence Interval ranging from -0.66 and 0.71. A contrast with previously estimated model 3 is with regard to participation in an environmental organization, where in model 6 it has a β-coefficient of -0.07 (SE=0.39), but which becomes insignificant in this model with z=-1.75, p=0.081 and a 95% Confidence Interval ranging from -1.450387 to 0.0831357. Energy consumption has a β-coefficient of -0.12 (SE=0.15) and remains insignificant at z=-0.80, p=0.426 and a 95% Confidence Interval between -0.41 and 0.17. Water consumption has a small β-coefficient of 5.51e-10 (SE=2.13e-09) and is not significant with z=0.26, p=0.796 and a 95% Confidence Interval ranging from -3.62e-09 and 4.72e-09. The variable CO^2 emissions has a β-coefficient of -5.53e-08 (SE=9.29e-08) and is still insignificant with z=-0.59, p=0.552 and the 95% Confidence Interval ranging from -2.37e-07 to 1.27e-07. As for NOx emissions, the β-coefficient is -0.0000516 (SE=0.0000386) and is not significant with z=-0.40 and p=0.686. The 95% Confidence Interval ranges from -0.0000913 and 0.0000601. SOx emissions have a β-coefficient of 0.0000172 (SE=0.0000297) and als remains insignificant with z=0.58, p=0.561 and the 95% Confidence Interval ranging from -0.0000409 and 0.0000754. Whereas waste produced in tonnes was significant in model 4, it becomes insignificant in model 6. The β-coefficient is 5.14e-08 (SE=2.82e-08) and this coefficient is insignificant tat z=1.83 and p=0.068. The 95% Confidence Interval ranges from -3.77e-09 to 1.07e-07. As mentioned in the description of model 4, the coefficient had a surprising positive direction, which would mean that producing more waste is beneficial for the ROA, so the fact that in model 6 the coefficient becomes insignificant means that the interpretation of this variable should be done with care. Amount of recycled or reused materials has a β-coefficient of -5.05e-08 (SE=6.87e-07) and remains not significant with z=-0.07, p=0.941 and a 95% Confidence Interval between -1.40e-06 and 1.30e-06. What is notable here is that, when comparing the result with that of model 4, the β-coefficient has flipped in direction, changing from positive (as would be expected) in model 4 to negative in model 6. However, the β-coefficient is not significant anyway.

Environmental R&D costs have a small β-coefficient of 2.95e-10 (SE=6.30e-11) and remains significant at z=0.998 and p-0.000, with a 95% Confidence Interval ranging from 1.71e-10 to 4.18e-10. However, total environmental expenditures was significant in model 5, but becomes insignificant in model 6. The β-coefficient in model 6 is 2.83e-11 (SE=2.88e-11) and is now not significant anymore with z=0.98 and p=0.325. The 95% Confidence Interval ranges from -2.81e-11 to 8.48e-11.

4.7) Model 7

ROA	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
C_Emissions	.5541906	1.051501	0.53	0.598	-1.506713	2.615095
C_Biodiversity	-.7755808	.5115615	-1.52	0.129	-1.778223	.2270615
C_Resources	-.8907273	.4843993	-1.84	0.066	-1.840133	.0586779
C_EMS	-2.485386	.4972077	-5.00	0.000	-3.459896	-1.510877
KPIenergy	.3502027	.3968059	0.88	0.377	-.4275225	1.127928
KPIemissions	.4384422	.416934	1.05	0.293	-.3787334	1.255618
KPIbiodiversity	-1.39631	.6809623	-2.05	0.040	-2.730972	-.0616489
T_Emissions	1.016211	.4930865	2.06	0.039	.0497788	1.982642
T_Innovation	-.8105518	.3644509	-2.22	0.026	-1.524862	-.0962411
C_Innovation	-.2733143	.37743	-0.72	0.469	-1.013063	.4664349
In_Biodiversity	.1467665	.5041318	0.29	0.771	-.8413136	1.134847
In_Spills	-.8013411	.4248151	-1.89	0.059	-1.633963	.0312812
Employees	-2.88e-06	2.95e-06	-0.97	0.330	-8.67e-06	2.91e-06
Bookvalue	-.0000401	.0000337	-1.19	0.233	-.0001061	.0000258
EarningsPerShare	.0003816	.0002611	1.46	0.144	-.0001301	.0008932
Country	-.0158465	.0460882	-0.34	0.731	-.1061776	.0744846
Industry	-.0001538	.0001197	-1.29	0.199	-.0003884	.0000808
_cons	8.070819	1.382381	5.84	0.000	5.361403	10.78024
sigma_u	2.7943965					
sigma_e	5.6579071					
rho	.19609596	(fraction of variance due to u_i)				

Table 19. Results model 7.

As for the influence of soft performance disclosure items on ROA, table 17 summarizes the results and model 7 is estimated as follows:

Return On Assets = 8.070819 + 0.5541906*C_Emissions - 0.7755808*C_Biodiversity-0.8907273*C_Resources - 2.485386*C_EMS + 0.3502027*KPIenergy + 0.4384422*KPIemissions - 1.39631*KPIbiodiversity + 1.016211*T_Emissions - 0.8105518*T_Innovation - 0.2733143*C_Innovation + 0.1467665*In_Biodiversity - 0.8013411*In_Spills - (2.88e-06)*Employees - 0.0000401*Bookvalue + 0.0003816*EarningsPerShare - 0.0158465*Country - 0.0001538*Industry + ε

The overall R^2 of model 6 is 0.0323, which means that 3.23% of the variance in ROA is explained by model 6. The Breusch and Pagan Lagrangian multiplier test for random effects is significant at p=0.0000, which means the random effects method is appropriate for this model as well (see table 18).

```
Breusch and Pagan Lagrangian multiplier test for random effects

        ROA[ISINb,t] = Xb + u[ISINb] + e[ISINb,t]

        Estimated results:
                        |       Var     sd = sqrt(Var)
                ---------+-----------------------------
                     ROA |    44.64791       6.681909
                       e |    32.01191       5.657907
                       u |    7.808652       2.794397

        Test:   Var(u) = 0
                             chibar2(01) =   568.59
                          Prob > chibar2 =   0.0000
```

Table 20. Breusch and Pagan Lagrangian multiplier test for random effects model 7.

Hypothesis 6 proposes that there is a positive relationship between soft performance disclosure and ROA and is tested by 12 predictors in total. The β-coefficient for the claims to have a process in place to improve emission reduction is 0.55 (SE=1.05), but is not significant with z=0.53 and p=0.598. The 95% Confidence Interval ranges from -1.51 to 2.62. For the claims to have processes in place to reduce impact on biodiversity, the β-coefficient is -0.78 (SE=0.51), where the coefficient is in the opposite direction compared to what was hypothesized. However, this β-coefficient is not significant with z=-1.52, p=0.129 and a 95% Confidence Interval between -1.78 and 0.23. Claiming to have processes in place to improve resource efficiency has a β-coefficient -0.89 (SE=0.48) and is also not significant with z=-1.84 and p=0.66 and a 95% Confidence Interval ranging from -1.84 to 0.06. Surprising is the significant coefficient for the claim to have process to maintain an environmental management system (but not certified, as was with ISO and EMAS), which is -2.49 (SE=0.4972077). It is significant with z=-5.00 and p=0.000, with a 95% Confidence Interval between -3.46 and -1.51. This is a rather large coefficient, meaning that, if the company claims to such a process in place, the ROA decreases with 2.49, which is opposite to the hypothesized direction of the coefficient.

As for the variables describing claims from companies that they use certain KPIs to monitor progress, the results are the following: First, the claim to use KPIs or balanced scorecards to monitor energy efficiency has a coefficient of 0.35 (SE=0.40), but is not significant with z=0.88 and p=0.377. The 95% Confidence Interval ranges from -0.43 to 1.13. Second, the claim to use KPIs or balanced scorecards to monitor emission reduction has a coefficient of 0.44 (SE=0.42) and is not significant with z=1.05, p=0.293 and a 95% Confidence Interval between -0.38and 1.26. Third, the claim to use KPIs or balanced scorecards to monitor impact on biodiversity is negative at -1.40 (SE=0.68) and is significant with z=-2.05 and p=0.040, with a 95% Confidence Interval between -2.73 and -0.06. This is an unexpected result, since it was hypothesized that such a claim would be beneficial for financial performance.

With regard to statements of measurable goals in terms of future environmental performance, objectives with regard to emission reduction have a β-coefficient of 1.02 (SE=0.49) and is significant with z=2.06, p=0.039 and a 95% Confidence Interval ranging between 0.05 and 1.98. This means that, if a company claims to have measurable goals for future emission reduction, the ROA increases with 1.02. Specific objectives to be achieved on environmental product innovation have a β -coefficient of -0.81 (SE=0.36), which means that there is a negative relationship between setting objectives for environmental innovation and ROA, which is opposite to what was hypothesized. The β -coefficient is significant with z=-2.22, p=0.026 and a 95% Confidence Interval between -1.52 and -0.10.

For the variable of a statement about specific environmental innovations and/or new technologies, the description of processes the company uses to accomplish environmental product innovation have a β -coefficient of -0.27 (SE=0.38), which is opposite to the direction expected in hypothesis 6. However, this β -coefficient is not significant with z=-0.72, p=0.469 and a 95% Confidence Interval ranging from -1.01 to 0.47.

With regard to environmental initiatives, if the company reports on initiatives to restore or protect the native ecosystem and/or biodiversity, the accompanying β -coefficient is 0.15 (SE=0.42), but is not significant with z=0.29, p=0.771 and a 95% Confidence Interval between -0.84 and 1.13. Describing an initiative to reduce, avoid or minimize the effects of spills has a β -coefficient of -1.80 (SE=0.42), which has an opposite direct to what was hypothesized, but is also not significant with z=-1.89, p=0.059 and a 95% Confidence Interval ranging from -1.63 and 0.03.

In conclusion, four different variables are significant in this model: The description or claim by a company to have a process in place to maintain an environmental management system, the claim to use KPIs or the balanced scorecard to monitor the company's impact on biodiversity, setting specific objectives to be achieved on emission reduction and setting specific objectives to be achieved on environmental product innovation. However, the first three variables mentioned above have negative coefficients, which is the opposite of what was hypothesized in H6. Therefore, this hypothesis cannot be accepted.

4.8) Model 6 and 7

To test hypothesis 7, which poses that there is a stronger relationship between soft performance disclosure and financial performance than hard performance disclosure, model 6 and 7 are compared with each other.

When comparing model 6 (table 17) with model 7 (table 19), only the significant relationships are described and compared. In model 8, using environmental criteria for selecting suppliers and sourcing partners has a β -coefficient of -1.21 (SE=0.47) and significant at z=-2.56 and p=0.010, with a 95% Confidence Interval ranging from -2.14 and -0.29. In addition, environmental R&D costs have a β -coefficient of 2.95e-10 (SE=6.30e-11) and is significant at z=4.67 and p=0.000, with a 95% Confidence Interval between 1.71e-10 and 4.18e-10. Thus, only two variables have a significant effect on ROA when pooled together with all hard performance indicators.

Within model 6, as described in the paragraph above, four variables are significant: First, claiming to have processes in place to maintain an environmental management system has a β-coefficient of -2.49 (SE=0.50). It is significant with z=-5.00 and p=0.000, with a 95% Confidence Interval between -3.46and -1.51. Second, the claim to use KPIs or balanced scorecards to monitor impact on biodiversity is negative at -1.40 (SE=0.68) and is significant with z=-2.05, p=0.040 and with a 95% Confidence Interval between -2.73 and -0.06. Third, setting objectives with regard to emission reduction have a β-coefficient of 1.02 (SE=0.49) and is significant with z=2.06, p=0.039 and a 95% Confidence Interval ranging between 0.05 and 1.98. Fourth, specific objectives to be achieved on environmental product innovation have a β-coefficient of -0.81 (SE=0.36), which means that there is a negative relationship between setting objectives for environmental innovation and ROA, which is opposite to what was hypothesized. The β-coefficient is significant with z=-2.22, p=0.026 and a 95% Confidence Interval between -1.52 and -0.10.

When comparing the significant results of model 6 and 7, the following can be concluded: First, the β-coefficient of using criteria for selecting suppliers and sourcing partners, -1.21, is larger than that of setting specific objectives with regard to emission reduction (β=1.02) and environmental product innovation (β=-0.81). Second, environmental R&D on the other hand, has a very small magnitude (β=2.95e-10), so this relationship to ROA is much weaker than that of all other variables. Third, of all the hard performance indicators, only two variables have a significant relationship to ROA, whereas four soft performance indicators have a significant effect on ROA. Even though the direction of the coefficients is not always as was expected, when considering the magnitude of the soft performance indicators versus the hard performance indicators, as well as the number of significant coefficients, it can be concluded that soft performance indicators indeed have a stronger effect on financial performance than hard performance indicators, so H7 is accepted.

4.9) Additional analyses

4.9.1) Developing country analysis

To check whether the results improve when making slight changes to the analyses, some additional analyses were performed. First, an additional analysis was performed, where only observations from companies from developing countries were used. In the dataset used, Russia, Brazil and Mexico were the only developing countries. When only keeping observations from these countries, only 55 observations were kept in the analysis, which is a low amount of observations. The analysis included model 6 and 7, but only for Russia, Brazil and Mexico. However, this did not improve the results, because of the following reasons: First, the R^2 in both models is extremely higher than in the original model 6 and 7. For model 6, the R^2 increases from 0.0463 originally to 0.6426 in the model with only developing countries. This would mean that 64.26% of the variance in ROA is explained by this model, which is an extremely large portion. For model 7, the R^2 increases from 0.0323 to 0.5697, which means that model 7 with only developing countries explains 56.97% of the variance in ROA, which is comparably large to the other R^2 with only developing countries. This is an indication of biased results and is confirmed by the inflation of coefficients and standard errors in the models. All coefficients and standard errors become much more inflated when only including developing countries. For example, the β -coefficient of having an ISO certified environmental management system goes from -0.30 (SE=0.71) in model 6 to -9.57 (SE=7.59) in model 6 with only developing countries. In addition, several dummy variables were omitted from the analysis due to collinearity, which is probably due to the low amount of observations. If companies have too many of the same values (0 or 1) for these variables, they are omitted in the results. However, this is more likely to happen when fewer observations are added. When checking for the appropriateness of the random effects model for both model 6 and 7 through the Breusch and Pagan Lagrangian multiplier test for random effects, the test is insignificant with Prob>chibar2=1.000, so the random effects model is not appropriate for this analysis. Therefore, the coefficients are even more difficult to compare to the original results, since it requires another method of analysis. Lastly, the Wooldridge test for autocorrelation in panel data for both models is significant with Prob>F=0.0216 (model 6) and Prob>F=0.0011 (model 7), which indicates that for these observations, autocorrelation is present. In conclusion, considering the current dataset used for the analysis of the main research questions, only performing the analysis for developing countries is not appropriate for improving the results.

4.9.2) Analysis for years 2016 and 2017

Since attention towards environmental performance has been increasing in recent years, it might be so that the results are improved when only considering the most recent years. Therefore, all seven models were tested again, but only for the years 2016 and 2017, to see whether the results improve (Appendix 5). When only including the years 2016 and 2017, only 441 observations were kept from the 223 companies. However, in this case, the results also do not improve, for the following reasons: First, the results get inflated again, and all the coefficients that were significant in the original models now become insignificant, except for environmental R&D costs. However, this β -coefficient and standard error increases with a comparably large amount, since it goes from β =2.92e-10 (SE=6.29e-11) in the original model to β =0.1578594 (SE=0.067083) in the model for the years 2016 and 2017. Second, the variable that describes the adherence to the CERES reporting principles is now omitted from the analysis, perhaps due to the low amount of observations. Third, and most importantly, when performing the Breusch and Pagan Lagrangian multiplier test for random effects, all of the tests are insignificant with Prob>chibar2=1.0000. This indicates that the random effects model is not an appropriate method for analysis when only considering these two years. However, a fixed effect model does also not yield any results, since many variables do not change every year.

5) Conclusion

This study investigated the relationship between environmental performance disclosure and the Return on Assets of 223 companies from 22 different countries, where a tot of 29 independent variables were used. From these 29 predictors, 17 variables were predictors describing hard performance disclosure indicators and the remaining 12 variables described soft performance disclosure indicators. This large amount of variables was employed to contribute to the gap in the literature with regard to the lack of more detailed measures of environmental performance disclosure and financial performance, measured as ROA. Through a random effects regression, the influence of environmental performance disclosure on financial performance was tested, generating results to answer the main research question of this paper: *"How does environmental performance disclosure influence financial performance?"*. However, to provide more detailed answers on this main question, three subquestions were constructed to answer first.

The answer to the first subquestion, *"what is the influence of hard performance disclosure on financial performance?"* was tested in hypothesis 1 until 5. From these hypotheses, only H5, "*there exists a relationship between environmental expenditure and financial performance"* was accepted, since both environmental R&D costs and total environmental expenditures had a significant positive relationship to Return on Assets in model 5. The positive coefficients can be explained in line with what Kim and Kim (2018) found, that a greater R&D intensity increases the ROA, as well as can mitigate the costs of environmental expenditure, where greater R&D intensity can yield that much profits that it more than compensates for the environmental expenditures. In model 6, total environmental expenditures became insignificant, so this result should be interpreted with care. However, environmental R&D costs remained significant, so therefore, it can be concluded that in this sample, from 2007 until 2017, from the hard information indicators only environmental R&D have a positive effect on ROA. Even though hypothesis 1 until 4 could not be accepted as a whole, the following results are notable to discuss: First, with regard to the governance structure in relation to ROA, it is interesting that disclosing to have a policy for a separate CSR committee has a positive effect on ROA, but actually having a separate committee has a negative impact on ROA. This could be due to the maintenance cost and salaries for this separate CSR committee, where the results imply that having such a separate committee generates more costs than it generates additional income. However, the β-coefficients for these variables were not all in line with the hypothesized positive effects and even became insignificant when pooled together with all other hard performance disclosure indicators. Therefore, this hypothesis could not be accepted. Second, disclosing that a company uses environmental criteria to select its suppliers and sourcing partners also decreases ROA, which might be due to the extra costs of investigating the suppliers and sourcing partners, the decrease in available suppliers and sourcing partners which might increase the price of supplies, as well as the fact that when the suppliers produce environmentally friendly, this is usually more expensive than when not taking the environmental impact into account. Disclosing the implementation of a certified management system, such as an EMAS or ISO certified system, was not found to have any significant relationship with ROA, in contrast to what was expected in H2 based on the reviewed literature. As for the credibility dimension of hard performance disclosures, tested in model 3, only participation in an environmental organization with different stakeholders (such as NGOs, other companies, governments) had a significant negative impact on ROA. This result implies that participation in such an organization comes with more costs than it generates income. With regard to model 4, only waste produced in tonnes has a significant effect on ROA, but has a positive effect, which would mean that the more waste a company produces, ROA increases. This is a strange result, since it was expected that there is a negative relationship between much waste production and ROA. Therefore, it was not surprising that the effect of this variable became insignificant in model 6 and no certain relationship could be established.

The second subquestion was: "*What is the influence of soft performance disclosure on financial performance?"* and was tested in model 6, where all soft performance indicators were pooled together in a random effects regression. Hypothesis 6 indicated that it was expected that there was a positive relationship between soft performance disclosures and financial performance, but the only significant positive relationship was with setting targets to reduce emissions. This means that it is beneficial for companies to disclose setting specific targets or objectives to be achieved with regards to emission reductions. However, in contrast to what was hypothesized, if a company set specific targets to be achieved in environmental product innovation, the Return on Assets decreased significantly, whereas if it set targets with respect to emission reduction, it increased significantly. An explanation could be that the cost of attaining the target is more expensive with respect to innovation when compared with emission reduction. Since the costs are higher and perhaps the short term profits lower in the case of targets for innovation, the Return on Assets might decrease instead of increase. However, this result is based on data within a short time span of 10 years and it might be possible that in the longer run, the profits that the environmental innovations might generate will cover the costs. What was also in contrast with hypothesis 6, was that claiming to have processes in place to maintain an environmental management system was significant and negative, which means that claiming this decreases the ROA. One explanation could be that, even though it is hard to verify by third parties, companies who claim to have such processes in place indeed do so, which means an increase in costs to maintain such an environmental management system, which decreases the Return on Assets. In addition, an interesting result was that if a company set specific targets to be achieved in environmental product innovation, the Return on Assets also decreased significantly. Lastly, claiming to use KPIs or balanced scorecards to monitor the company's impact on biodiversity was also significant and negative, which means that claiming to use this decreased ROA between 2007 and 2017 for the selected companies. This type of claim also might represent underlying costs that are greater than the benefits.

The third subquestion, *"what is the difference between the effect of hard and soft performance disclosure on financial performance?"* was tested in hypothesis 7, where it was proposed that the relationship between soft performance disclosures and ROA is stronger than the relationship between hard performance disclosures and ROA. This hypothesis was accepted for the following reasons: First, most of the coefficients of the significant soft performance indicators had a larger magnitude than the significant hard performance indicators. Moreover, when comparing the pooled random effects model of both types of environmental performance disclosures, there were four significant soft indicators, whereas there were only two significant hard indicators. However, this only regards the magnitude of the coefficients (and thus relationships), but does not say anything about whether the effects are positive or negative, since the results are mixed in this regard.

Summarizing the above mentioned, the results in this study on the influence of environmental performance disclosures on financial performance are mixed, in line with previous literature on this topic. Some environmental performance disclosures can have a positive effect on ROA, but others have a negative impact on ROA. The answers to the subquestions provided more detailed answers to this main question, but in general, no one-directional influence (positive or negative) was found in this study.

6) Discussion

6.1) Limitations

This study has had some limitations, which could have influenced the results presented in chapter 4. With regard to the time frame and workload of this research, only Return On Assets was used as a dependent variable. However, the results might change when other financial performance measures would be used, such as stock price, where disclosing certain performance items might have a differential effect on investors' perceptions and thus might have a differential effect on financial performance. Especially for the soft performance disclosure indicators the results might differ, because it is difficult to check whether the claims of the company with regard to its environmental performance are true. For example, the claim to have processes in place to maintain an environmental management system were expected to be positive, but if the company indeed maintains such processes, the costs are higher for the company than when they only claim it, but not really employ it. Since it is difficult for third parties to check whether the company is accurately disclosing the information, the benefits might be larger for companies that only claim it, but do not have to bear the costs of actual implementation. Thus, the underlying actual environmental performance has an effect on the actual costs and benefit pf soft performance disclosures. However, within this study, there was no actual access to these companies, so it could not verify the actual underlying environmental performance. Moreover, the time span of the data used in this study was ten years. However, in the recent couple of years, increasing attention is paid by companies to environmental performance, due to public pressures. Perhaps, if data is used – for example – for the two most recent years, so 2016 and 2017, the results might differ from the results presented in this study.

In addition, even though the factor correlation matrices did not display any high correlations, coefficients such as using environmental criteria when selecting suppliers and sourcing partners ($\beta = -1.21$, table 17) seemed a bit inflated. In the example of the selection of suppliers and sourcing partners, it would mean that the ROA decreases with a bit more than 1, which is rather high. This could be a sign of slight multicollinearity, which might have inflated this result a little. Besides that, due to data unavailability, not the complete list of environmental performance disclosure indicators from Clarkson et al. (2013) were included in the regression models. However, the remaining variables that were not included could have led to omitted variable bias, which may also have inflated the coefficients, since the effects of the omitted variables are attributed to the ones included in the analysis.

Furthermore, in the Wooldridge test for autocorrelation in panel data, the test was significant at $p<0.05$ with Prob>F = 0.0475. Since it was not significant at $p<0.001$ and given the time frame left for this study, the model was not removed. However, none of the relationships in this model seemed to be significant, which might be due (partially) to the fact that there might be some serial correlation present in this model. Therefore, if this study is repeated at another time, this should be looked at more closely.

Last, this study could not test a common theory and is mostly based on the indicators presented by Clarkson et al. (2013), who conducted one of the first studies with such detailed indicators with regard to environmental performance disclosure. However, their results have not been tested much, only by Plumlee et al. (2015), so the indicators used in this study are not widely accepted indicators within the academic literature. Even though the results of Clarkson et al. (2013) were mostly significant, this does not say that these indicators are the optimal predictors for financial performance.

6.2) Future research

As mentioned in paragraph 6.1, future research should include a wider variety of financial performance measures, to test the possible differential effect of the predictors presented in this study. By using the more detailed soft and hard performance disclosure items described in this study, more detailed analysis of the specific effects of the disclosure items can be studied. In addition, this study accounted for industry and country of origin differences by including industry and country as control variables, but did not focus on industry and country differences in the scope of the analyses. Future research could progress on this avenue of research, where the differences in magnitude of effects of environmental performance disclosure for highly polluting industries or low polluting industries can be studied. In addition, more focus could be on the country differences, where a sample of companies from developing countries could be used to see if there are differential effects of disclosures on financial performance based on the country of origin. The additional analysis in this study that only included observations from developing countries did not yield any interesting results, but this could be due to the low amount of observations left when only including these countries. Therefore, future research should employ a larger sample of companies originating from developing countries. Moreover, the Breusch and Pagan Lagrangian multiplier tests indicated that the random effects model was not appropriate within this study, so perhaps in future studies, also another method should be employed to analyze the effects of the environmental performance disclosures on financial performance.

As mentioned in the last paragraph, this study could not check for underlying actual performance. Future research could take a closer look at the extent to which the soft information disclosures actually represent performance. Access to internal records of the companies is key, so that might be difficult, but if those can be accessed, new insights might be found on the additional costs or benefits of disclosing environmental performance. These future studies can compare the disclosed environmental performance with the actual performance, which leads to a more detailed view on the how the disclosure is related to real performance and how that affects the net costs or benefits.

Moreover, there is still a need for more theoretical background on the effects of environmental performance disclosures, because there is no consensus within the literature yet. The studies reviewed were not much grounded in theory, but based on the results of other empirical studies. The effect is that the research on this topic is still widely scattered and there is no construction yet of common theories that can be tested by other researchers. Therefore, future research should focus on building theory around this subject.

References

Bansal, P., Bogner, W. (2002). Deciding on ISO 14001: Economics, institutions and context, *Long Range Planning*, 35(3), 269-290.

Bewley, K., Li, Y. (2000). Disclosure of Environmental Information by Canadian Manufacturing Companies: A Voluntary Disclosure Perspective, *Advances in Environmental Accounting & Management, 1,* 201-226.

Borck, J. C., Coglianese, C. (2009). Voluntary environmental programs: Assessing their effectiveness, *Annual Review of Environment and Resources,* 34, 305-324.

Cañón-de-Francia, J. Garcés-Ayerbe, C. (2009). ISO 14001 environmental certification: A sign valued by the market?, *Environment and Resource Economics,* 44,245-262.

Clarkson, P. M., Li, Y., Richardson, G. D. (2004). The market valuation of environmental capital expenditures by pulp and paper companies, *The Accounting Review,* 79(2), 329-353.

Clarkson, P. M., Li, Y., Richardson, G. D., Vasvari, F. P. (2008). Revisiting the Relation between Environmental Performance and Environmental Disclosure: An Empirical Analysis, *Accounting, Organizations and Society,* 33, 303-327.

Clarkson, P. M., Fang, X., Li, Y., Richardson, G. D. (2013). The Relevance of Environmental Disclosures: Are such Disclosures Incrementally Informative?, *Journal of Accounting and Public Policy,* 32, 410-431.

Dragomir, V. D. (2009). Environmentally sensitive disclosures and financial performance in a European setting, *Journal of Accounting & Organizational Change,* 6(3), 359-388.

Fan, L.W., Pan, S.J., Liu, G.Q., Zhou, P. (2017). Does energy efficiency affect financial performance? Evidence from Chinese energy-intensive firms, *Journal of Cleaner Production,* 151, 53-59.

Fisher-Vanden, K., Thorburn, K. S. (2011). Voluntary corporate environmental initiatives and shareholder wealth, *Journal of Environmental Economics and Management,* 62(3), 420-445.

Gerschewski, S., Shufeng Xiao, S. (2015). Beyond financial indicators: An assessment of the measurement of performance for international new ventures, *International Business Review,* 24, 615-629.

Guidry, R. P., Patten, D. M. (2012). Voluntary Disclosure Theory and Financial Control Variables: An Assessment of Recent Environmental Disclosure research, *Accounting Forum, 36,* 81-90.

Hahn, R., Reimsbach, D., Schiemann, F. (2015). Organizations, Climate Change and Transparency: Reviewing the literature on Carbon Disclosure, *Organization & Environment*, 28(1), 80-102.

Hummel, K., Schlick, C. (2016). The relationship between sustainability performance and sustainability disclosure: Reconciling voluntary disclosure theory and legitimacy theory, *Journal of Accounting and Public Policy,* 35, 455-476.

Iatridis, G. E. (2013). Environmental disclosure quality: Evidence on environmental performance, corporate governance and value relevance, *Emerging Markets Review,* 14, 55-75.

Johnston, D. (2005). An investigation of regulatory and voluntary environmental capital expenditures, *Journal of Accounting and Public Policy*, 24(3), 175-206.

Kim, T. H., Kim, B. (2018). Firm's environmental expenditure, R&D intensity and profitability, *Sustainability,* 10, 1-12.

Konar, S., Cohen, M. A. (2001). Does the market value environmental performance?, *The Review of Economics and Statistics*, 83(2), 281-289.

Lee, S., Park, Y., Klassen, R. D. (2013). Market Responses to Firms' Voluntary Climate Change Information Disclosure and Carbon Communication, *Corporate Social Responsibility and Environmental Management, 22,* 1-12.

Matsumura, E. M., Prakash, R., Vera-Muñoz. (2014). Firm-value effects of carbon emissions and carbon disclosures, *The Accounting Review,* 89(2), 695-724.

Magness, V. (2006). Strategic posture, financial performance and environmental disclosure, *Accounting, Auditing & Accountability Journal*, 19 (4), 540-563.

Moneva, J. M., Cuellar, B. (2009). The value relevance of financial and non-financial environmental reporting, *Environmental and Resource Economics,* 44, 441-456.

Moon, S., Bae. S., Jeong, M. (2014). Corporate sustainability and economic performance: An empirical analysis of a voluntary environmental program in the USA, *Business Strategy and the Environment*, 23, 534-546.

Morrow, D., Rondinelli, D. (2002). Adopting corporate Environmental Management Systems: Motivations and results of ISO 14001 and EMAS certification, *European Management Journal*, 20(2), 159-171.

Nishitani, K. (2011). An empirical analysis of the effects on firms' economic performance of implementing environmental management systems, *Environmental and Resource Economics*, 48, 569-586.

Patten, D. M. (2002). The Relation Between Environmental Performance and Environmental Disclosure: A Research Note, *Accounting, Organizations and Society*, 27, 763-773.

Plumlee, M., Brown, D., Hayes, R. M., Marshall, R. S. (2015). Voluntary Environmental disclosure quality and firm value: Further evidence, *Journal of Accounting and Public Policy*, *34*, 336-361.

Qiu, Y., Shaukat, A., Tharyan, R. (2016). Environmental and Social Disclosures: Link with Corporate Financial Performance,

Robinson, M., Kleffner, A., Bertels, S. (2011). Signaling sustainability leadership: Empirical evidence of the value of DJSI membership, *Journal of Business Ethics*, 101, 493-505.

Silva-Gao, L. (2012). The Disclosure of Environmental Capital Expenditures: Evidence from the Electric Utility Sector in the USA, *Corporate Social Responsibility Management*, 19(4), 240-252.

Sueyoshi, T., Goto, M. (2009). Can environment investment and expenditure enhance financial performance of US electric utility firms under the clean air act amendment of 1990?, *Energy Policy*, 4819-4826.

Appendix 1: Correlation coefficients

	ROA	Policy~m	Separa~m	Criter~s	CERES	EnvAward	EnvOrg~n	Energy~e	WaterUse	CO2Emi~s	NOxEmi~s	SOxEmi~s	TotalW~e	TotalR~d	EnvExp~e	EnvRD	C_Emis~s	C_Biod~y	C_Reso~s
ROA	1.0000																		
PolicyCSRcom	0.0564	1.0000																	
SeparateCS~m	-0.0879	0.2214	1.0000																
Criteriasu~s	-0.0494	0.0638	0.2297	1.0000															
CERES	0.0332	0.0578	0.0049	-0.0352	1.0000														
EnvAward	-0.0728	-0.0495	-0.0034	0.0772	-0.0284	1.0000													
EnvOrganiz~n	-0.0027	0.0857	0.2128	0.2317	0.0477	0.0694	1.0000												
EnergyUse	-0.0101	-0.0133	0.0284	-0.0009	0.0196	0.0431	0.0535	1.0000											
WaterUse	0.0217	-0.0148	-0.0542	-0.1030	0.0572	-0.0423	0.0089	0.0673	1.0000										
CO2Emissions	0.0343	-0.0170	-0.1054	-0.1802	0.0180	-0.0477	-0.0428	0.0163	0.1390	1.0000									
NOxEmissions	-0.0006	0.0189	-0.0729	-0.0277	0.0128	0.0536	-0.0092	0.0146	0.1274	0.0677	1.0000								
SOxEmissions	0.0092	-0.0022	-0.0614	-0.0277	0.0053	0.0347	-0.0090	-0.0124	0.1145	0.0646	0.7892	1.0000							
TotalWaste	0.0153	0.0249	-0.0333	-0.0764	0.0414	0.0016	0.0358	0.1736	0.3372	0.0915	0.0960	0.0540	1.0000						
TotalRecyc~d	0.0253	0.0582	-0.0023	-0.0236	-0.0127	-0.0457	0.0592	0.1347	0.1983	0.0492	0.0576	0.0108	0.3712	1.0000					
EnvExpendi~e	0.0836	0.0288	-0.1195	-0.0999	0.0474	-0.0427	0.0076	-0.0082	0.0654	0.0091	0.0692	0.0675	0.0265	0.0685	1.0000				
EnvRD	0.1894	0.1617	-0.0510	-0.0166	0.0865	-0.1766	0.1117	0.0036	0.0706	0.0748	-0.0470	-0.0639	0.0326	0.0892	0.2804	1.0000			
C_Emissions	0.0000	0.0776	0.1504	0.1201	0.0141	0.0230	0.1570	0.0296	-0.0158	-0.0310	-0.0271	-0.0370	-0.0529	-0.0416	-0.0274	0.0436	1.0000		
C_Biodiver~y	-0.0610	0.1240	0.1684	0.1019	0.0036	0.0027	0.2728	0.0796	0.0175	0.0136	-0.0631	-0.0035	0.0251	0.0623	0.0348	0.1249	0.1946	1.0000	
C_Resources	-0.0011	0.0837	0.1098	0.1826	0.0095	0.0994	0.2225	0.0048	-0.0027	-0.0007	-0.0150	-0.0112	-0.0365	-0.0760	-0.0318	-0.0140	0.1777	0.1029	1.0000
EMAS	-0.0445	-0.0783	0.0712	0.0656	-0.0526	0.0026	0.0797	-0.0452	-0.0522	-0.0173	-0.0617	-0.0197	-0.0274	0.0255	0.0233	0.0478	0.0457	0.1896	-0.0639
ISO	-0.1371	-0.0046	0.0959	0.0452	-0.1054	0.0929	0.0113	0.0223	-0.1890	-0.0068	-0.0099	0.0124	-0.0718	-0.1093	-0.1104	-0.1907	-0.0094	0.0539	0.0454
KPIenergy	0.1153	0.0735	0.1590	0.1690	-0.0139	-0.0861	0.2174	0.0131	-0.0350	-0.1020	-0.0233	-0.0226	-0.0741	-0.0258	0.0643	0.2411	0.1238	0.1197	0.0989
KPIemissions	0.0766	0.0526	0.1856	0.2076	-0.0129	-0.0104	0.2236	0.0257	-0.0626	-0.1025	-0.0176	-0.0431	-0.1022	-0.0633	-0.0130	0.1566	0.1646	0.1835	0.1842
KPIbiodive~y	-0.0132	0.0082	-0.0024	0.0626	-0.0286	-0.0710	0.0378	0.0236	-0.0058	-0.0356	-0.0002	0.0043	0.0281	0.1154	-0.0373	0.0928	0.0373	0.1496	-0.0882
T_Emissions	0.0397	0.0303	0.1282	0.0777	0.0220	0.0766	0.1006	0.0306	-0.0278	-0.0413	-0.0174	0.0094	-0.0794	-0.1500	-0.0730	-0.1066	0.0960	0.0137	0.0603
T_Innovation	-0.0868	-0.0273	0.0832	0.0448	-0.0106	0.2648	-0.0414	-0.0210	-0.0611	-0.0385	-0.0790	-0.0799	-0.0053	-0.0795	-0.0497	-0.1825	0.0278	-0.0523	0.1107
C_Innovation	-0.0778	0.0123	0.0580	0.0995	0.0210	0.2129	0.0203	0.0409	-0.0258	-0.0835	-0.0019	-0.0418	-0.0300	-0.0994	-0.0457	-0.1047	0.0719	-0.0526	0.1757
In_Biodive~y	-0.0526	0.1556	0.1662	0.1612	0.0291	-0.0121	0.2132	0.0799	0.0133	0.0180	0.0162	0.0326	0.0402	0.0383	-0.0000	0.1220	0.2015	0.6271	0.1377
In_Spills	-0.0489	0.1355	0.0526	0.0020	-0.0043	-0.1207	-0.0037	0.0192	0.0521	0.0319	-0.0441	-0.0642	0.0560	0.1341	0.0338	0.1033	0.0454	0.1337	-0.0866
Bookvalue	-0.0045	0.0386	0.0160	0.0141	-0.0153	0.1208	0.0244	0.0055	-0.0137	-0.0048	0.0287	0.0224	-0.0222	-0.0427	-0.0208	0.0250	0.0015	-0.1099	0.0382
EarningsPe~e	0.0130	0.0343	0.0052	0.0082	-0.0113	0.1061	0.0287	0.0042	-0.0100	0.0001	0.0097	0.0052	-0.0170	-0.0336	-0.0139	0.0431	0.0072	-0.0981	0.0330
Employees	-0.0314	-0.0645	0.0643	0.1534	0.0421	0.3175	0.1740	0.0830	-0.0072	-0.0140	0.1020	0.1062	0.0545	-0.0149	-0.0013	0.0135	0.0669	0.1222	0.1445
Industry	-0.0520	0.0944	-0.0056	-0.0727	0.0364	-0.1655	0.0782	0.0478	0.0715	0.0324	0.0661	0.1455	0.0367	0.0286	0.0053	-0.0368	-0.0129	0.2651	-0.0902
Country	0.0011	0.0520	-0.0355	-0.0718	0.0424	0.0070	-0.0097	-0.0099	0.0640	0.0700	0.0114	0.0299	0.0008	-0.0988	-0.0973	-0.0162	-0.0250	-0.0669	0.0338

	EMAS	ISO	KPIene~y	KPIemi~s	KPIbio~y	T_Emis~s	T_Inno~n	C_Inno~n	In_Bio~y	In_Spi~s	Bookva~e	Earnin~e	Employ~s	Industry	Country
EMAS	1.0000														
ISO	0.1221	1.0000													
KPIenergy	0.1230	-0.0373	1.0000												
KPIemissions	0.1665	-0.0151	0.5659	1.0000											
KPIbiodive~y	0.0790	0.0114	0.1537	0.1512	1.0000										
T_Emissions	0.0443	0.1137	0.1121	0.1287	0.0458	1.0000									
T_Innovation	-0.0482	0.0838	-0.0442	0.0534	-0.0560	0.1445	1.0000								
C_Innovation	-0.0153	0.1952	0.0476	0.0371	-0.1500	0.0743	0.4666	1.0000							
In_Biodive~y	0.1478	0.0338	0.0477	0.1847	0.1295	0.0359	-0.0494	-0.0171	1.0000						
In_Spills	0.1494	-0.0045	0.0599	-0.0066	0.1607	-0.0974	-0.1320	-0.0695	0.1187	1.0000					
Bookvalue	-0.0670	-0.0018	0.0030	0.0054	-0.0335	0.0283	0.1013	0.0519	0.0213	-0.0245	1.0000				
EarningsPe~e	-0.0568	0.0004	0.0085	0.0070	-0.0264	0.0232	0.0878	0.0485	0.0228	-0.0162	0.9485	1.0000			
Employees	0.1568	0.0247	0.1071	0.1161	-0.0238	0.1186	0.1756	0.1766	0.1175	-0.1477	0.0235	0.0216	1.0000		
Industry	0.0842	0.0150	-0.0560	-0.0464	0.0622	-0.0199	-0.2195	-0.2180	0.1702	0.1023	-0.0756	-0.0707	-0.1483	1.0000	
Country	-0.2317	-0.0370	-0.1379	-0.1078	-0.1012	0.0230	0.0342	0.0439	0.0346	-0.0844	0.0567	0.0483	-0.0068	-0.0301	1.0000

Appendix 2: Wooldridge tests for autocorrelation

Model 1:
```
Wooldridge test for autocorrelation in panel data
H0: no first-order autocorrelation
    F(  1,      222) =      3.382
           Prob > F =      0.0672
```

Model 2:
```
Wooldridge test for autocorrelation in panel data
H0: no first-order autocorrelation
    F(  1,      222) =      3.674
           Prob > F =      0.0565
```

Model 3:
```
Wooldridge test for autocorrelation in panel data
H0: no first-order autocorrelation
    F(  1,      222) =      3.317
           Prob > F =      0.0699
```

Model 4:
```
Wooldridge test for autocorrelation in panel data
H0: no first-order autocorrelation
    F(  1,      222) =      3.970
           Prob > F =      0.0475
```

Model 5:

```
Wooldridge test for autocorrelation in panel data
H0: no first-order autocorrelation
    F(  1,      222) =       3.635
           Prob > F =       0.0579
```

Model 6:

```
Wooldridge test for autocorrelation in panel data
H0: no first-order autocorrelation
    F(  1,      222) =       2.751
           Prob > F =       0.0986
```

Model 7:

```
Wooldridge test for autocorrelation in panel data
H0: no first-order autocorrelation
    F(  1,      222) =       2.778
           Prob > F =       0.0970
```

Model 8:

```
Wooldridge test for autocorrelation in panel data
H0: no first-order autocorrelation
    F(  1,      222) =       3.405
           Prob > F =       0.0663
```

Appendix 3: Results model 6 for observations from Russia, Brazil and Mexico

ROA	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
PolicyCSRcom	-7.033464	5.195393	-1.35	0.176	-17.21625	3.149318
SeparateCSRcom	3.623679	4.194434	0.86	0.388	-4.59726	11.84462
Criteriasuppliers	-2.27052	4.82766	-0.47	0.638	-11.73256	7.191519
EMAS	0	(omitted)				
ISO	-9.568028	7.586118	-1.26	0.207	-24.43655	5.300489
CERES	0	(omitted)				
EnvAward	.6414133	3.606613	0.18	0.859	-6.427419	7.710245
EnvOrganization	-1.667367	5.370517	-0.31	0.756	-12.19339	8.858652
EnergyUse	-1.202516	3.805025	-0.32	0.752	-8.660227	6.255195
WaterUse	-1.59e-09	1.11e-08	-0.14	0.887	-2.34e-08	2.03e-08
CO2Emissions	2.24e-07	3.39e-07	0.66	0.508	-4.40e-07	8.88e-07
NOxEmissions	-.3020936	1.333923	-0.23	0.821	-2.916535	2.312348
SOxEmissions	.2332763	1.029024	0.23	0.821	-1.783573	2.250125
TotalWaste	2.21e-07	1.89e-07	1.17	0.244	-1.50e-07	5.92e-07
TotalRecycled	-8.67e-07	7.28e-06	-0.12	0.905	-.0000151	.0000134
EnvExpenditure	-2.14e-10	3.65e-10	-0.59	0.558	-9.30e-10	5.02e-10
EnvRD	7.30e-10	1.02e-09	0.71	0.476	-1.28e-09	2.74e-09
Employees	-.0002864	.0001516	-1.89	0.059	-.0005835	.0000106
Bookvalue	.0108471	.0052418	2.07	0.039	.0005734	.0211208
EarningsPerShare	-.0035128	.0058898	-0.60	0.551	-.0150566	.008031
Country	-1.318293	.7191045	-1.83	0.067	-2.727711	.0911264
Industry	.0004481	.0037806	0.12	0.906	-.0069617	.0078579
_cons	41.55362	35.2608	1.18	0.239	-27.55629	110.6635
sigma_u	0					
sigma_e	5.2833936					
rho	0	(fraction of variance due to u_i)				

```
Breusch and Pagan Lagrangian multiplier test for random effects

        ROA[ISINb,t] = Xb + u[ISINb] + e[ISINb,t]

        Estimated results:
                        |       Var     sd = sqrt(Var)
                ---------+-----------------------------
                     ROA |   49.49647       7.035373
                       e |   27.91425       5.283394
                       u |          0              0

        Test:   Var(u) = 0
                             chibar2(01) =     0.00
                          Prob > chibar2 =   1.0000
```

```
Wooldridge test for autocorrelation in panel data
H0: no first-order autocorrelation
    F(  1,        4) =      13.380
           Prob > F =       0.0216
```

Appendix 4: Results model 7 for observations from Russia, Brazil and Mexico

ROA	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
C_Emissions	0	(omitted)				
C_Biodiversity	0	(omitted)				
C_Resources	-10.73229	5.932025	-1.81	0.070	-22.35885	.8942619
C_EMS	0	(omitted)				
KPIenergy	5.384325	5.071849	1.06	0.288	-4.556316	15.32497
KPIemissions	-40.66386	13.32184	-3.05	0.002	-66.77419	-14.55353
KPIbiodiversity	31.74638	12.85644	2.47	0.014	6.548214	56.94455
T_Emissions	1.739716	2.901595	0.60	0.549	-3.947305	7.426738
T_Innovation	2.934566	4.179749	0.70	0.483	-5.25759	11.12672
C_Innovation	-2.080365	3.264669	-0.64	0.524	-8.478999	4.318269
In_Biodiversity	-16.5562	6.512904	-2.54	0.011	-29.32126	-3.791141
In_Spills	-3.934229	3.211524	-1.23	0.221	-10.2287	2.360241
Employees	-.0004451	.000142	-3.13	0.002	-.0007234	-.0001668
Bookvalue	.0020783	.0035814	0.58	0.562	-.0049412	.0090977
EarningsPerShare	-.0032955	.0060678	-0.54	0.587	-.0151881	.0085971
Country	.7054944	.5275999	1.34	0.181	-.3285823	1.739571
Industry	.0063494	.0033598	1.89	0.059	-.0002356	.0129344
_cons	27.97848	21.38544	1.31	0.191	-13.9362	69.89317
sigma_u	0					
sigma_e	5.3761118					
rho	0	(fraction of variance due to u_i)				

```
Breusch and Pagan Lagrangian multiplier test for random effects

        ROA[ISINb,t] = Xb + u[ISINb] + e[ISINb,t]

        Estimated results:
```

	Var	sd = sqrt(Var)
ROA	49.49647	7.035373
e	28.90258	5.376112
u	0	0

```
        Test:   Var(u) = 0
                            chibar2(01) =     0.00
                         Prob > chibar2 =   1.0000
```

```
Wooldridge test for autocorrelation in panel data
H0: no first-order autocorrelation
    F(  1,       4) =     69.548
           Prob > F =      0.0011
```

Appendix 5: Results models for years 2016 and 2017

Variable	Obs	Mean	Std. Dev.	Min	Max
ROA	441	4.910385	8.638271	-57.36	128.42
PolicyCSRcom	446	.5067265	.5005162	0	1
SeparateCS~m	446	.9506726	.2167938	0	1
Criteriasu~s	446	.9327354	.2507609	0	1
CERES	446	0	0	0	0
EnvAward	446	.1659193	.3724259	0	1
EnvOrganiz~n	446	.793722	.4050868	0	1
EnergyUse	426	1.02e+08	2.68e+08	67862	2.21e+09
WaterUse	439	4.82e+08	3.29e+09	10796	4.76e+10
CO2Emissions	442	1.10e+07	2.57e+07	845	1.94e+08
NOxEmissions	404	22617.34	63351.01	.15	504000
SOxEmissions	394	25205.87	138424.8	0	1877970
TotalWaste	432	2.69e+07	1.65e+08	359	1.73e+09
TotalRecyc~d	380	638184.6	2400051	180	2.45e+07
EnvExpendi~e	370	1.32e+10	5.49e+10	0	9.51e+11
EnvRD	184	6.80e+09	1.41e+10	0	7.96e+10
C_Emissions	446	.9887892	.1054039	0	1
C_Biodiver~y	446	.8251121	.3802978	0	1
C_Resources	446	.9013453	.2985327	0	1
EMAS	446	.2286996	.420467	0	1
ISO	446	.9304933	.2545994	0	1
C_EMS	446	.9013453	.2985327	0	1
KPIenergy	446	.67713	.4680985	0	1
KPIemissions	446	.8340807	.3724259	0	1
KPIbiodive~y	446	.0896861	.2860524	0	1
T_Emissions	446	.8721973	.3342449	0	1
T_Innovation	446	.4215247	.4943577	0	1
C_Innovation	446	.7623318	.4261328	0	1
In_Spills	446	.3139013	.464598	0	1
In_Biodive~y	446	.8340807	.3724259	0	1
Employees	446	57292.18	77247.45	156	626715
Bookvalue	446	2414.037	17475.43	-1585.458	257222
EarningsPe~e	446	216.7195	1621.225	0	23884.71
Industry	446	4715.978	1977.667	1610	8580
Country	446	12.67713	4.937703	1	22

	ROA	Policy~m	Separa~m	Criter~s	CERES	EnvAward	EnvOrg~n	Energy~e	WaterUse	CO2Emi~s	NOxEmi~s	SOxEmi~s	TotalW~e	TotalR~d	EnvExp~e	EnvRD	C_Emis~s
ROA	1.0000																
PolicyCSRcom	0.0489	1.0000															
SeparateCS~m	0.0496	0.1713	1.0000														
Criteriasu~s	0.0526	0.0721	0.0637	1.0000													
CERES	.	.	.	.	.												
EnvAward	-0.0835	0.0852	0.1183	0.1976	.	1.0000											
EnvOrganiz~n	-0.1402	-0.1441	0.0302	0.0952	.	0.0495	1.0000										
EnergyUse	-0.0674	-0.0300	0.0594	-0.0202	.	-0.1031	0.1206	1.0000									
WaterUse	-0.0347	-0.0701	0.0225	0.0362	.	-0.0598	0.0746	0.9143	1.0000								
CO2Emissions	-0.1770	-0.1102	-0.0643	-0.0697	.	-0.1331	-0.0312	0.2714	0.2034	1.0000							
NOxEmissions	-0.2531	0.0129	0.0349	-0.2500	.	-0.1315	-0.0668	0.2622	0.0402	0.2719	1.0000						
SOxEmissions	-0.2849	0.0187	0.0350	-0.2330	.	-0.1182	-0.0679	0.2650	0.0382	0.2280	0.9690	1.0000					
TotalWaste	-0.0856	-0.0739	0.0206	0.0006	.	-0.0969	0.0551	0.2215	0.1247	0.8213	0.0595	0.0110	1.0000				
TotalRecyc~d	-0.0358	-0.0349	-0.0219	-0.0917	.	-0.0276	0.0586	0.1801	0.0368	0.4303	-0.0010	-0.0313	0.7955	1.0000			
EnvExpendi~e	-0.1255	0.1516	-0.0868	-0.0275	.	0.1305	0.2417	-0.1010	-0.0561	-0.0681	-0.0826	-0.1004	-0.0563	0.0605	1.0000		
EnvRD	-0.0698	0.1350	-0.0067	0.1363	.	0.1236	0.2090	-0.0969	-0.0510	-0.1058	-0.0445	-0.0958	-0.1358	-0.1152	0.8439	1.0000	
C_Emissions	-0.0398	0.1070	-0.0262	0.1652	.	0.0739	0.1822	0.0363	0.0139	0.0356	0.0291	0.0251	0.0489	0.0527	0.0693	0.0623	1.0000
C_Biodiver~y	-0.0889	0.2292	-0.1056	0.1471	.	0.0686	0.1854	0.0960	0.0527	0.1036	0.0654	0.1047	0.1532	0.1499	0.1709	0.1194	0.2486
C_Resources	0.1476	0.1090	0.0497	0.2767	.	0.0999	0.1073	-0.0401	0.0402	-0.0212	-0.4571	-0.4842	0.1217	0.1354	0.1688	0.1023	0.3451
EMAS	-0.0381	-0.0826	0.0872	-0.0006	.	-0.0388	-0.1769	0.0763	-0.0244	0.3484	0.2304	0.2001	0.3504	0.1498	-0.2369	-0.1778	0.0545
ISO	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C_EMS	-0.1382	0.1090	-0.0760	0.2767	.	-0.0143	-0.1030	0.0050	0.0221	0.0530	0.0747	0.0699	0.0153	-0.0485	0.0115	0.1223	0.3451
KPIenergy	0.1199	-0.0705	0.0543	-0.1098	.	-0.3173	0.1313	0.1754	0.0882	0.1988	0.2179	0.1912	0.3027	0.3450	0.0598	0.0019	0.0083
KPIemissions	0.0124	-0.1734	-0.1056	0.0824	.	0.2059	0.0591	0.0703	0.0545	0.0807	-0.0814	-0.1182	0.0745	0.0643	0.0633	0.1780	0.0913
KPIbiodive~y	0.1347	0.2698	0.0462	0.0772	.	-0.1302	-0.0013	-0.0615	-0.0246	-0.0311	-0.0511	-0.0452	-0.0518	-0.0541	0.3142	0.3326	0.0289
T_Emissions	0.0436	-0.1136	0.2404	0.2854	.	0.1710	0.1696	0.0258	0.0281	0.0497	0.0666	0.0599	0.0174	-0.0524	0.0936	0.1029	0.1972
T_Innovation	-0.1888	0.0523	0.1658	-0.0666	.	0.2847	0.0163	-0.1721	-0.1233	-0.2117	0.0778	0.1231	-0.1965	-0.0910	0.2332	0.2434	0.1558
C_Innovation	-0.0531	0.0826	0.0266	0.1468	.	0.1422	0.0342	0.0727	0.0379	-0.3036	-0.0142	0.0506	-0.1855	-0.0485	0.0552	0.1023	0.3010
In_Spills	0.1039	0.0526	0.1056	0.0469	.	-0.0686	-0.1012	0.0446	-0.0513	-0.0177	0.3732	0.3473	-0.0697	-0.1093	0.0076	0.0901	0.0659
In_Biodive~y	0.0215	0.1933	-0.1209	0.3396	.	0.1703	0.0948	0.0162	0.0611	0.0539	-0.2712	-0.2957	0.1919	0.1947	0.1645	0.2130	0.2171
Employees	-0.1904	0.0207	0.0314	0.1880	.	0.4961	0.1244	0.1808	0.1829	0.0587	-0.0734	-0.0691	0.0590	0.0273	0.3765	0.4110	0.0913
Bookvalue	0.0152	0.1112	-0.0897	-0.2429	.	0.0822	0.0760	-0.0757	-0.1135	-0.0911	0.3167	0.3258	-0.2527	-0.1798	0.3241	0.2804	-0.0842
EarningsPe~e	0.0928	0.1048	-0.0322	-0.0899	.	0.1379	0.0734	-0.1271	-0.1036	-0.1135	0.1110	0.0614	-0.1939	-0.1023	0.3846	0.4184	-0.0648
Industry	-0.1260	-0.0309	-0.0913	-0.1752	.	-0.1030	0.0148	0.2429	0.1691	0.3503	0.3372	0.3598	0.1824	0.1076	-0.1461	-0.2188	-0.0983
Country	-0.0841	0.1028	-0.0862	-0.1438	.	0.0662	0.0376	-0.2801	-0.1570	-0.4197	0.0081	0.0305	-0.5344	-0.3580	0.2844	0.1887	-0.0538

	C_Biod~y	C_Reso~s	EMAS	ISO	C_EMS	KPIene~y	KPIemi~s	KPIbio~y	T_Emis~s	T_Inno~n	C_Inno~n	In_Spi~s	In_Bio~y	Employ~s	Bookva~e	Earnin~e	Industry
C_Biodiver~y	1.0000																
C_Resources	0.2342	1.0000															
EMAS	0.1091	-0.1168	1.0000														
ISO	.	.	.	.													
C_EMS	0.3557	0.2416	0.1578	.	1.0000												
KPIenergy	-0.1652	0.0488	0.0847	.	-0.2486	1.0000											
KPIemissions	0.1727	0.0519	0.2191	.	0.0519	0.0730	1.0000										
KPIbiodive~y	0.1161	-0.1469	0.1128	.	0.0837	-0.0899	-0.0685	1.0000									
T_Emissions	-0.0070	-0.0190	0.1260	.	-0.0190	0.1379	-0.0798	0.0668	1.0000								
T_Innovation	0.2228	0.0480	-0.1067	.	0.0480	-0.0787	0.1420	-0.1211	0.0584	1.0000							
C_Innovation	0.1109	0.3228	-0.0677	.	0.0482	0.0499	0.1109	-0.3214	0.0385	0.5175	1.0000						
In_Spills	-0.2214	-0.0519	0.2209	.	-0.0519	0.3637	0.1680	0.0685	0.1526	-0.0612	0.1641	1.0000					
In_Biodive~y	0.6017	0.4029	0.0462	.	0.2899	-0.1096	0.4206	-0.0388	-0.1070	0.1163	0.2096	-0.1942	1.0000				
Employees	0.2869	0.2038	0.1514	.	0.2106	-0.1270	0.2338	0.0541	0.1091	0.2457	0.1937	-0.1083	0.2796	1.0000			
Bookvalue	-0.1437	-0.1826	-0.2132	.	-0.1687	0.0356	-0.1704	-0.0028	-0.0447	0.1406	0.0610	0.1546	-0.2195	-0.0131	1.0000		
EarningsPe~e	-0.2005	-0.0490	-0.2843	.	-0.1693	0.0415	-0.0151	0.0049	0.0439	0.1369	-0.0004	0.0902	-0.0679	0.0209	0.7332	1.0000	
Industry	0.2318	-0.2793	-0.0125	.	0.1116	-0.0804	-0.1211	0.0053	-0.0845	-0.2364	-0.4221	-0.0687	-0.0852	-0.1141	0.1057	-0.1119	1.0000
Country	-0.1226	-0.1325	-0.5637	.	-0.0856	-0.2715	-0.2165	0.0592	-0.1245	0.2153	-0.0091	-0.2716	-0.0383	-0.2759	0.4705	0.4267	-0.0348

Results model 1 for 2016/2017:

$R^2 = 0.0120$

ROA	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
PolicyCSRcom	.8966555	.8354843	1.07	0.283	-.7408636	2.534175
SeparateCSRcom	-.2587307	1.90993	-0.14	0.892	-4.002124	3.484662
Criteriasuppliers	1.122154	1.668973	0.67	0.501	-2.148973	4.393281
Employees	-5.48e-06	5.48e-06	-1.00	0.318	-.0000162	5.27e-06
Bookvalue	-.0001945	.0001609	-1.21	0.227	-.0005099	.0001209
EarningsPerShare	.0020516	.0017344	1.18	0.237	-.0013479	.005451
Country	.0491549	.085553	0.57	0.566	-.1185259	.2168358
Industry	-.0002152	.0002152	-1.00	0.317	-.000637	.0002066
_cons	4.382442	2.985901	1.47	0.142	-1.469817	10.2347
sigma_u	0					
sigma_e	8.958828					
rho	0	(fraction of variance due to u_i)				

```
Breusch and Pagan Lagrangian multiplier test for random effects

        ROA[ISINb,t] = Xb + u[ISINb] + e[ISINb,t]

        Estimated results:
                        |       Var     sd = sqrt(Var)
                ---------+-----------------------------
                     ROA |   74.61972       8.638271
                       e |    80.2606       8.958828
                       u |          0              0

        Test:   Var(u) = 0
                             chibar2(01) =     0.00
                          Prob > chibar2 =   1.0000
```

Results model 2 for 2016/2017:

$R^2 = 0.0120$

ROA	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
EMAS	.4516693	1.031091	0.44	0.661	-1.569232	2.47257
ISO	-2.170946	1.689345	-1.29	0.199	-5.482	1.140109
Employees	-5.63e-06	5.49e-06	-1.03	0.305	-.0000164	5.14e-06
Bookvalue	-.0001918	.0001606	-1.19	0.232	-.0005065	.0001229
EarningsPerShare	.0020118	.001731	1.16	0.245	-.001381	.0054045
Country	.0522878	.0869947	0.60	0.548	-.1182187	.2227943
Industry	-.000222	.0002136	-1.04	0.299	-.0006406	.0001967
_cons	7.565923	2.308645	3.28	0.001	3.041063	12.09078
sigma_u	0					
sigma_e	8.8898791					
rho	0	(fraction of variance due to u_i)				

```
Breusch and Pagan Lagrangian multiplier test for random effects

        ROA[ISINb,t] = Xb + u[ISINb] + e[ISINb,t]

        Estimated results:
```

	Var	sd = sqrt(Var)
ROA	74.61972	8.638271
e	79.02995	8.889879
u	0	0

```
        Test:   Var(u) = 0
                             chibar2(01) =     0.00
                          Prob > chibar2 =   1.0000
```

Results model 3 for 2016/2017:

$R^2 = 0.0148$

ROA	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
CERES	0	(omitted)				
EnvAward	-1.649567	1.243538	-1.33	0.185	-4.086857	.7877225
EnvOrganization	1.149495	1.030265	1.12	0.265	-.8697872	3.168778
Employees	-3.23e-06	5.94e-06	-0.54	0.586	-.0000149	8.41e-06
Bookvalue	-.0001746	.0001606	-1.09	0.277	-.0004894	.0001402
EarningsPerShare	.0018954	.0017309	1.10	0.274	-.0014971	.005288
Country	.046983	.0849524	0.55	0.580	-.1195206	.2134867
Industry	-.0002644	.0002152	-1.23	0.219	-.0006862	.0001574
_cons	5.118181	1.762059	2.90	0.004	1.66461	8.571752
sigma_u	0					
sigma_e	8.9374902					
rho	0	(fraction of variance due to u_i)				

Breusch and Pagan Lagrangian multiplier test for random effects

ROA[ISINb,t] = Xb + u[ISINb] + e[ISINb,t]

Estimated results:

	Var	sd = sqrt(Var)
ROA	74.61972	8.638271
e	79.87873	8.93749
u	0	0

Test: Var(u) = 0

chibar2(01) = 0.00

Prob > chibar2 = 1.0000

Results model 4 for 2016/2017:
R^2 =0.0230

ROA	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
EnergyUse	-.1261001	.1675479	-0.75	0.452	-.4544879	.2022878
WaterUse	-.2034054	.2504536	-0.81	0.417	-.6942855	.2874747
CO2Emissions	-.2705988	.3151594	-0.86	0.391	-.8883	.3471023
NOxEmissions	-.2776115	.1970612	-1.41	0.159	-.6638443	.1086212
SOxEmissions	.1667904	.1837876	0.91	0.364	-.1934268	.5270075
TotalWaste	.0384898	.1947243	0.20	0.843	-.3431627	.4201424
TotalRecycled	.0454683	.1048419	0.43	0.665	-.160018	.2509547
Employees	-4.81e-06	5.53e-06	-0.87	0.384	-.0000156	6.02e-06
Bookvalue	-.0001739	.0001612	-1.08	0.281	-.0004898	.000142
EarningsPerShare	.0018364	.0017375	1.06	0.291	-.0015691	.0052419
Country	.0484023	.0867349	0.56	0.577	-.1215951	.2183996
Industry	-.0001192	.0002193	-0.54	0.587	-.000549	.0003106
_cons	5.287545	1.674732	3.16	0.002	2.005131	8.569959
sigma_u	0					
sigma_e	8.8693196					
rho	0	(fraction of variance due to u_i)				

Breusch and Pagan Lagrangian multiplier test for random effects

ROA[ISINb,t] = Xb + u[ISINb] + e[ISINb,t]

Estimated results:

	Var	sd = sqrt(Var)
ROA	74.61972	8.638271
e	78.66483	8.86932
u	0	0

Test: Var(u) = 0

chibar2(01) = 0.00

Prob > chibar2 = 1.0000

Results model 5 for 2016/2017:

R^2 =0.0211

ROA	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
EnvRD	.1578594	.067083	2.35	0.019	.0263792	.2893396
EnvExpenditure	-.0826918	.0867101	-0.95	0.340	-.2526405	.0872569
Employees	-5.12e-06	5.44e-06	-0.94	0.347	-.0000158	5.55e-06
Bookvalue	-.0001741	.00016	-1.09	0.276	-.0004877	.0001394
EarningsPerShare	.001826	.0017251	1.06	0.290	-.0015552	.0052072
Country	.0509981	.0846055	0.60	0.547	-.1148256	.2168219
Industry	-.0001606	.0002123	-0.76	0.449	-.0005768	.0002556
_cons	4.347226	1.704621	2.55	0.011	1.006231	7.688221
sigma_u	0					
sigma_e	8.9591437					
rho	0	(fraction of variance due to u_i)				

Breusch and Pagan Lagrangian multiplier test for random effects

ROA[ISINb,t] = Xb + u[ISINb] + e[ISINb,t]

Estimated results:

	Var	sd = sqrt(Var)
ROA	74.61972	8.638271
e	80.26626	8.959144
u	0	0

Test: Var(u) = 0

chibar2(01) = 0.00

Prob > chibar2 = 1.0000

Results model 6 for 2016/2017:
R^2 =0.0414

ROA	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
PolicyCSRcom	.697148	.870851	0.80	0.423	-1.009689	2.403985
SeparateCSRcom	-.2194084	1.96182	-0.11	0.911	-4.064505	3.625689
Criteriasuppliers	.8489268	1.722602	0.49	0.622	-2.527311	4.225164
EMAS	.2444588	1.066526	0.23	0.819	-1.845893	2.33481
ISO	-1.1735	1.79904	-0.65	0.514	-4.699553	2.352554
CERES	0	(omitted)				
EnvAward	-.991465	1.312402	-0.76	0.450	-3.563726	1.580796
EnvOrganization	1.177501	1.079938	1.09	0.276	-.9391395	3.294141
EnergyUse	-.1249665	.1721901	-0.73	0.468	-.4624529	.2125198
WaterUse	-.2013833	.2522608	-0.80	0.425	-.6958053	.2930387
CO2Emissions	-.2883796	.3203014	-0.90	0.368	-.9161588	.3393995
NOxEmissions	-.2376903	.2010766	-1.18	0.237	-.6317931	.1564125
SOxEmissions	.1467171	.1852152	0.79	0.428	-.2162979	.5097322
TotalWaste	.0351361	.1961363	0.18	0.858	-.3492839	.4195561
TotalRecycled	.0050016	.107974	0.05	0.963	-.2066236	.2166268
EnvExpenditure	-.0741013	.0894817	-0.83	0.408	-.2494823	.1012796
EnvRD	.10132	.0753303	1.35	0.179	-.0463247	.2489648
Employees	-3.65e-06	6.18e-06	-0.59	0.555	-.0000158	8.46e-06
Bookvalue	-.0001536	.0001619	-0.95	0.343	-.0004709	.0001637
EarningsPerShare	.0015968	.0017446	0.92	0.360	-.0018225	.0050161
Country	.0420038	.0897892	0.47	0.640	-.1339798	.2179874
Industry	-.0001437	.0002297	-0.63	0.531	-.0005938	.0003064
_cons	4.224508	3.548036	1.19	0.234	-2.729516	11.17853
sigma_u	0					
sigma_e	8.9115897					
rho	0	(fraction of variance due to u_i)				

Breusch and Pagan Lagrangian multiplier test for random effects

ROA[ISINb,t] = Xb + u[ISINb] + e[ISINb,t]

Estimated results:

	Var	sd = sqrt(Var)
ROA	74.61972	8.638271
e	79.41643	8.91159
u	0	0

Test: Var(u) = 0
chibar2(01) = 0.00
Prob > chibar2 = 1.0000

Results model 7 for 2016/2017:
R^2=0.0488

ROA	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
C_Emissions	.7578462	4.179658	0.18	0.856	-7.434133	8.949825
C_Biodiversity	-1.134812	1.392917	-0.81	0.415	-3.86488	1.595255
C_Resources	3.091469	1.529417	2.02	0.043	.0938663	6.089072
C_EMS	-1.836843	1.491369	-1.23	0.218	-4.759872	1.086186
KPIenergy	1.546722	1.004327	1.54	0.124	-.4217224	3.515167
KPIemissions	.9453233	1.261988	0.75	0.454	-1.528128	3.418775
KPIbiodiversity	1.23979	1.577793	0.79	0.432	-1.852628	4.332207
T_Emissions	1.857469	1.310031	1.42	0.156	-.7101442	4.425082
T_Innovation	-.7503755	.9791361	-0.77	0.443	-2.669447	1.168696
C_Innovation	-.4951406	1.162486	-0.43	0.670	-2.77357	1.783289
In_Biodiversity	.3947699	1.394672	0.28	0.777	-2.338736	3.128276
In_Spills	-1.604455	.9354472	-1.72	0.086	-3.437898	.2289875
Employees	-7.93e-06	5.73e-06	-1.39	0.166	-.0000192	3.29e-06
Bookvalue	-.0001684	.0001605	-1.05	0.294	-.000483	.0001462
EarningsPerShare	.0017492	.0017305	1.01	0.312	-.0016426	.005141
Country	.0714257	.0874929	0.82	0.414	-.1000573	.2429086
Industry	-.0000861	.000234	-0.37	0.713	-.0005447	.0003725
_cons	1.240744	4.461434	0.28	0.781	-7.503507	9.984994
sigma_u	0					
sigma_e	8.9550229					
rho	0	(fraction of variance due to u_i)				

```
Breusch and Pagan Lagrangian multiplier test for random effects

        ROA[ISINb,t] = Xb + u[ISINb] + e[ISINb,t]

        Estimated results:
```

	Var	sd = sqrt(Var)
ROA	74.61972	8.638271
e	80.19243	8.955023
u	0	0

```
        Test:   Var(u) = 0
                             chibar2(01) =     0.00
                          Prob > chibar2 =   1.0000
```