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From Green to Gold – Alchemy in the 21st Century?

The effect of voluntary environmental initiatives, certifications, and awards on short-term stock returns in Norway and Sweden

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Abstract

This thesis aims at identifying the relationship between a company's environmental and economic performance. Using an event study methodology, we study 125 environmental press releases on voluntary initiatives, awards and certifications from 43 companies listed in Norway and Sweden. Through both a univariate and a cross-sectional analysis, we find that although there is no overall relationship between environmental and economic performance, there are in fact differences related to the strength of the environmental press release; stronger announcements, with a higher environmental commitment, are met with a more negative reaction by investors than weaker ones. This suggests that investors believe that the benefits related to strong environmental performance will be more than offset by the corresponding costs. Further research should therefore aim to expand the understanding of when environmental policies are profitable, and under what circumstances they are unprofitable. This will clarify for managers which environmental policies to initiate, and for lawmakers what regulation is needed to protect the environment in a satisfactory way.

Preface

Both the authors are part of a double degree programme between NHH - Norwegian School of Economics and HEC Paris, and wrote this thesis for the most part in Bergen during the spring of 2012. The paper combines elements of both financial and economic analysis – our respective majors at NHH – and environmental sustainability, which is a main focus of our MSc in Sustainable Development at HEC Paris.

We find the meeting point of environment and finance to be strikingly exciting – it is a field that needs much more study, and has a potential to both show private investors profitable environmental strategies, and clarify for environmental regulators where the shoe pinches. Our excitement led us to the subject of profitability of environmental activities, but we soon encountered problems with data collection and finding good measures of environmental friendliness. So the most part of spring was used manually searching through all available press archives of 185 publicly listed companies in Norway and Sweden, categorizing press releases, and gathering financial data.

The thesis has taught both the authors many invaluable lessons like building a good framework, structuring and splitting up work, widening our ways of finding information, taking initiative, and together solving problems through thorough research and long discussions.

We would like to take this opportunity to thank our advisor, Karin S. Thorburn. Much of the inspiration for this study was found through discussions with her, and her 2011 study of voluntary environmental issues in the United States. We would also like to thank Kristina Fliflet and Yvette Naufal for proofreading, and all other friends and family for great support and lending an ear to our many problems underway.

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Ingvild Hagen and Eivind Rasmussen Fliflet

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1. Introduction

The last decades have seen an extensive discussion about the firm's role in society; with much focus from companies, media, and researchers on corporate social responsibility and sustainable business practices. As many firms have extended their business to parts of the world where environmental laws are less stringent (or even non-existent) and civil rights are viewed from a different perspective, the importance of corporate social responsibility and sustainable business practices has been reinforced.

How a firm acts in relation to its environment has in the last years become a significant part of its identity. In 1994, John Elkington (2006) introduced the concept of a triple bottom line, where performance in a company is measured on three dimensions: economically, socially and environmentally. This concept raises the question of whether there is a positive or negative relationship between the performances along these three dimensions. Although this study will focus on the relationship between the economic and environmental performance of firms, the social aspect of the triple bottom line should not be neglected.

A multitude of theoretical and empirical studies have investigated the connection between a firm's economic and environmental performance. While the first trend in the theoretical studies was that a company should take care of the environment only to the extent that it could save money on clean-up and litigation costs (Melnyk et al., 2003), later studies (e.g. Porter, 1991, Hart, 1995) argued that companies which incorporate environmental responsibility into their corporate strategies could experience increased profits through sustained competitive advantage. More recent studies indicate that the relationship between economic and environmental performance depends on the policy; some environmental policies meet the profit criteria, others do not (Prakash, 2000). The empirical studies in the field also point in both directions; some studies have identified a clear positive relationship between environmental and economic performance (e.g. Klassen and McLaughlin, 1996, Al-Tuwaijri et al., 2004), while others have concluded just the opposite (e.g. Cañón-de-Francia and Garcés-Ayerbe, 2009, Fisher-Vanden and Thorburn, 2011). So although it has been widely studied, both theoretically and empirically, the relationship between economic and environmental performance remains ambiguous.

1.1. Objective and Research Question

Our aim with this study is to further analyse the relationship between environmental and economic performance. The research question we seek to enlighten can be phrased in the following way:

Is there a relationship between environmental and economic performance, and is there a difference related to the strength of the environmental announcement, or whether the firm is listed in Norway or Sweden?

We approach this question using the event study methodology, which is an analysis of the cumulative abnormal stock returns (CAR) that can be related to an event. After manually searching through 14 years of press archives on firm websites and Factiva (2012) from 185 Swedish and Norwegian firms, we end up with 125 press releases/announcements about voluntary environmental plans and achievements. While several event studies have investigated the relationship between economic and environmental performance by linking it to a specific event, this study includes a variety of environmental announcements and distinguishes between them according to their characteristics. We categorize the announcements on two dimensions: according to the country in which the firm is listed, Norway or Sweden, and according to the strength. We define three categories of strength: weak, medium and strong. The strength of the announcements is defined by its degree of commitment and the novelty of the information. The categorizations are used to analyse whether environmental commitments perceived as strong, result in different cumulative abnormal returns than weaker commitments, and whether there is a difference depending on the country in which the company is listed.

In order to test our hypotheses, we perform both a univariate and a cross-sectional analysis on cumulative abnormal returns that are related to the date of the press releases. In the cross-sectional analysis we also divide the sample into three categories according to the type of the announcement: (a) environmental certifications and inclusions in sustainable and responsible investment (SRI) indices, (b) environmental awards, and (c) environmental initiatives. This analysis allows us to better identify the differences in cumulative abnormal returns related to the type, strength and country of the announcement, as well as other variables such as firm characteristics.

1.2. Summary of Findings

We find that on the overall level, firms announcing an environmental plan or achievement experience no significant effect on the stock price. Although the overall average effect is slightly negative, it is not significant. Dividing the sample according to country of announcement provides no additional information. However, analysing the announcements in categories of strength, we find indications that medium and strong environmental commitments are associated with a negative cumulative abnormal return. The cross-sectional analysis supports the division into categories according to strength; we find that especially strong environmental announcements result in reduced cumulative abnormal return compared to other announcements. The results may reflect that investors expect stronger environmental commitments to be more costly than weak commitments. Weak announcements may improve customer satisfaction and firm reputation without imposing high costs on the firm, and thus neither decrease nor increase shareholder value. For the strong commitments on the other hand, investors seem to believe that the costs of the initiative will offset the positive effects on shareholder value.

Seeing that investors react differently to firms' environmental commitments depending on how strong the commitment is, we propose that the question "Does it pay to be green?" should be replaced by "When does it pay to be green?". Further research should confirm the strength effect we have found, and then investigate whether all strong environmental commitments destroy shareholder value, or if strong environmental policies that meet the profit criteria exist, thus establishing a positive relation between the economic and environmental performance of the firm.

1.3. Structure

The thesis is built up in the following way: chapter 2 gives an overview of the existing literature on the relationship between economic and environmental performance; chapter 3 provides a description of the event study methodology and of our dataset; chapter 4 presents and discusses the results from the two main analyses, while chapter 5 contains an overall conclusion of the thesis. The chapters are divided into sections and subsections.

2. Literature Review and Hypothesis Development

Having raised a research question, we will now look at what previous researchers have found on this subject, and formulate precise hypotheses that we will later attempt to answer. Figure 2.1 shows the environmental and economic performance in relation to the triple bottom line introduced by Elkington in 1994.

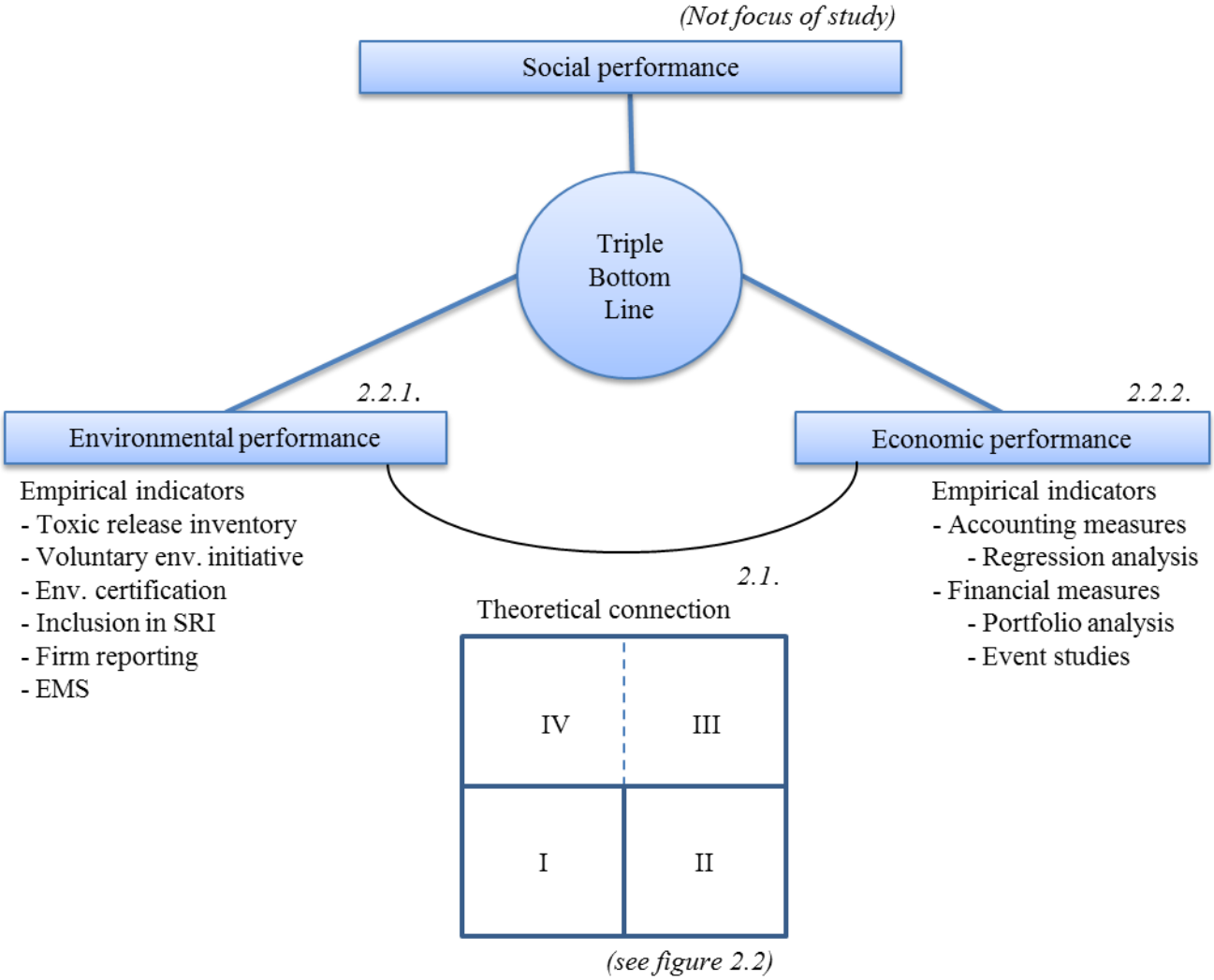


***Figure 2.1**: Framework for chapter 2, numbers in italics indicate section and subsection where the subjects are discussed.*

The first section of this chapter will look at what theoretical connections there are between economic and environmental performance, classifying environmental policies into four distinct types according to whether they are mandated by regulation and whether they meet a profit criterion. The second section looks at which environmental and economic indicators that are generally used to test the relationship between environmental and economic performance, and what earlier studies have found on the subject. Based on the theoretical and

empirical findings, we will in the last section develop three distinct hypotheses on whether there is a connection at all, whether this connection varies between companies listed in Norway and Sweden, and whether it differs between strengths of environmental commitments.

2.1. Theoretical Background

The question "Does it pay to be green?" has in the last two decades been met with a host of both empirical and theoretical studies, ranging from short run (e.g. Al-Tuwaijri et al., 2004, Fisher-Vanden and Thorburn, 2011, Klassen and McLaughlin, 1996), to long run (e.g. Nakamura, 2011, Ziegler et al., 2011) profitability studies and meta studies summarizing earlier findings and drawing broader conclusions (e.g. Ambec and Lanoie, 2008). We will here discuss the basis for studies such as these and the theoretical links that lead researchers to test whether protecting the environment may be profitable.

The first studies trying to identify links between environmental and economic performance focused mainly on environmentally harmful events and their direct effect on market capitalization (e.g. Shane and Spicer, 1983). The prevailing view was that the environmental activity of a private company should represent a trade-off between the costs of being clean versus the costs of polluting, and the studies performed in this period were more interested in identifying the costs of polluting perceived by the market. The existence of externalities like clean air and water only imposed costs on the companies (Ambec and Lanoie, 2008). It was deemed that doing more for the environment than what would be saved in clean-up and litigation costs was inappropriate for companies and in conflict with their duty of maximizing shareholder value (Melnyk et al., 2003). Porter and van der Linde (1995a, 1995b) call this an "arm wrestling match" between the social costs of polluting and the private costs of prevention and clean-up.

We have moved past this view of being either for or against the environment, and there are now several different views on why firms "go green" and how profitable this is. Prakash (2000) divides environmental policies into four types: those that (1) go beyond compliance and meet or exceed the profit criteria, (2) go beyond compliance and do not meet the profit criteria, (3) are required by law and meet or exceed the profit criteria, and (4) are required by law and do not meet the profit criteria. See figure 2.2 for a summary.

Type 3 and Type 4 policies are required for all firms by law, so understanding why they are adopted is not very difficult; they are subsequently not further looked at here. Type 1 policies

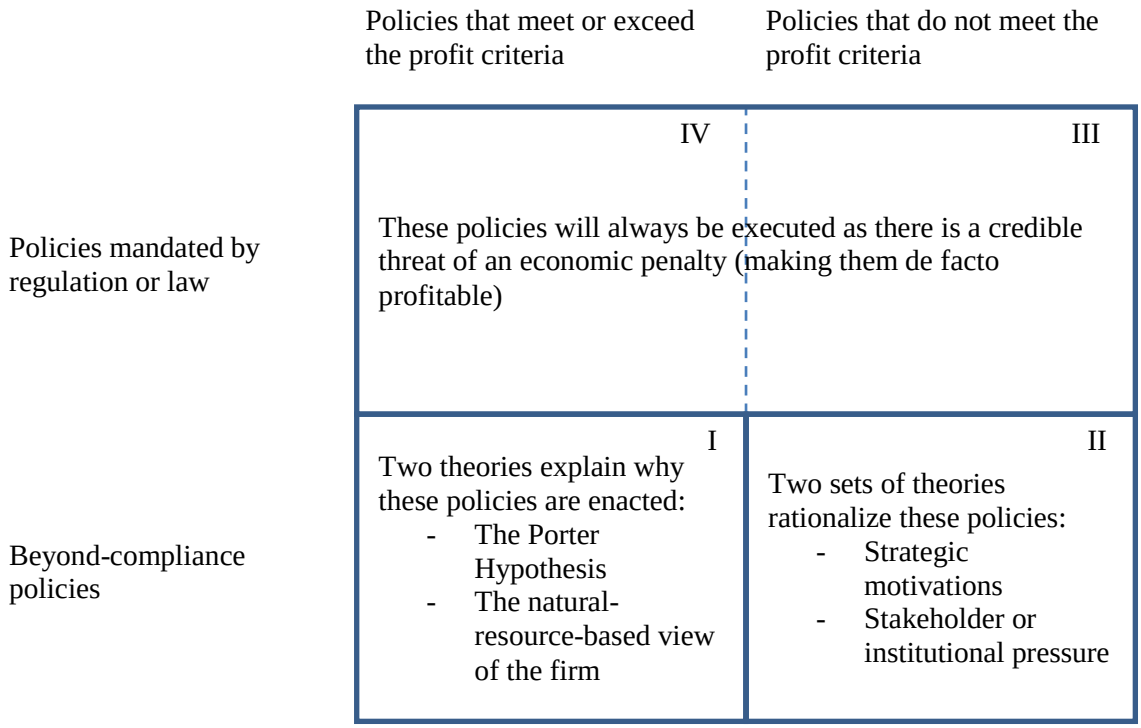


Figure 2.2: *Four different types of environmental policies. Theories on why they are enacted are listed in the boxes (Prakash, 2000).*

are not required by law, but meet the profit criteria a firm will apply to any project it assesses. Type 2 policies, however, are neither mandated by law nor apparently profitable, and it is not easily understood why they are adopted. In the next two subsections we will look closely at the theories that explain why managers implement Type 1 and Type 2 policies.

2.1.1. Policies That Meet the Profit Criteria

The idea that firms should only carry out projects that exceed a decided internal rate of return in order to deliver shareholder value is founded in the neoclassical view of the firm. This view was neatly summarized by Friedman (1970), who claims that the social objective of business is only to maximize shareholders' wealth. He calls any drive for social responsibility in business "pure and unadulterated socialism", and managers that dare for example reduce pollution more than what is required as "unwitting puppets of the intellectual forces that have been undermining the basis of a free society" (Friedman, 1970, p. 33). This view states that firms should only engage in environmental activities that are profitable, and by definition taking care of the environment was not seen as profitable.

This view prevailed until the early 90's, when the two first main proposals of a different view were presented: the Porter Hypothesis (Porter, 1991, Porter and van der Linde, 1995a, Porter and van der Linde, 1995b), and the natural-resource-based view of the firm (Hart, 1995, Hart

and Dowell, 2011). The Porter Hypothesis, first proposed by Porter in 1991 and refined in two articles in 1995 (Porter and van der Linde, 1995a, Porter and van der Linde, 1995b) postulates that pollution is nothing but unnecessary waste for companies, which through proper innovation instead may be turned to a competitive advantage. Environmental activities such as a firm's attempts to reduce transportation may give immediate profits through lower petrol costs, but also put the company at a competitive advantage should a larger tax on emissions be introduced. Porter and van der Linde (1995a, 1995b) support more environmental regulation (though more efficient than the current), giving companies an incentive to innovate more and at a higher speed.

Approximately at the same time as the Porter Hypothesis was developed, Hart published an article proposing an extension of the resource-based view of the firm. This view considers the internal resources and capabilities of a firm in order to find an optimal strategy (Hart, 1995). By looking at the adverse development of the environment and climate, Hart suggests also taking into account the relationship of the firm to the natural environment in order to build competitive advantage. He argues that because businesses will be constrained by and dependent on the natural environment, they need to take this into account when building their strategy. Hart introduces a framework with three interdependent strategies which are able to build lasting dynamic capabilities: pollution prevention, product stewardship, and sustainable development. The most important strategy for our case (and the most researched) is the proactive pollution prevention. This is by nature opposite from the reactive pollution control, and is proven in the article (Hart, 1995) and by later research (summarized in Hart and Dowell, 2011) to be much more profitable. The problem is that managers do not find profitable pollution prevention opportunities if they do not look for them, so the ability to profit from such opportunities depends on the mind-set and expectations of the management to find them. So if firms change their attitudes, they will be able to create shareholder value by first picking the "low hanging fruit" and later building strategic capabilities that confer value to the company. Sharma and Vredenburg (1998) show how those oil and gas firms in Canada that had a proactive stance towards the environment and stakeholders, were over a long period able to build a strategic capability not easily imitable by others, which allowed them to better manage their waste reduction, energy conservation programs, and costs.

2.1.2. Policies That Do Not Meet the Profit Criteria

While the neoclassical view of the firm may describe why profitable environmental policies are adopted, there is not one single equivalent view of the firm to describe why managers

enact policies that are not profitable for the firm and the shareholders. Prakash (2000) identifies two sets of explanations for why these policies are adopted: strategic motivations and stakeholder/institutional pressure.

The strategic explanations postulate that companies adopt the seemingly unprofitable environmental policies for long-term strategic reasons, for example to precede environmental regulation. Hart (1995) describes how BMW was able to convince German regulators that their car-recycling method was the best by developing one prior to the regulation process. Though the recycling programme was initially not profitable, it pre-empted regulation and forced the competitors to copy BMW's process at a much higher cost. In the same manner, technologically advanced companies may create barriers to entry for new firms by designing capital-intensive environmentally friendly technology, and making it the industry standard (Prakash, 2000). Long-term strategic concerns may thus explain why companies adopt apparently unprofitable policies.

The second set of explanations is based on stakeholder theory and sociological institutional theory – theories that are, respectively, based on the belief that the firm considers all stakeholders affected by their operations, or is influenced by other institutional groups. Common for both theories is that the firm acts on some non-profit goal that may or may not increase their long-term profits (Prakash, 2000). Though these theories may explain why firms adopt non-profitable environmental policies, they do not explain why not all firms adopt similar policies if they are "the right thing to do". Most of Prakash's book (2000) goes into answering this question, and after various case studies he posits that it is because these environmental policies are often not subject to formal investment appraisal processes, but more dependent on the organizational dynamics and key people in power. The profits from environmental investments are often difficult to assess, so instead of being a rigorous and neutral measurement, estimates of future profits become extensions of the personal opinions of various managers and employees. In summary, these theories propose that firms adopt unprofitable strategies because of differing personal views and organizational dynamics in different companies; not exactly a good starting point for rigorous numerical analysis. Prakash himself states that analysing this wearing the spectacles of neoclassical economists will give strange and varying results.

Nonetheless, economists, environmentalists and financial researchers have for decades tried to identify a clear connection between the environmental and economic performance of

companies with varying results. In the next section we will look at what these researchers have discovered.

2.2. Empirical Findings

The difficulty of studying the relationship between environmental and economic performance of companies lies in finding good proxies for the two variables that are readily measurable. Some studies have applied a specific environmental event such as an environmental certification (e.g. Paulraj and de Jong, 2011), joining a voluntary environmental initiative (e.g. Fisher-Vanden and Thorburn, 2011), or being included in an environmental index (e.g. Wai Kong Cheung, 2011) as an indicator of total environmental performance. Other studies have used quantifiable but longer-term indicators such as the reporting on environmental issues (e.g. Ziegler et al., 2011, Al-Tuwaijri et al., 2004) as a proxy for the environmental performance. Though more general and long-term indicators seem better, they also have to be matched with long-term economic indicators where it may be difficult to separate the effects of "going green" from other factors. Long-term economic indicators that have been used include Jensen's α in CAPM and the four factor model (e.g. Ziegler et al., 2011) for portfolio studies, the book value of intangible assets (e.g. Konar and Cohen, 2001) and the return on assets (e.g. Nakamura, 2011) for regression studies, whereas the most common short-term indicator used are cumulative abnormal returns (e.g. Gilley et al., 2000, Cañón-de-Francia and Garcés-Ayerbe, 2009, Wai Kong Cheung, 2011). The following subsections will look closer at the different indicators of economic and environmental performance used, and the researched connection between them.

2.2.1. The Economic Indicator

There are numerous accounting and financial measures we can use as an indicator of the economic performance of a firm, but the problem is to have measures which give a meaningful comparison to the different environmental measures we will discuss in the next subsection. Several studies (e.g. Ambec and Lanoie, 2007, Fisher-Vanden and Thorburn, 2011) argue that these measures can be grouped into three main categories: portfolio analysis, regression analysis, and event studies. While portfolio analyses and event studies generally look at stock returns from owning environmentally friendly firms, regression studies mostly study accounting profitability measures of the companies.

Portfolio analysis studies (e.g. Ziegler et al., 2011) create their own subset of companies based on an environmental characteristic, or look at the performance of a socially responsible

fund or index created in a similar manner, and then compare the stock returns in this subset of companies with the returns of other funds or indices without the higher environmental or social standards. An inherent problem with such an analysis is to separate the effects of being environmentally friendly from other factors such as fund-manager skill and fund composition. The use of the four factor model by Carhart (1997) instead of CAPM alleviates many of these problems, but also makes the model much more complex and thus not much used. An initial argument is that the performance of these funds will be worse than comparable funds due to their restrictions on portfolio diversification (Aslaksen and Synnestvedt, 2003, Ziegler et al., 2011). Ambec and Lanoie (2007) summarize the findings from 16 portfolio studies and find that 11 of these show no statistical difference between environmentally friendly and comparable funds or indices, while five of them conclude that environmentally funds outperform the conventional ones. Johnsen and Gjølberg (2009), on the other hand, find that socially responsible indices perform worse than the market because the restrictions imposed on them make them biased towards specific industries and markets. They also suggest that socially responsible funds with a positive selection criterion perform worse than those with a negative selection criterion.

Regression analysis studies also allow researchers to look at the long-term effects of environmental friendliness. In contrast to the portfolio studies, however, these studies look at single firms and accounting measures, studying economic performance by Tobin's Q, return on assets, return on sales, return on equity, or the value of intangible assets (Ambec and Lanoie, 2008, Konar and Cohen, 2001). A large multitude of such studies have been performed in the last two decades with very varying results. Ambec and Lanoie (2007) examine 12 studies that use regression analysis, nine of which find a positive relationship between economic and environmental performance, two of which are inconclusive, and one which postulates a negative relationship. Nakamura (2011), using ex ante firm environmental protection efforts, finds that there is a time lag between the investment and the increased firm return on assets; the author suggests that consumers value the investment only once it arrives in the market. However, this value diminishes with time and reverts to zero. He thus implicitly assumes that the heightened economic performance comes from consumer preferences and not directly from innovation and improved waste management; one of the main parts of the Porter Hypothesis. Konar and Cohen (2001), on the other hand, find that an increase in emissions of toxic chemicals significantly decreases the value of a firm.

Telle (2006) argues that the methods most often used in regression analysis studies suffer from several shortcomings, the most important being their lack of control for omitted unobserved variables. These variables could be firm-specific characteristics like management quality, employee motivation and specific regulatory environments. So even though a positive relationship has been found several times between long-term economic and environmental performance, it is not certain if it is the good financial results that allow for environmental investments or if it is the good environmental performance that leads to higher profitability. It may also be the case that an omitted variable, for example the management's quality, affects both the economic and environmental results.

The third way of measuring the economic performance of a firm is using short-term event studies. These studies examine what happens to the price of a stock in the days around an environmental event, above what you could usually expect from the stock. The event study methodology will be discussed in detail in chapter three. Again, Ambec and Lanoie (2007) have gathered the results for 14 such studies, and they find that for all studies an environmentally harmful (negative) event leads to a significant reduction in stock returns, and vice versa for environmentally beneficial (positive) events.

Ambec and Lanoie (2007) criticize the event study methodology by arguing that for the stock to move, either day traders have to look for arbitrages based on the new environmental information, or long-term environmentally conscious investors have to buy (sell) the now "clean" ("dirty") stock. Since they deem it unlikely that the first scenario is true, they turn to the second for an explanation. But if the second is true, the buying and selling of the stock by long-term investors is better measured by long-term indicators, thus rendering the event study methodology imprecise. However, Aslaksen and Synnestvedt (2003) argue that since environmentally conscious investors constitute a very small fraction of all investors, they will be more successful in bidding up the price of desirable stocks than they are in forcing down the price of undesirable stocks. Accepting this argument, the second explanation by Ambec and Laoie (2007) of the movement in stock prices holds only for stock increases due to a positive event, but does not explain most event studies where stock prices decrease following a negative event. This does not support the suggestion of only socially conscious investors moving the stock following an environmental event, and therefore we cannot reject that day traders try to make profits from calculating the cash flow effects of the event. The stock price will then move very quickly, and the event study methodology can be appropriate.

Although many of the aforementioned studies conclude that being more environmentally friendly leads to higher profits, it is important to point out that some of these studies look for and find a fall in the economic indicator following a negative environmental event. Even though it is found that for example more pollution leads to a fall in the market value of a firm, this does not necessarily imply that the market value would increase following a decrease in pollution. Since we do not know whether the relationship is linear, a negative argument does not make a positive one.

As explained in chapter 3, this study will apply the short-run methodology, looking for positive press releases by the company related to environmental commitments and connecting these with the short-term abnormal returns in the stock price of the company.

2.2.2. The Environmental Indicator

Where the financial and accounting measures are easily accessible proxies for the economic effect of going green, finding a proxy for the environmental performance is difficult.

The first studies carried out in this field were generally reliant on data supplied by third parties such as the Council on Economic Priorities (CEP) or the Toxic Release Inventory (TRI) by the US Environmental Protection Agency. Studies such as the one by Shane and Spicer (1983) mostly found, rather unsurprisingly, that there is a negative effect on the stock price when the market learns that a company pollutes much. These studies were however rather methodically imprecise, using crude and simplified event studies that have been proven statistically inferior to the methods described later in this thesis (Kolari and Pynnonen, 2011, McWilliams and Siegel, 1997).

Environmental management systems (EMS), such as ISO 14001 and EMAS, have been used as an indicator of environmental performance by researchers since their introduction. ISO 14001 was introduced in 1996 as an international standard for EMSs, facilitating the cross-border understanding of environmental friendliness. Melnyk et al. (2003) test whether having an EMS improves overall performance for a firm, and whether certifying this system (for example through ISO 14001) improves performance even more. Through a survey of American managers, they find that both having and certifying the management system significantly increases performance for eight of ten indicators. Through an event study of firms listed on the Madrid Stock Exchange, Cañón-de-Francia and Garcés-Ayerbe (2009) find that the adoption of the ISO 14001 standard significantly reduces the market value of certain firms. Specifically, firms that are less internationalized and pollute less observe a more

negative stock price effect than other firms, indicating that investors expect the cost of implementing the EMS to outweigh any benefits when the firm is already a low polluter. Using a larger sample of American firms, Paulraj and Jong (2011) similarly find a negative stock price effect of ISO 14001 certification announcements when comparing the stock returns to matched control firms.

Another environmental indicator that has been used by Wai Kong Cheung (2011) is the inclusion in sustainability indexes. Wai Kong Cheung tests whether an inclusion or exclusion in the Dow Jones Sustainability World Index is followed by a change in either stock return or risk, but finds no significant long-term effects. He does however identify a temporary increase (decrease) in stock returns on the day of the inclusion (exclusion), reflecting a temporary surge in demand, which stabilizes after a day and moves the stock back to pre-inclusion (pre-exclusion) levels.

Gilley et al. (2000) look for positive effects of environmental initiatives, but are not able to find a statistically significant connection. They do, however, find differences between process-driven and product-driven initiatives which seek to minimize the environmental impact of the firm's processes and products, respectively. Product-driven initiatives are more easily observed by both the market and the consumer, and the researchers find that these create value for the company through a possible reputation enhancing effect. On the other hand, the process-driven environmental initiatives are not as visible to consumers, and are found by Gilley et al. to destroy value.

Yet another indicator that has been used is the release of environmental reports by firms. A paper by Ziegler et al. (2011) looks at the relationship between having a "climate impact statement" and "released carbon reduction measures" and long-term stock returns. They find that although there is no overall gain from buying stocks that disclose their environmental performance and selling those that do not, the profitability of such a strategy has risen over time in Europe. In testing the relationship between economic and environmental performance, the authors take a detour via environmental reporting, without problematizing the relationship between environmental performance and reporting. Al-Tuwaijri et al. (2004), in their review of prior research on the relationship between these three variables, find that the relationship between environmental performance and reporting has most often been found to be non-significant, and at times contradictory. However, in their empirical analysis, the same authors find a positive and highly significant coefficient between the two variables, indicating that the assumptions by Ziegler et al. (2011) may be correct.

In deciding the proxy for environmental performance, it is important to distinguish between environmental initiatives that are voluntary, and those that are only a result of compliance. Using Prakash's (2000) definition, introduced in the previous section, this is the same as the difference between the beyond-compliance policy types 1 and 2, versus the policy types 3 and 4 which are only there in order to adhere to regulation. Fisher-Vanden and Thorburn (2011) argue that previously inconsistent results on the relationship between economic and environmental performance can be explained by making this distinction, and show that only studies that choose an environmental measure tied to liability, compliance, and regulatory risks find a positive relationship. The prediction is that firms engaged in environmental activity to reduce risk or in response to liability or compliance claims will observe a positive effect of that activity, whereas firms engaged in environmental activity for any other purposes will destroy value. The authors find, by looking at voluntary environmental initiatives aimed at reducing carbon emissions, that the stock market effects are negative following press releases related to firms adopting the initiatives. From a managerial point of view, it is also more interesting to regard only voluntary initiatives, as it is here that managers have leeway to act.

2.3. Hypothesis Development

Earlier research has to a large extent focused on specific and detailed issues like for example the adoption of one specific EMS or a forest certification. However, in order to establish a relationship between economic and environmental performance that is of use to managers in Norway and Sweden today, it is necessary to look more broadly at environmental plans and achievements, and consider whether they are economically attractive in general.

In order to avoid the positive bias in news announcements that are tied to liability, compliance, or regulatory risk, this paper will only look at environmental awards, certifications, and voluntary initiatives by a firm.

Porter (1991) and Porter and van der Linde (1995a, 1995b) postulated two decades ago that taking voluntary steps to reduce the impact of a firm's actions on the environment could be a source of value. Radical changes have since occurred as to how companies are run, and managers now focus much more on environmental issues. A valid question now is if they focus too much; have they gone beyond the scope of merely preventing pollution first discussed by Porter? Is going green still profitable in Norway and Sweden, or have all the gains already been realized? This uncertainty is consistent with previous studies that have not

been very decisive in whether the relationship between economic and environmental performance is positive or negative (or even non-existent). To open for both possibilities, this thesis will be open for results in both directions by keeping two-sided hypotheses.

We define an environmental announcement (or an environmental press release) as any press release or new disclosure concerning: the receipt of an environmental award; being/ planning to be environmentally certified; being included in a socially responsible index; initiating cooperation with an NGO on an environmental issue, or the commencement of other voluntary environmental initiatives.

Our first hypothesis will look for any overall effects from the environmental press releases of all types in both Norway and Sweden to try to find the elusive answer to whether going green is profitable.

H_1: An environmental press release has no effect on the stock price of the firm concerned.

H_{1A}: An environmental press release has a positive or negative effect on the stock price of the firm concerned.

Even if a general conclusion may be drawn from this first hypothesis, a more narrow question is not whether it pays to be green, but in which situations? It is possible that managers act in favour of the environment out of a personal conviction and set of values. Attitudes and values towards the environment may differ between Norway and Sweden, and consequently there may be differences in the reaction to environmental press releases.

Table 2.1 shows the results of two World Values Survey (2005-2008) questions by respondents in Norway, Sweden, and the United States. It shows how Norway and Sweden are relatively similar in the perception of the dangers of global warming; 91.6% and 94.8%, respectively, believe that this is a very or somewhat serious world problem. Nevertheless, when it comes to prioritizing either economic growth or saving the environment, the countries differ somewhat – with 77.2% of Norwegians and 64.7% of Swedes preferring the environment. Any differences in reaction to relevant press releases may be a consequence of this.

Question posed	Possible answers	Country of response		
		Norway	*Sweden*	*United States*
Environmental problems in the world: Global warming or the greenhouse effect.	Very serious	58.50 %	64.30 %	48.50 %
	Somewhat serious	33.10 %	30.50 %	32.00 %
	Not very serious	6.50 %	4.90 %	13.30 %
	Not serious at all	1.90 %	0.30 %	6.30 %
	Total answers	**1014**	**989**	**1213**
Protecting environment vs. Economic growth	Protecting environment	77.20 %	64.70 %	54.10 %
	Economy growth and creating jobs	20.90 %	33.50 %	45.90 %
	Other answer	1.90 %	1.80 %	0
	Total answers	**1013**	**981**	**1209**

Table 2.1: *Perceptions of and attitudes towards the environment.*

The table also shows how both Norway and Sweden differ significantly from the United States with respect to acknowledging global warming and prioritizing the environment over economic growth – Americans prefer economic growth to a much larger extent than the two Scandinavian countries. Most of the earlier research has been done in the United States, but since our study focuses only on Norway and Sweden, our conclusions may be different due to these varying values. We can formulate our second hypothesis:

H_2: The stock market reaction following an environmental press release is the same for companies listed in Norway and in Sweden.

H_{2A}: The stock market reaction following an environmental press release differs between companies listed in Norway and in Sweden.

Earlier event studies have generally looked at merely one or two types of press releases (e.g. Melnyk et al., 2003, Fisher-Vanden and Thorburn, 2011), making it possible to isolate the effect of that specific type of news announcement. When looking at all types of voluntary public disclosures, it is therefore important to classify the announcements in order to examine the perceived differential performance of different types of environmental initiatives (Gilley et al., 2000). We will here classify the announcements into three categories according to how environmentally "strong" they are. Though it is probable that all categories show a relationship in the same direction but of different size with regards to strength, it is possible that the markets react in a different manner to weak environmental initiatives that demand less investment, than to stronger and more expensive initiatives.

The third hypothesis is therefore:

H_3: Environmental press releases of different strengths have the same effect on the stock price of a company.

H_{3A}: Environmental press releases of different strengths do not have the same effect on the stock price of a company.

With these three hypotheses to test, we now move on to collecting and summarizing the data used.

3. Method and Data

Taking environmental responsibility has become more and more popular for companies the last couple of decades, but researchers have not yet been able to identify a clear relationship between economic and environmental performance. This unclear relationship has led us to three research questions concerning the overall relationship, differences between Norway and Sweden, and how the strengths of the press releases may affect the stock price.

To answer these questions in a rigorous and quantitative manner, we need to use a precise and acknowledged methodology – in this case the event study – in a transparent and understandable way. In order to achieve this, it is necessary to describe (1) the method, its prerequisites and advantages, (2) how we have applied the method in this specific case along with any assumptions made, (3) the sample used and the data collected, and (4) which statistical tests have been used in assessing the collected data. This is also the manner in which the chapter is organized, starting with an introduction to the event study methodology.

3.1. The Event Study Approach

We have in this thesis applied the event study methodology, examining the effect of an unanticipated economic event on firm value, measured through the price of publicly listed common equity.

In this setting, an event is considered as anything that leads to disclosure of new relevant information (McWilliams and Siegel, 1997). The price of a security is in general the discounted value of all (expected) future cash flows, and an event that changes the market's expectation of future cash flows to a firm should therefore be followed by a change in the security price. Given that markets are efficient, the effect of an economic event should be captured in the security price immediately (MacKinlay, 1997). Although event studies may be performed on different types of securities, the most frequent approach is to perform it on common equity (MacKinlay, 1997). That is also the approach in this study.

In the event study, the return on a security during a specified period around the time of announcement (generally called the event window), is compared to the return which should be expected absent of any news announcement. This "abnormal return" is defined as the excess return above the expected return, and is assumed to capture the market's response to new information (McWilliams and Siegel, 1997). Generally, the abnormal return can be expressed as:

$$AR_{i,t} = R_{i,t} - E\left[R_{i,t} \mid X_t\right]$$

Where $AR_{i,t}$ is the abnormal return of press release *i* at time *t*, $R_{i,t}$ is the actual return, $E\left[R_{i,t} \mid X_t\right]$ is the expected or normal return, and X_t is the conditioning information for the normal return model (Campbell et al., 1997). *t* is a day index where the announcement day takes the value of zero, preceding days are negative, and consequent ones are positive.

In the previous chapter we presented three methods for studying the relationship between economic and environmental performance: portfolio analysis, regression analysis, and long-term regression studies. We have chosen to perform our analysis using the event study methodology because it is the analysis which most securely isolates the specific effect of information regarding environmental performance reaching the investors. Longer term analysis would be prone to omitted unobserved variables, and would require the use of a complex four factor model and a larger and more diversified dataset.

The weakness of a short-term model is, however, that it builds heavily on one assumption: that markets are efficient. In order for an unanticipated event to have an impact on the stock price of a company, investors have to be actively buying and selling the stock following new information. The assumption of efficient markets is therefore a crucial one in an event study.

3.1.1. The Efficient Market Hypothesis

The Efficient Market Hypothesis (EMH) states that security prices should at all times fully reflect all available information (Fama, 1970), and this is an important underlying assumption in the use of event studies (McWilliams and Siegel, 1997).

It is common to distinguish between three forms of market efficiency: weak form, semi-strong form, and strong form. Weak form efficiency refers to markets where the security price reflects all past prices and price movements, semi-strong form efficiency to markets in which the price reflects all publicly available information, and strong form efficiency to markets where all both private and public information is reflected in security prices (Fabozzi, 2009).

While strong form efficiency implies that inside information, i.e. information not yet published, is available to all investors, semi-strong efficiency only assumes that all published information is available to all investors (Scott, 1995). From these definitions, and in line with Fabozzi's (2009) classification of the U.S. stock market, we assume that the Scandinavian stock markets are semi-strong form efficient. The only factor that speaks against this assumption is that the Scandinavian markets are much smaller, and have lower trading

frequency, than the more efficient US market. However, this alone is not enough to classify the Swedish and Norwegian markets as weak-form efficient, so the assumption still holds.

3.2. Details of the Event Study and Our Approach

We have seen that the event study measures short-term stock returns following an unanticipated event, and that market efficiency is an important assumption. In order to have reliable and verifiable results, we will show how the event study methodology has been used in this thesis. Specifically, we will describe how and which returns have been used; which types of environmental announcements (unanticipated events) we have measured; how we have dealt with several news announcements (confounding effects) at once; for how long an event window we have measured the returns, and, finally, how we have categorized the announcements to find any differential effects.

3.2.1. Abnormal Returns – Quantifying the Stock Returns

As defined earlier, the abnormal return is the excess return over the expected or normal return on a security. What defines expected or normal returns on a stock is not a fact given in the market, but can be calculated using one of two categories of models: statistical models or economic models (Campbell et al., 1997).

While the statistical models rely on statistical assumptions about the behaviour of security returns, economic models are based on assumptions about investors' behaviour. However, statistical assumptions are also often necessary for the economic models, rendering them inferior to statistical models. Among the statistical models are the constant-mean-return model, the market model, and the factor model; while the Capital Asset Pricing Model (CAPM) and versions of the Arbitrage Pricing Theory (APT) are examples of economic models (Campbell et al., 1997).

This study uses the market model, which predicts an expected return based on the correlation of the stock return with the market return in an estimation period. The multifactor model also predicts a return based on historical correlations, but takes into consideration several factors (MacKinlay, 1997). According to Campbell et al. (1997), there is little difference in using a multifactor model instead of the market model to determine normal performance in event studies. The reason is that variables other than the market return have little explanatory power in such a short period of time, and thus contribute to only marginally reducing the variance in the abnormal return.

In this study, the approach used to calculate expected return is the market model:

$$R_{i,t} = \alpha_i + \beta_i R_{m,t} + \epsilon_{i,t}$$

where

$R_{i,t}$ = *the stock return related to press release i at time t*

α_i = *the intercept for press release i from the estimation period*

β_i = *the correlation between the return on the stock and the return on the market during the estimation period of press release i*

$R_{m,t}$ = *the return on market at time t*

$\epsilon_{i,t}$ = *the residual in the regression model for press release i at time t*

In order to estimate the most accurate expected return for companies listed in Norway or Sweden, we utilize two different indices to approximate the market return. The return on the All Share Gross Index (OSEBX) is used as the market return for Norwegian-listed companies, while the return on the SIX Return Index[1] (SIXRX) is used for Swedish-listed companies. These indices are both gross return indices, meaning that dividends are assumed to be reinvested in the index. In order for the individual stock returns to be comparable to these indices, we also use dividend-adjusted stock prices for all companies. Stock prices and the corresponding value of the market index are retrieved from Macrobond (2012). The returns are calculated as continuous returns:

$$R_t = ln\left(\frac{P_t}{P_{t-1}}\right)$$

where P_t is today's closing price and $P_{i,t-1}$ is yesterday's closing price.

The market model is estimated during a period prior to the event window – the estimation period. The estimation period ends before the start of the event window in order to exclude the possible abnormal returns caused by the event. It is common to use an estimation period of around 250 days, which is approximately the number of trading days in a calendar year (Corrado, 2011). In line with Corrado (2011) and Fisher-Vanden and Thorburn (2011), we have used an estimation period of 251 days.

[1] We had initially planned to use OMXSGI (OMX Stockholm Gross Index) for the Swedish-listed companies, but since this index was not listed until 28.12.2007 we have chosen to use the SIXRX instead. There is, however, perfect correlation (99.99 %) between the two indices since that date.

We estimate the market model for each press release using an Ordinary Least Squares (OLS) regression. Using OLS to estimate α_i and β_i, we assume the following (Patell, 1976):

$$E(\epsilon_{i,t}) = 0$$

$$Cov(\epsilon_{i,s}, \epsilon_{i,v}) = \begin{cases} 0 \; for \; s \neq v \\ \sigma_i^2 \; for \; s = v \end{cases}$$

$$Cov(\epsilon_{i,t}, R_{m,t}) = 0, \qquad t = \tau_1, \dots, \tau_2 \; and \; i = 1, \dots, n$$

This means that the error term $\epsilon_{i,t}$ has an expectation of zero; there is no autocorrelation (correlation in the error term $\epsilon_{i,t}$ though time), and no endogeneity (correlation between the error term $\epsilon_{i,t}$ and the explanatory variable $R_{m,t}$). *s* and *v* are days in the estimation period, $\tau_1$and τ_2 is the start and end day of the estimation period, respectively, and *n* is the number of press releases. Using the estimated alpha and beta from the market model, the expected return on day *t* of press release *i* is given by:

$$E[R_{i,t}|R_{m,t}] = \hat{\alpha}_i + \hat{\beta}_i R_{m,t}$$

The abnormal return (AR) on day *t* for press release *i* in the event window is then the difference between the actual return, $R_{i,t}$, and the expected return $E[R_{i,t}|R_{m,t}]$:

$$\widehat{AR}_{i,t} = R_{i,t} - (\hat{\alpha}_i + \hat{\beta}_i R_{m,t})$$

The cumulative abnormal return (CAR) related to press release *i* is just the sum of abnormal returns over all days in the event window:

$$\widehat{CAR}_{i,(T_1,T_2)} = \sum_{t=T_1}^{T_2} \widehat{AR}_{i,t}$$

where T_1 and T_2 is the start and end day of the event window, respectively. CAR is the key measure we will use to assess the extraordinary stock returns following the unanticipated news announcement.

The cumulative average abnormal return (CAAR), the average CAR over all press releases, in the event window $[T_1, T_2]$ is then:

$$\widehat{CAAR}_{(T_1,T_2)} = \frac{1}{n} \sum_{i=1}^{n} \widehat{CAR}_{i,(T_1,T_2)}$$

When summing the CARs of the press releases, it is assumed that there is no correlation between the abnormal returns related to the different announcements (Campbell et al., 1997).

3.2.2. Types of Corporate Disclosures Studied

Our study analyses the effect of environmental announcements on firm value. In order to detect whether the effect varies across categories of announcements, we have chosen to include press releases concerning different types of environmental plans and achievements. The approach to environmental action varies from industry to industry, and by including several types of environmental announcements, we might get observations from more industries than we otherwise would have had.

The types of announcements included are environmental certifications, awards for environmental responsibility, inclusion in environmental and sustainability indices, NGO cooperation, and voluntary environmental initiatives such as CO2 reductions and improved waste management. Contract announcements are included when the company in question enters a contract to buy new equipment and stresses that the equipment is environmentally friendly. Sales contracts are assumed to have an unequivocal positive impact on earnings after tax, and are therefore excluded from the analyses. Reporting on environmental policy, emissions, pollution, etc. is only included if the reporting is recognized and awarded.

3.2.3. Confounding Effects

A critical assumption in the event study methodology is that there are no confounding effects from other events (McWilliams and Siegel, 1997). Confounding events are other events that have a potential effect on the security price. To ensure that a change in the security price is related to the event studied, announcements with confounding events within the event window are removed from the sample.

To control for confounding effects, we have excluded press releases for which there have been Factiva press releases during the event window on declaration of dividends, earnings or credit announcements, takeover bids, merger negotiations, changes in key executives, restructuring, joint ventures, major contract awards, significant liability suits, and announcements of major new products. The result is that the number of press releases remaining in each event window varies, with most press releases in the shortest event window and fewest in the longest event window.

3.2.4. Event Window Length

Several factors affect the choice of event window length, i.e. how long we assume it takes for the new information to be fully reflected in the stock price. Among these are the Efficient

Market Hypothesis, confounding effects, and uncertainty about when information becomes publicly available.

The Efficient Market Hypothesis gives support to a short event window because it suggests that new information is rapidly reflected in the security price. Additionally, the longer the event window gets, the more difficult it is to control for confounding effects (McWilliams and Siegel, 1997). Both these factors provide support for choosing a shorter event window.

In order to take into account the effects of announcements made after the closing of the stock market, the event window is often expanded to include the day after the announcement day (Campbell et al., 1997). Days prior to the announcement day may also be included in the event window to ensure that possible leakages of information are captured in the security returns. Another reason for including days before or after the announcement day is that there might be uncertainties around when the information is publicly available (McWilliams and Siegel, 1997).

This study looks at three different event windows: The first includes the announcement day[2] and the day after, [0,1], the second includes also a day before, [-1,1], and the third includes two days prior to the announcement as well as two days after, [-2,2]. The estimation period starts at t = -253 and ends at t = -3, where t= 0 is the announcement day.

3.2.5. Categorization

In order to get a better understanding of our data, we divide the press releases according to two main dimensions: country of listing and strength of the announcement. The country of listing can either be Norway or Sweden, and we define three categories of strength: weak, medium, and strong. We also introduce an additional dimension by determining whether the announcement is an award, a certification, or an initiative.

Press releases are allocated into categories of strength according to the commitment of the press release and the novelty of the information in the press release. The greater the commitment or prestige involved and the more new information it carries, the stronger the press release is considered. It is for example not as impressive to be included in the same sustainability index twice. The reason for categorizing the data according to their strength is that we hypothesize strong announcements to have greater impact on firm value than weak announcements.

[2] American press releases and articles are moved to the day after the American announcement date, when trading resumes in Europe, while Asian press releases are registered on the same day. There are four American and five Asian press releases in the sample.

Environmental awards are conferred by independent organizations to the company due to superior environmental performance. Awards are categorized according to their prestige and geographical dimension. International awards are categorized as strong, national as medium, and local as weak. Awards that have been received before are downgraded for each time the award is received. Awards received by subsidiaries are also downgraded.

Certifications of whole firms that are either planned or achieved are categorized as medium, while certifications on subsidiary level are categorized as weak. Inclusions in sustainability indices also count as certifications. If they are global, they are categorized as medium, while inclusions in national indices are categorized as weak. No inclusions in sustainability indices are categorized as strong. If the company has been included again after having been excluded for a period of time, the inclusion is downgraded.

Planned or achieved *environmental initiatives* are sorted into the categories weak, medium, and strong according to their concreteness and degree of commitment. An environmental initiative is considered as anything the company voluntarily does to reduce its environmental impact or improve environmental conditions. In order to classify as a strong initiative, the results of the initiative must be measurable, and the initiative must be concrete with regards to the period over which the results have been, or will be, achieved. Concrete planned or achieved initiatives on subsidiary level are categorized as medium. Non-concrete plans or achievements on firm level are also downgraded to medium. Cooperations with NGOs are categorized as weak unless the cooperation will be a large investment for the firm.

Table 3.1 summarizes our categorization of announcements:

Strong	**Medium**	**Weak**
Concrete environmental initiative on firm level.	Concrete environmental initiative on subsidiary level.	Certification of plant.
International awards.	Non-concrete initiative on firm level.	Local awards.
	Prestigious certification.	Inclusion in national sustainability index.
	National awards.	Re-inclusion in global sustainability index.
	Inclusion in global sustainability index.	Cooperation with NGO.

Table 3.1: *Strength categorization.*

3.3. Sample Selection and Data Description

We have described the event study and how this has been used for gathering data. It is now appropriate to present the press releases found, the companies that released them, and other important measures.

3.3.1. Sample Selection

The sample used in the study comprises 125 press releases from companies listed in Norway and Sweden during the period from March 1998 to January 2012. All companies are either listed on the Oslo Stock Exchange (Oslo Børs), the Stockholm Stock Exchange (Stockholmsbörsen, OMX Stockholm), or both. Although the companies on these exchanges originate from countries around the world, we will refer to them as Norwegian and Swedish companies.

Norwegian companies are from the indices OBX and OB Match, whereas Swedish companies are from the index OMX Stockholm 60. These indices were chosen to ensure liquidity in the shares, which is important for the share price to fully capture the market's response to the event. In cases where a company had more than one share listed on the index, the most liquid share was used.

Press releases were found by searching for environmental announcements in the press archives on the web sites of the 185 companies on the three indices. We also searched Factiva (2012) for press releases from these companies, limiting our search using keywords such as *environmental, ISO 14001, emissions, CO2.* In all, we found 170 press releases regarding environmental initiatives, certifications, or awards. 45 of these were eliminated due to confounding events or lack of stock data. In the final sample, 125 press releases from 43 companies were included.

As pointed out by Patell (1976), there is a bias of self-selection in this type of event studies: Only those companies which announce their environmental initiatives are included in the study.

3.3.2. Description of Final Dataset

The final dataset consists of 125 press releases from 43 Norwegian and Swedish companies listed on the Oslo Stock Exchange and Stockholm Stock Exchange. A full description of all press releases is given in Appendix A.

Table 3.2 shows how the press releases are distributed over companies and sectors. Some companies appear more than once in the sample of press releases and are thus overrepresented compared to companies with only one press release in the sample. This creates a potential source of bias in our sample.

The majority of the press releases in the sample (73 %) come from firms within the sectors of consumer discretionary, consumer staples, industrials and materials. These are sectors that tend to pollute more, and might therefore be more concerned about reducing their environmental impact or improving their reputation in this area than companies in less polluting sectors, such as the health care sector.

GICS sector	**Number of Press releases**	**Number of Companies**	**Average press releases per company**	**Minimum press releases per company**	**Maximum press releases per company**
Consumer Discretionary	19	5	3.8	1	13
Consumer Staples	20	4	5	1	13
Energy	7	5	1.4	1	2
Financials	7	3	2.3	1	5
Health Care	3	2	1.5	1	2
Industrials	37	12	3.1	1	8
Information Technology	11	5	2.2	1	5
Materials	15	5	3	1	5
Telecommunication Services	6	2	3	3	3
Total sample	125	43	2.9	1	13

Table 3.2: *Distribution of press releases over companies and sectors.*

Table 3.3 presents financial and sector information about the firms related to each of the press releases in the sample. The information is divided according to the categories of strength and country. The market value of equity is reported as of the last day in the estimation period (at t = -3), while total sales and market-to-book value are reported as of the last day in the last quarter before the event window. Sales are thus quoted in only the last quarter before the event. We choose to use quarterly sales because this number is readily accessible and better reflects the size of the company at the time of the event than a longer time period would. The data is gathered from Macrobond (2012), Børsprosjektet (NHH, 2012) and firm annual reports.

	Total sample	Weak	Medium	Strong
Number of press releases	125	66	46	13
Norway	*41*	*20*	*18*	*3*
Sweden	*84*	*46*	*28*	*10*
Market value of equity at t=-3 (bn NOK)				
Mean	61.4	56.5	66.7	67.6
Norway	*41.9*	*29.6*	*56.8*	*34.7*
Sweden	*70.9*	*68.2*	*73.0*	*77.5*
Median	32.7	31.1	39.2	27.8
Norway	*6.5*	*6.5*	*5.3*	*5.7*
Sweden	*38.5*	*34.0*	*46.8*	*27.7*
Sales, quarterly (bn NOK)				
Mean	19.4	17.9	20.9	21.5
Norway	*9.2*	*6.0*	*12.9*	*8.1*
Sweden	*24.3*	*23.0*	*26.1*	*25.6*
Median	12.4	11.5	11.8	11.1
Norway	*4.34*	*3.65*	*4.75*	*4.7*
Sweden	*21.6*	*20.4*	*22.4*	*23.0*
Market-to-book ratio				
Mean	2.03	1.95	2.24	1.68
Norway	*2.35*	*2.16*	*2.66*	*1.79*
Sweden	*1.87*	*1.85*	*1.98*	*1.65*
Median	1.50	1.43	1.58	1.54
Norway	*1.48*	*1.45*	*1.49*	*1.73*
Sweden	*1.52*	*1.41*	*1.66*	*1.47*

Table 3.3: *Selected financial data of sample companies.*

There are twice as many press releases from Sweden than from Norway: While there are 41 press releases gathered from Norway, there are 84 from Sweden. Sample companies on the Oslo Stock Exchange releasing environmental announcements have lower market value of equity than sample companies on the Stockholm Stock Exchange. This might indicate that Swedish companies taking environmental action are in general larger than Norwegian companies taking such action, but most likely it is a reflection of the composition of the Norwegian and Swedish stock exchanges. A company listed on the Stockholm stock exchange has on average almost twice the market cap of one listed in Oslo (Macrobond, 2012). The quarterly sales show approximately the same as the market value of equity. The market-to-book is on average larger in Norway than Sweden, but the medians are approximately equal.

This indicates that Norway has a few very high growth firms, but that the "normal" company is no different in this regard than Swedish companies.

Figure 3.1 shows the distribution of environmental press releases over the years 1998 to 2011. Although the number of press releases went down in 2010, the overall trend seems to be positive. There seems to be no overall trend in the number of press releases in each strength category.

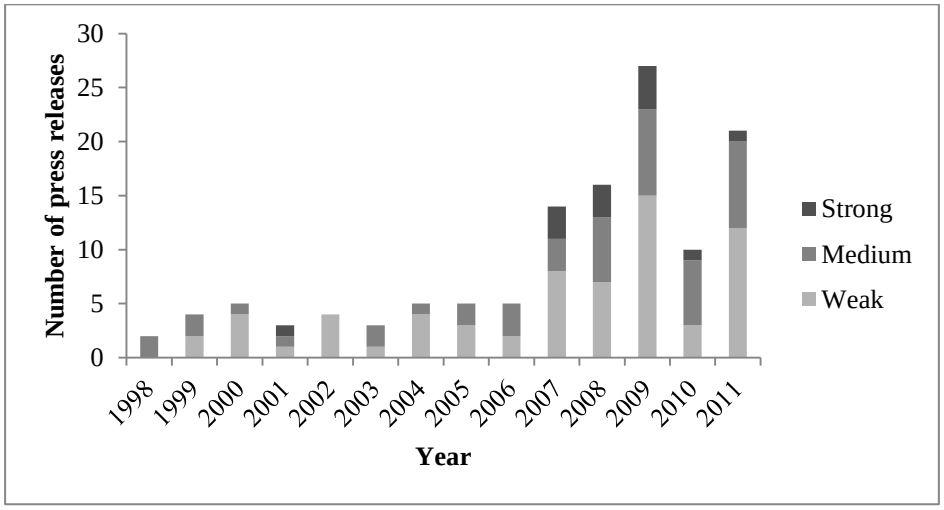


Figure 3.1: *Distribution of press releases over strength and year.*

Figure 3.2 shows how press releases from Norwegian and Swedish companies have evolved over time. While the first observations of Swedish companies are from 1998 and peak in 2009, the first observations of Norwegian companies are from 2003 and continue to grow.

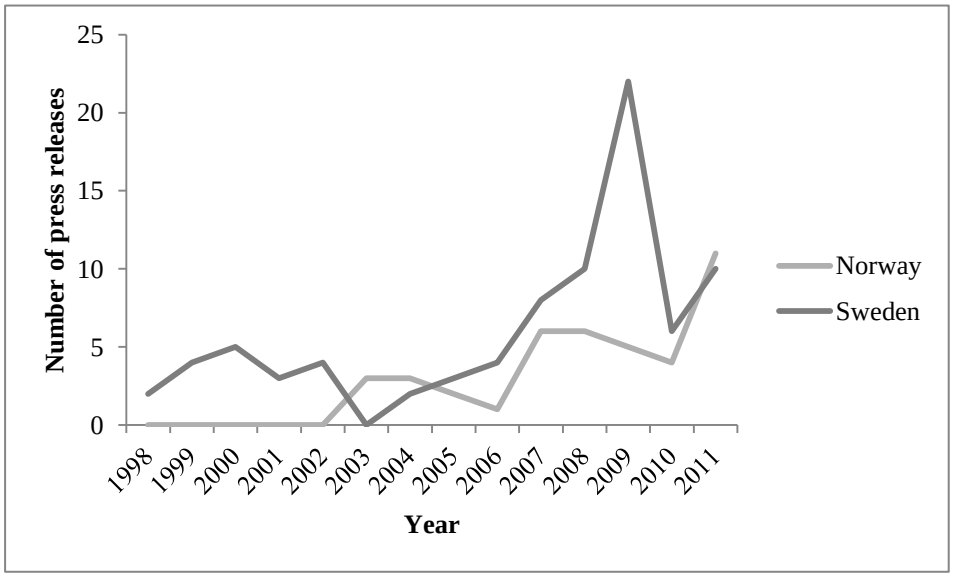


Figure 3.2: *Distribution of press releases over country and year.*

3.4. Statistical Methodology

In order to study the relationship between environmental and economic performance, we need statistical tests that give robust and reliable results. Before presenting these, however, we identify which tests are suitable based on whether the data is normally distributed or not. This section is therefore divided into three subsections: The first will test for normality of stock returns, while the other two will present the two statistical approaches, univariate and cross-sectional analysis, that are used to test the hypotheses developed in the preceding chapter.

3.4.1. Normality of Stock Returns

It is generally assumed that logarithmic stock returns are normally distributed (Campbell et al., 1997), an assumption that allows us to use parametric methods to test our hypotheses. However, this assumption is easily violated, and it is therefore important to test whether it holds for our dataset or not.

We test the normality assumption by testing the distributions of CAR for the total sample and for the country and strength categories. The tests are performed for all three event windows. Table 3.4 shows the results of two commonly used statistical tests with a null hypothesis of normal distribution: the Shapiro-Wilk W test for normal data, and the skewness/ kurtosis test for normality, calculated in Stata version 12 (StataCorp, 2011). Selected frequency plots are presented in Appendices B.1 to B.3.

The Shapiro-Wilk W test is a strong test (Royston, 1995) of departure from normality, first proposed by Shapiro and Wilk in 1965, and later developed by several authors (e.g. Pearson et al., 1977). W can be interpreted as a measure of the straightness of the line in a probability plot, and any departure from normality is shown by a low p-value. The skewness/ kurtosis test for normality is based on a chi-square test that combines testing if the skewness and kurtosis alone deviate from a those of a standard normal distribution; zero and three, respectively (StataCorp, 2011). Our findings are consistent with Campbell et al. (1997), who state that for short horizons historical returns show weak evidence of skewness and strong evidence of excess kurtosis (fat tails).

Both tests in table 3.4 indicate that the distributions of the CAR for the total sample, the Sweden sample, and the weak sample in the [0,1] window significantly deviate from the normal distribution. The Shapiro-Wilk W test also shows evidence of non-normality in the Norway sample for this window. All these tests are significant on the 1 % level. For the full sample, the skewness/kurtosis test indicates non-normality on the 10 % level for all event

windows. This does not necessarily mean that all parametric tests are invalid, but that we need to check their results using also non-parametric methods.

			Shapiro-Wilk W test for normal data	Skewness/ Kurtosis test for Normality		
Sample	*Event window*	*Observations*	*W*	*Skewness*	*Kurtosis*	*chi^2*
Full sample						
	[0,1]	125	0.959***	0.834	4.413	15.46***
	[-1,1]	115	0.980	0.236	4.167	5.71*
	[-2,2]	86	0.981	0.378	3.908	5.15*
Norway						
	[0,1]	41	0.921***	0.685	2.436	4.19
	[-1,1]	39	0.962	0.013	4.766	4.67*
	[-2,2]	31	0.975	0.360	2.506	1.04
Sweden						
	[0,1]	84	0.943***	0.898	5.979	16.65***
	[-1,1]	76	0.979	0.366	3.789	4.39
	[-2,2]	55	0.982	-0.205	3.142	0.90
Weak						
	[0,1]	66	0.921***	1.137	4.653	13.93***
	[-1,1]	59	0.957**	0.621	4.370	7.32**
	[-2,2]	46	0.977	0.178	3.709	2.24
Medium						
	[0,1]	46	0.980	0.377	2.726	1.38
	[-1,1]	43	0.967	-0.186	3.837	2.61
	[-2,2]	28	0.955	0.379	2.762	1.00
Strong						
	[0,1]	13	0.982	0.032	3.136	0.87
	[-1,1]	13	0.928	-0.237	1.701	2.67
	[-2,2]	12	0.940	-0.666	2.764	2.06

* p-value < 0.10; ** p-value < 0.05; *** p-value < 0.01
All tests are two-sided.

Table 3.4: *Normal distribution tests for categories and event windows.*

In order to compare two groups with a two-sided parametric test, we also need to identify whether the variance in the CAR is the same in two groups. As such a test is needed to test hypothesis number 2, we need to check whether the CARs in the Norway sample and the Sweden sample have the same variance. This is done with a traditional F-test (where the null-hypothesis is equal variances) in Stata (StataCorp, 2011), and the results are presented in table 3.5.

	P-values		
Event window	*σ(S) < σ(N)*	*σ(S) ≠ σ(N)*	*σ(S) > σ(N)*
[0,1]	*0.8842*	*0.2315*	*0.1158*
[-1,1]	*0.6760*	*0.6481*	*0.3240*
[-2,2]	*1.0000*	*0.0000*	*0.0000*

Table 3.5: *Test of equal variance for Norway and Sweden sample.*

The table shows that the p-value of greater variance in Swedish returns than in Norwegian returns is practically zero for the longest event window, indicating that the variance is indeed larger for the Swedish returns in this event window. For the shorter event windows, such a difference in the variance of returns cannot be proven. Nevertheless, in order to allow for the possibility that the variances are in fact different, we will choose a test that opens for unequal variances. This only means that we need to choose an appropriate parametric test-estimator in the comparison in the next subsection; it will have no effect on the non-parametric tests.

3.4.2. Applied Tests for Univariate Analysis

The univariate analysis is one of two methods we use to test our hypothesis of an effect of environmental press releases on a company's stock price. Table 3.6 shortly describes the eight statistical univariate tests that are applied. The first three tests are used to test the hypothesis of zero effect, while the next five are tests used for comparisons of subgroups. A full description of the tests can be found in Appendix C. The ANOVA test assumes equal variances in the compared groups. We test this assumption using Bartlett's test of equal variances which is described in detail in Appendix C.4.

3.4.3. Methodology for Cross-Sectional Analysis

The univariate analysis focuses on whether the CAAR differs from zero and whether there is a difference between the CAAR for observations in different country and strength categories. Elaborating the analysis with a multiple regression allows us to investigate how the CAR varies across different types of environmental announcements and identify factors that can explain the variation over press releases in the CAR. We choose to use the medium-long event window, [-1,1], in the regression analysis, and the dependent variable is therefore $\widehat{CAR}_{[-1,1]}$.

Test name	Test description
Tests of zero effect	
Patell-Z	A test developed by James Patell (1976), commonly used in event studies. Based on normally distributed returns, the student-t distribution and the central limit approximation.
Generalized sign test (Cowan-Z)	A non-parametric test counting positive vs. negative observations and comparing them to the pre-event ratio (Cowan, 1992).
Generalized rank test (GRANK-T)	An extension of the ordinary rank test which allows for robust analyses of event windows longer than one day. Also accounts for event-induced volatility (Kolari and Pynnonen, 2011).
Tests of comparison	
Two-sided t-test	A regular t-test for comparison of two groups, assuming unequal variances (Newbold et al., 2010).
Wilcoxon rank sum test	A non-parametric test which compares the medians of the two populations and checks if they deviate significantly (Newbold et al., 2010).
Analysis of variance (ANOVA)	Normal analysis of variance testing whether all means are the same, extension of two-sided t-test (StataCorp, 2011).
Scheffe's multiple comparison	Compares the means of the variables one at a time. Recommended over other multiple comparison tests by Wesolowsky (1976).
Kruskal-Wallis	In the same way that ANOVA is the extension of the two-sided t-test, Kruskal-Wallis is an extension of the Wilcoxon rank sum test (Mickey et al., 2004).

Table 3.6: *Summary of univariate tests.*

To analyse how the CAR varies with strength, country and other factors, we use a multiple regression. Our data is cross-sectional, meaning that the dataset is one-dimensional and that all subjects (press releases) are measured only once. The market model we use to calculate expected returns (see section 3.2.) does not explain the same amount of variation in the estimation period returns for the different press releases. The result is that the precision of the expected returns in the event window varies over the press releases, leading to varying precision in the CAR. In order to control for these differences in precision, we use a weighted least squares (WLS) regression. Instead of weighing each observation equally (which is the approach in the OLS regression), each observation is here weighted according to the inverse of its standard deviation of the residual from the market model. This type of weighing ensures

that less precise observations are given less importance than more precise observations. See Appendix D for the WLS assumptions.

3.4.3.1. Model Building and Misspecification

The optimal regression model includes factors that make economic sense (Studenmund, 2006) and which for a given number of independent variables provides the maximum adjusted R-squared[3], meaning that it best explains the variation in the dependent variable (Freund et al., 2006).

Two common errors in the specification of a regression model are to omit relevant variables and to include irrelevant variables (Wooldridge, 2009). Omitted variable bias arises when a relevant independent variable is left out of the regression, and the effect of that variable on the dependent variable is captured by the coefficients of independent variables included in the regression (Greene, 2008). Over-specification means including variables in the regression model that do not contribute to explaining the variance in the dependent variable (Freund et al., 2006). Over-specification does not cause biased estimators, but it can however increase the variance of the estimators and thus the conclusions drawn about the significance of the model coefficients (Wooldridge, 2009).

3.4.3.2. Dummy Variables and Interaction Terms

In order to study the effect of categorical and ordinal variables on the dependent variable in a regression, the use of dummy variables and interaction terms is very convenient. A dummy variable takes the value of one if the observation is in the particular category, and otherwise zero (Greene, 2008). Introducing dummy variables in our regression lets us analyse the difference in cumulative abnormal returns related to one specific type of environmental announcements, by allowing the constant in the regression to be divergent for different categories of announcements. If we include interaction terms in the regression, also the slope may vary over categories of announcements. An interaction term is used when the effect of two or more independent variables on the dependent variable is not additive, or when the effect of one of the independent variables on the dependent variable depends on the level of another independent variable (Mickey et al., 2004). By introducing interaction terms in our regression, we can thus analyse the marginal effect of a variable when the observation is in a particular category (Wooldridge, 2009).

[3] Coefficient of determination.

3.4.3.3. Variables in Multiple Regression

The theory on omitted variable bias and over-specification highlights the importance of defining a good regression model. With this goal we will base our choice of variables on previous studies as well as economic theory and intuition. We will then consider which of these variables seems best to explain the variation in cumulative abnormal returns, measured by the coefficient of determination.

In order to test hypothesis 2 about differences in CAR related to the country in which the firm is listed, we introduce a dummy variable for Swedish press releases, a Sweden dummy. This variable takes the value of one if the press release comes from a Swedish company and the value of zero if it comes from a Norwegian company.

To test hypothesis 3 about differences in CAR related to the strength of the environmental announcement, we introduce dummy variables for medium and strong announcements. These two variables will take the value of one if they are classified as medium or strong, respectively, and zero otherwise. The base case for the regression will therefore be a weak announcement, and any effects of this will be caught in the constant term. We hypothesize that the effect of medium and strong announcements will augment the explained variation of the model, as both these categories mean a larger commitment to the environment and therefore potential losses or gains. If there are differences, we expect these to be larger for strong than for medium announcements.

Several studies have shown that one of the variables that contribute to explain variance in abnormal returns is the size the firm (e.g. Collins et al., 1981, Bathke Jr et al., 1989). This so called "size effect" was explored by Banz (1981), who found that small companies tend to have higher risk-adjusted returns than larger firms. In the environmental context, it is possible that smaller firms are less scrutinized by the public and have less stakeholder pressure to be environmentally friendly than larger firms; the effect should therefore be larger for bigger firms. We use sales (in NOK) in the last quarter ending before the event as a measure of firm size, retrieved from Macrobond (2012). In line with Melnyk et al. (2003), we use dummies for the quartiles of the sales instead of absolute value. In this manner we will take size into account, but we will not assume that there is a linear relationship between the cumulative abnormal return and the sales. Since most companies are represented with several press releases in the sample, it could have been a problem that some firms were overrepresented in the quartiles. This does not seem to be the case, as the first quartile includes 17 companies, the second 16 companies, and the third and fourth include 12 companies each.

Some studies include a variable for the market value of equity, but we find that there is a correlation of 82.4 % between sales and market value of the firms in the sample. Including both variables would thus cause a problem of multicollinearity, and we consequently choose not to include market value of equity.

In line with Fama and French (1995), we also include the market-to-book (M/B) ratio as a variable. They find that firms with high market-to-book ratio have higher returns than firms with low market-to-book ratio. Firms with a high market-to-book ratio are generally priced based on their future earnings and growth opportunities, and not based on their assets of today. So if the $\widehat{CAR}_{[-1,1]}$ is more negative for these firms, it may mean that investors believe stricter environmental policies will limit growth opportunities, and vice versa if the variable is positive. While the market value of equity is found for t= -3, the book value of equity is retrieved for the quarter preceding the event (Macrobond, 2012). For those companies which were not listed on Macrobond, the remaining book values were gathered through NHH Børsprosjektet (2012) or annual reports. For press releases that did not have available data on any of these sources due to their age, the oldest possible observation for that company is used.

In order to identify whether the effect of environmental announcements differs from polluting industries to less polluting industries, we introduce a dummy that takes the value of one for polluting industries, and zero otherwise. This is based on a separate analysis of the industries by both authors where the inter-rater agreement rate was 95%, and any disagreements were solved by consensus. We hypothesize that press releases from polluting sectors will aggravate any overall effects we identify, since these will have more to win and lose by "going green".

In line with Fisher-Vanden and Thorburn (2011), we also define a variable that is the natural logarithm of the number of press hits on environmentally related topics in Factiva (2012) during the 12 months ending in the month prior to the announcement. This variable is included because we hypothesize that the response to firms' environmental announcements becomes more favourable as the public interest for climate issues increases. While it would be ideal to include the press hits from Sweden for firms listed in Sweden, and press hits from Norway for firms listed in Norway, Factiva does not contain enough sources from these two countries to be a representative selection from the two countries. Therefore, we use the world interest (measured by total world press hits) for the environment as an approximation of the interest in the two countries. We find that the correlation between the natural logarithm of the number of press hits and a variable for the year of announcement is 96.1 %, which indicates

that the interest for climate-related issues has increased exponentially over the years. Figure 3.3 confirms this:

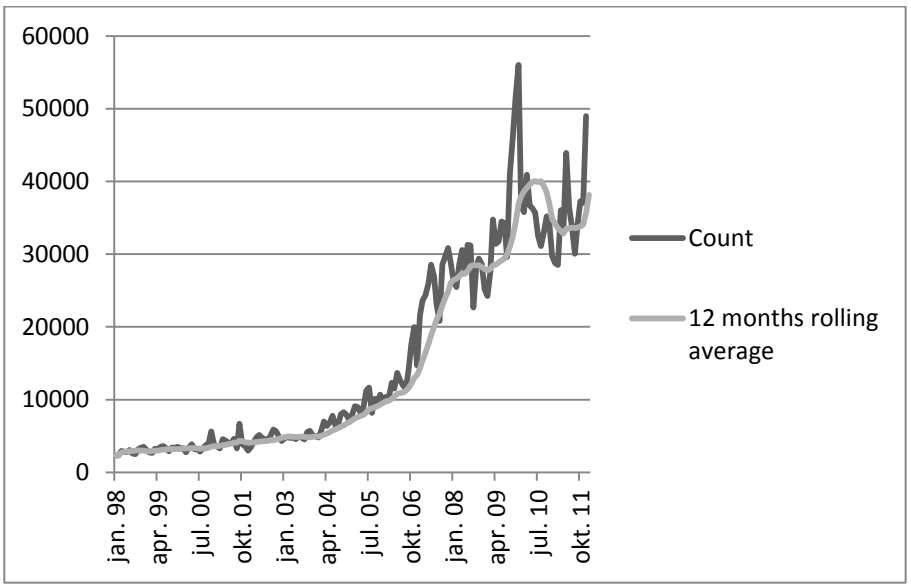


***Figure 3.3**: Factiva press hits on the following search phrase: "ISO 14001 OR Climate Change OR Sustainability OR Environmental initiative OR CO2 reduction OR emission".*

We also include a variable containing a three month average of the price (in NOK) of brent crude oil ending one month prior to the announcement, using the global spot (ICE) price of brent crude oil retrieved from Macrobond (2012). The rationale behind this is that a higher oil price might increase the profitability of environmental policies.

Using the three different types of announcements (awards, certification and SRI inclusions, initiatives), we create a dummy for announcements that deal with awards and a dummy for announcements that deal with certifications and SRI inclusions (collectively referred to as certifications). This will allow us to identify any differences in cumulative abnormal returns according to the type of announcement. Any effects of the announcement being an environmental initiative will then be captured by the constant term of the regression.

Since some firms are represented more than once in our dataset, we also look at whether the reaction to environmental announcements from any of these firms is significantly different from the reaction to other environmental announcements. We do so by introducing firm dummies for firms that are represented with more than three announcements in the dataset. When the firm dummies are included in a regression, we first run the regression including all firm dummies, and then rerun the regression including only those firm dummies that have a significant effect in the first regression.

4. Results and Discussion

In the previous two chapters the hypotheses have been developed and the methodology has been laid out. In this chapter we run the tests necessary to test the hypotheses, and find that a firm's positive environmental performance has no statistically significant effect on its stock price, and that this effect is the same for both Norway and Sweden. We also find, however, that strong press releases have a significantly worse effect on the stock price than weaker ones – a result that is confirmed even with a recategorization of the press releases.

The first two sections will present the results from the univariate and the cross-sectional analyses. The third section will then redo the analyses following a new categorization of the strength of the press releases, in order to confirm our findings that the effect becomes more negative with higher strength. The last section will go beyond reporting what we have found, and contains a discussion of the reasons and implications of our results.

4.1. Univariate Analysis

The univariate analysis is the first group of tests we run to test our three hypotheses. The first part discusses and tests hypothesis 1 only – whether there is an overall effect from releasing an environmental press release. Subsections 4.1.2 and 4.1.3 test the next two hypotheses, looking only at the difference between countries and strength.

4.1.1. Overall Effect

Table 4.1 summarizes the results from the three tests Patell-Z, generalized rank test (GRANK-T), and the generalized sign test (Cowan-Z). In order to test hypothesis 1 of no overall effect, we examine the results in the first column. The other columns are not directly used to test any of our hypotheses, but give important insight into the various subgroups which can be used in the discussions of hypotheses two and three.

As some of our subsamples are proven to be non-normal (see section 3.4.), we cannot rely solely on the parametric Patell-Z test, but must also check the two non-parametric tests. At a first glance, the table does not provide much support for rejection of the first hypothesis. The Patell-Z test finds the CAAR to not be significantly different from zero even at the 10% level. The two non-parametric tests show significance at the 10% level, but only in the event window [0,1].

	Total Sample	Norway	Sweden	Strong	Medium	Weak
Event window [0,1]						
n	125	41	84	13	46	66
CAAR (%)	**-0.234**	**-0.042**	**-0.328**	**-0.828**	**-0.654**	**0.175**
Patell-Z	-1.449	-0.430	0.510	-1.274	-1.840*	0.107
GRANK-T	1.895*	0.971	1.672*	1.129	2.383**	0.265
Negative/Positive	**75/50**	**26/15**	**49/35**	**9/4**	**30/16**	**36/30**
COWAN-Z	1.941*	1.441	1.361	1.351	1.878*	0.503
Event window [-1,1]						
n	115	39	76	13	43	59
CAAR (%)	**-0.253**	**-0.181**	**-0.290**	**-1.544**	**-0.878**	**0.487**
Patell-Z	-1.105	-0.232	-1.193	-1.966**	-1.585	0.733
GRANK-T	0.106	0.446	1.143	1.533	2.263**	-0.801
Negative/Positive	**61/54**	**21/18**	**40/36**	**8/5**	**27/16**	**26/33**
COWAN-Z	0.363	0.222	0.288	0.796	1.511	-1.157
Event window [-2,2]						
n	86	31	55	12	28	46
CAAR (%)	**-0.101**	**0.057**	**-0.191**	**-1.996**	**-0.319**	**0.525**
Patell-Z	-0.713	-0.292	-0.673	-1.789*	-0.947	0.677
GRANK-T	0.270	0.311	0.954	2.648***	1.579	-0.926
Negative/Positive	**46/40**	**16/15**	**30/25**	**10/2**	**18/10**	**18/28**
COWAN-Z	0.382	-0.082	0.539	2.278**	1.362	-1.704

* p-value < 0.10; ** p-value < 0.05; *** p-value < 0.01
All tests are two-sided.

Table 4.1: *Results of univariate tests with a null-hypothesis of zero effect.*

Although we find no significance on the overall level in the two longer event windows, all event windows show both a negative CAAR and a preponderance of negative reactions to the press releases. This indicates that the effect is in general negative, but not significantly enough for us to conclude that it must be so for all other samples than our own.

Looking at the press releases from companies listed in Norway and Sweden individually, we find no notable significance in either a positive or negative direction. However, we can observe that CAAR in Norway is always larger than in Sweden, and for the longest event window, [-2,2], is even positive.

When it comes to the medium and strong announcements, the results are somewhat clearer than for the whole sample. CAAR is negative in all event windows for both these categories, and more so for the strong than the medium announcements. For the strong announcements, none of the tests show significant effects for the [0,1] window. For the [-1,1] window, only

the Patell-Z test shows a significantly negative effect, while for the [-2,2] event window, all three tests indicate that the reaction is significantly negative. The CAAR for strong announcements in this event window is –1.996 %, indicating that the average strong environmental announcement is met with a reduction in firm value (above what is normal for the company) of 1.996 % during this period. This equals an average reduction in market value of equity of 1 182 million NOK for the companies measured. It is, however, important to point out that we have only 12 observations in this category, and any inferences must be interpreted accordingly. For the medium announcements, both the Patell-Z test and the two non-parametric tests indicate a significant negative effect in the shortest event window, [0,1], with a CAAR of -0.65 %. The GRANK-T test also proves significance for a negative effect in the [-1,1] window. None of the tests indicate a significant effect of medium announcements in the longest event window, quite contrary to what one would expect, given the strong category's very high significance here. In contrast to the medium and strong announcements, the reaction to weak announcements is actually positive for all the event windows, but never significant.

The primary aim of the tests performed and discussed in this first subsection is to evaluate whether the CAAR in the event window of the overall sample differs from zero. Performing the tests on groups of the total sample has also given us some insights when we move on to testing hypotheses 2 and 3. In these hypotheses we are interested in comparing the CAAR of two or several groups of observations; we want to test whether there are any differences related to the country in which the firm is listed or related to the strength of the announcement. The interest is whether there are differences in the CAAR between the groups, and not directly if the CAAR of a group differs from zero.

4.1.2. Norway vs. Sweden

Table 4.2 shows a comparison of the CAAR in Norway and Sweden. The comparison of the CAAR in the two countries is done with the parametric t-test assuming unequal variances, as well as the non-parametric Wilcoxon rank sum test. There is no significant difference between Norway and Sweden, neither for the two-sided t-test nor the Wilcoxon rank sum test. In all event windows, however, the reaction to the announcements from the Swedish firms seems to be more negative than the reaction to announcements from the Norwegian firms. Appendix B.4 shows dot plots for the two countries and the three event windows.

	CAAR (%)		T-test	Wilcoxon rank sum
Event window	*Norway*	*Sweden*	*T-statistic*	*Z-statistic*
[0,1]	-0.042	-0.328	1.146	0.197
[-1,1]	-0.181	-0.290	0.190	0.136
[-2,2]	0.057	-0.191	0.259	-0.058

* p-value < 0.10; ** p-value < 0.05; *** p-value < .01
All tests are two-sided.

Table 4.2: *Comparison of the CAAR in Norway and Sweden.*

4.1.3. Strength

Appendix B.5 shows a dot plot of the distribution of CAR for the different strengths and event windows. Even though all the dotplots show a downward sloping distribution as the press release gets stronger, it is the variance in these distributions which critically decides whether we can find a significant difference in the means. Table 4.3 shows the results of the Scheffe multiple comparison test, the analysis of variance (ANOVA), Bartlett's test for equal variances and the Kruskal-Wallis test. As mentioned in chapter 3 (described in detail in Appendix C.3 and C.4), ANOVA tests whether there are any differences between the means; Scheffe tests which means are different; Bartlett's tests if the parametric assumption of equal variances in Scheffe and ANOVA holds, and Kruskal-Wallis offers a non-parametric version of ANOVA.

For the event window [0,1], the ANOVA test cannot conclude that the population means of the samples weak, medium and strong are not identical. Consequently, Scheffe can find no significant differences either. Though the Bartlett's test shows that the variances may be the same for all the categories, chapter 3 gives us reason to believe that the data is non-normally distributed. This means that we must put more faith in the non-parametric Kruskal-Wallis test, which actually indicates that the CAAR for at least one of the strength categories is different from the CAAR in the other categories on the 5% level – however, it does not let us identify which ones are different.

For the [-1,1] window, Scheffe's test finds that both the medium and strong announcements are significantly different from the weak announcements, but it finds no difference between the two former categories. Both the ANOVA and the Kruskal-Wallis test confirm with high significance that at least one mean is different from the others.

	CAAR (%)	Std. Dev. (%)	P-values of difference (Scheffe)		ANOVA	Bartletts test	Kruskal-Wallis test
			Weak	*Medium*	*F-statistic*	*chi^2*	*chi^2*
Event window [0,1]							
Weak	0.175	2.429	0				
Medium	-0.654	2.091	0.178	0	2.23	1.21	6.43**
Strong	-0.828	2.421	0.362	0.972			
Event window [-1,1]							
Weak	0.487	2.806	0				
Medium	-0.878	2.720	0.053	0	4.60**	0.05	7.54**
Strong	-1.544	2.794	0.062	0.750			
Event window [-2,2]							
Weak	0.525	3.974	0				
Medium	-0.319	2.951	0.602	0	2.57*	5.53*	6.43**
Strong	-1.996	2.360	0.089	0.382			

* p-value < 0.10; ** p-value < 0.05; *** p-value < 0.01
All tests are two-sided.

Table 4.3: *Comparison of the CAAR for weak, medium, and strong.*

In the last event window, [-2,2], we can only find a difference between the weak and strong categories, while we are unable to conclude that medium announcements are different from the two other categories. Both the ANOVA and the Kruskal-Wallis test confirm that at least one strength category has a CAAR different from the others; we can therefore assume the inference is correct even though the Bartlett's test shows that the categories have different variances.

Summing up the univariate analysis, we cannot reject hypotheses one and two of no overall effect and of equal effects for Norwegian and Swedish companies. We have, however, discovered a significant difference pertaining to the strength of the press release. The question we will seek to answer in the next section is whether the cross-sectional analysis will corroborate these findings.

4.2. Cross-Sectional Analysis

The results from the univariate analysis suggest that there is no overall relationship between the environmental and economic performance of a firm. However, the results indicate that there is a difference related to the strength of the announcement. Moreover, there might also be other factors that can help explain the variance in CAR over the observations in the

sample. In order to detect these differences, we will perform a cross-sectional analysis in this section.

As described in subsection 3.4.3., we approach the cross-sectional analysis using a WLS regression, with the inverse of the standard deviation of the residual from the market model as weights. We choose to use the medium long event window, [-1,1], in the regression, and therefore the dependent variable is $\widehat{CAR}_{[-1,1]}$. Excluding those press releases with confounding effects in the event window, we have 115 observations.

In order to ascertain that there is no problem with multicollinearity between the variables in our regressions, we analyse the correlation matrix (Appendix E) with relevant variables. A commonly used rule of thumb is that two explanatory variables with higher correlation than 80 % or 90 % should not be included in the same regression because of potential collinearity problems (Griffiths et al., 1993). Therefore, we do not include variables with higher correlation than 80 % in the same regression.

Table 4.4 shows the estimated results from six different WLS regressions. Regression 1 includes all defined variables except the interaction terms and the firm dummies. As the table shows, the award dummy and the crude oil price are the only significant variables at the 1 % level. Both coefficients are negative. At the 5 % level, also the strong dummy and the certification dummy are significant. Both these variables have negative signs in the regression. The coefficients of the medium dummy, sales 2nd quartile, and the sales 4th quartile are negative, while the coefficients of the Sweden dummy, market-to-book, the polluting industry dummy, and sales 3rd quartile are positive. None of these variables are significant in the model. The adjusted-R^2 of the model is 10.74 %.

Regressions 2, 3 and 4 all include the crude oil price and the variable for climate press hits (LN 12mth press hits). While regression 2 includes the strength dummies (medium and strong) and regression 3 includes the type dummies (award and certification), regression 4 includes all the variables from regression 2 and 3. The crude oil price is significantly negative in all three models, although on different levels: on the 5 % level in regression 2 and on the 1 % level in regressions 3 and 4. The strong dummy is significant on the 10 % level in regression 2 and on the 5 % level in regression 4. The coefficient is negative in both regressions. The medium dummy is negative, but not significant in any of the models. Both the award dummy and the certification dummy are significantly negative on the 5 % level in regressions 3 and 4. The coefficient of LN 12mth press hits is positive, but insignificant, in all

three regressions. The adjusted-R^2 of these models ranges from 4.67 % to 9.82 %, where the highest belongs to regression 4.

	Weighted Least Squares Regression					
Independent variables	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
Medium dummy	-0.0049	-0.0050		-0.0055	-0.0058	-0.0044
t-value	*-1.08*	*-1.09*		*-1.22*	*-1.27*	*-0.99*
Strong dummy	-0.0181	-0.0132		-0.0145	-0.0134	-0.0191
t-value	*-2.47***	*-1.91**		*-2.13***	*-1.89**	*-2.73****
Award dummy	-0.0141		-0.0107	-0.0119	-0.0122	-0.0133
t-value	*-2.85****		*-2.23***	*-2.52***	*-2.45***	*-2.81****
Certification dummy	-0.0159		-0.0135	-0.0130	-0.0129	-0.0151
t-value	*-2.34***		*-2.15***	*-2.09***	*-2.05***	*-2.27***
LN of 12mth press hits	0.0032	0.0039	0.0027	0.0036	0.0038	0.0033
t-value	*1.04*	*1.31*	*0.89*	*1.21*	*1.23*	*1.11*
Crude oil price (NOK)	-0.0001	-0.0000	-0.0000	-0.0000	-0.0000	-0.0001
t-value	*-3.05****	*-2.36***	*-2.85****	*-2.82****	*-2.52***	*-3.39****
Market-to-Book	0.0012				0.0008	
t-value	*0.76*				*0.49*	
Sweden dummy	0.0024				-0.0001	
t-value	*0.44*				*-0.02*	
Polluting industry dummy	0.0045				0.0042	
t-value	*0.70*				*0.68*	
Sales 2nd quartile	-0.0084					-0.0067
t-value	*-1.25*					*-1.06*
Sales 3rd quartile	0.0022					0.0041
t-value	*0.3*					*0.61*
Sales 4th quartile	-0.0122					-0.0099
t-value	*-1.59*					*-1.41*
Constant	-0.0121	-0.0340	-0.0114	-0.0194	-0.0270	-0.0071
t-value	*-0.31*	*-0.97*	*-0.32*	*-0.54*	*-0.71*	*-0.19*
F-statistic of the model	2.14**	2.40**	3.29***	3.07***	2.06**	2.80**
Adjusted R-squared	0.1074	0.0467	0.0745	0.0982	0.0771	0.1245
Number of press releases	115	115	115	115	115	115

* p-value < 0.10; ** p-value < 0.05; *** p-value < 0.01

Table 4.4: *Results of regressions 1-6. Coefficients in absolute terms.*

In addition to the variables in regression 4, regression 5 includes the market-to-book ratio, the Sweden dummy and the polluting industry dummy. The coefficients of market-to-book and the polluting industry dummy are positive, while the coefficient of the Sweden dummy is negative. None of these three variables are significant, and they only contribute to reduce the adjusted-R^2, which is 7.71 %.

The last regression model in table 4.4, regression 6, also includes the six variables from regression 4 as well as the dummies for the second, third and fourth quartiles of sales. The model explains 12.45 % of the variation in CAR. While the coefficients of sales 2nd quartile and sales 4th quartile are negative, the coefficient of sales 3rd quartile is positive. None of the sales quartile dummies are significant in themselves, but jointly they are almost significant at the 10 % level (p-value of 10.72 %). The strong dummy, the award dummy and the crude oil price are all significant at the 1 % level, while the certification dummy is significant at the 5 % level. All these variables have negative coefficients in the model. The medium dummy has a negative coefficient and the climate press hits variable has a positive coefficient in the model. Neither of them are significant.

Table 4.5 presents four new regressions where interaction terms and firm specific effects are also taken into account. In addition to the variables in regression 6, regressions 7-10 include different combinations of the following interaction terms: medium*award, medium*certification, Sweden*crude oil price and Sweden*LN 12mth press hits. The interaction terms medium*award and medium*certification indicate that the observation is a medium award and a medium certification, respectively. The coefficients of Sweden*crude oil price measures the partial effect on CAR of the crude oil price for Swedish firms, while the coefficient of Sweden*LN 12mth press hits measures the partial effect of the focus on the environment for Swedish firms.

The regressions in table 4.5 also take into account significant firm-specific effects. Firstly, the regressions were run with all firm dummies (firms with more than three announcements in the dataset). They were then rerun including only those firm dummies that were significant in the original regression, and these are the regressions displayed in table 4.5. The firm dummies are left out of the table and replaced by the line "Firm Specific Effect", which indicates whether there is a firm-specific effect in the regression or not ("Yes"/"No").

The strong dummy, award dummy, crude oil price, sales 2nd quartile, sales 3rd quartile and sales 4th quartile and the LN 12mth press hits all have the same sign and significance (or insignificance) in regression 7-10 as they have in regression 6. There are, however, some differences between the regressions when it comes to the significance of the medium and certification dummies. While not significant in any of the regressions in table 4.4, the medium dummy is now significantly negative on the 10 % level in regressions 8 and 10. The certification dummy is significantly negative on the 10 % level in regressions 7 and 9, and on the 5 % level in regressions 8 and 10.

	Weighted Least Squares Regression			
Independent variables	*(7)*	*(8)*	*(9)*	*(10)*
Medium dummy	-0.0082	-0.0096	-0.0030	-0.0094
t-value	*-1.25*	*-1.72**	*-0.63*	*-1.69**
Strong dummy	-0.0243	-0.0243	-0.0243	-0.0236
t-value	*-3.36****	*-3.37****	*-3.34****	*-3.31****
Award dummy	-0.0186	-0.0191	-0.0140	-0.0181
t-value	*-2.97****	*-3.13****	*-2.89****	*-3.06****
Certification dummy	-0.0138	-0.0154	-0.0134	-0.0149
t-value	*-1.81**	*-2.32***	*-1.75**	*-2.26***
LN of 12mth press hits	0.0044	0.0044	0.0030	0.0044
t-value	*1.44*	*1.43*	*0.99*	*1.43*
Crude oil price (NOK)	-0.0001	-0.0001	-0.0001	-0.0001
t-value	*-3.57****	*-3.56****	*-3.7****	*-3.62****
Sales 2nd quartile	-0.0038	-0.0035	-0.0046	-0.0024
t-value	*-0.57*	*-0.53*	*-0.68*	*-0.38*
Sales 3rd quartile	0.0074	0.0076	0.0075	0.0085
t-value	*1.02*	*1.05*	*1.03*	*1.20*
Sales 4th quartile	-0.0061	-0.0057	-0.0085	-0.0046
t-value	*-0.81*	*-0.77*	*-1.14*	*-0.63*
Medium * Award	0.0121	0.0135		0.0133
t-value	*1.20*	*1.43*		*1.41*
Medium * Certification	-0.0048		-0.0094	
t-value	*-0.43*		*-0.88*	
Sweden * Crude oil price	0.0000	0.0000		
t-value	*0.73*	*0.71*		
Sweden * LN of 12mth press hits			0.0004	
t-value			*0.85*	
Constant	-0.0199	-0.0191	-0.0068	-0.0204
t-value	*-0.52*	*-0.51*	*-0.18*	*-0.54*
Firm-Specific Effect	Yes	Yes	Yes	Yes
F-statistic of the model	2.53**	2.75**	2.64**	2.97***
Adjusted R-squared	0.1487	0.1556	0.1469	0.1597
Number of press releases	115	115	115	115

* p-value < 0.10; ** p-value < 0.05; *** p-value < 0.01

Table 4.5: *Results of regressions 7-10. Coefficients in absolute terms.*

None of the interaction terms are significant, but they have coefficients of the same sign across all the regressions they are included in. While those of medium*award and Sweden*crude oil price are positive, the coefficients of medium*certification and Sweden*LN press hits are negative for all the regressions. The coefficient of determination, the adjusted-R^2, varies from 14.69 % for regression 9 to 15.97 % for regression 10.

As table 4.5 shows, firm-specific effects were found in all four regressions. In all cases, the firm-specific effect could be related to the Norwegian firm Atea, as this was the only significant firm-specific effect. The Atea dummy is not reported in table 4.5, but it is taken into account in all four regressions. The average CAR in the [-1,1] event window for announcements from Atea is 2.29 %. In the regressions, the Atea dummy therefore appears with a positive sign. The coefficient varies between 3.05 % and 3.40 %, and is significant at the 5 % level in all four regressions. This indicates that only the environmental announcements from Atea were significantly different from the other announcements in the dataset.

We have tested all the models for heteroskedasticity, normality of residuals, multicollinearity and omitted variables. We find no problems with heteroskedasticity, multicollinearity or omitted variables. However, the normality assumption does not hold for all the regressions; for regressions 2, 5, 7-8 and 10-14 the p-value of normality ranges from 3.3 % to 8.8 % (see Appendix F for details). We therefore need to be careful in the interpretation of these regressions.

4.2.1. Norway vs. Sweden

The Sweden dummy is included in two regressions and has a positive coefficient in one of them and a negative in the other. The variable is never significant. This indicates that the country in which the company is listed does not impact the CAR – very much in line with the findings in the univariate analysis.

4.2.2. Strength

In all regression models in tables 4.4 and 4.5 where the strength dummies are included, strong announcements are shown to have a significantly negative effect on CAR. Table 4.5 also shows that when the partial effect on CAR of a medium award is taken into account, also the medium dummy becomes significantly negative at the 10 % level. Although only significant in two of the ten models, the coefficient for the medium dummy is negative in all regressions. The strength dummies thus have negative coefficients in all regression models where included. While the coefficient of the medium dummy ranges from - 0.44 % to - 0.96 %, the coefficient of the strong dummy ranges from - 1.32 % to – 2.43 % in the regression models. This strengthens the hypothesis that there is actually a difference in investors' reaction to an environmental announcement according to its strength. Moreover, the tendency seems to be

that the more powerful and committing the announcement is, the more negative the reaction is.

4.2.3. Other Findings

In all regressions where they are included, the award and certification dummies also have significantly negative coefficients. These dummies were introduced in order to control for potential differences related to the type the announcement. The significantly negative coefficients therefore indicate that such differences exist.

The price of brent crude oil is highly significant, but small, in the ten regressions: -0.01 % or less in all models. This indicates that an increase in the oil price of NOK 1 corresponds to a change in the CAR of -0.01 percentage points; the reaction in CAR to an environmental announcement becomes more negative as the oil price increases.

Both the number of climate press hits and the polluting industry dummy have positive, but insignificant, coefficients in all regressions where they are included. Whether the climate focus is high or low and whether the firm belongs to a polluting industry does accordingly not seem to explain much of the variation in CAR. If anything, however, the reaction is more positive if the climate focus is high and the firm belongs to a polluting industry. The market-to-book ratio also has an insignificantly positive coefficient.

The sales quartiles have the same sign in all regressions: sales 2nd quartile has a negative coefficient, sales 3rd quartile a positive coefficient and sales 4th quartile a negative coefficient. They are, however, never significant.

Many of the results from the cross-sectional analysis are similar to those from the univariate analysis. Investors' reaction, measured in CAR, seems to become more negative when the strength of the environmental announcement increases, but does not seem to be affected by the country in which the firm is listed. Nonetheless, the cross-sectional analysis also presents new information regarding other factors that help explain the variation in CAR. Among these are the crude oil price and the type of the announcement (award, certification or initiative). Moreover, the cross-sectional analysis indicates that there are some firm specific effects in the data related to the Norwegian firm Atea.

4.3. Robustness Check/Recategorization

To some extent, the results from the univariate and cross-sectional analyses presented in the previous sections are sensitive to our categorization of the press releases. To test the

robustness of the analysis, we reclassify all announcements into two categories, forte and piano, based on the criteria in table 4.6, and perform the univariate and cross-sectional analyses again based on this classification.

Forte	**Piano**
Concrete environmental initiative on firm level.	Certification of plant.
International awards.	Local awards.
Concrete environmental initiative on subsidiary level.	National awards.
Prestigious certification.	Inclusion in national sustainability index.
Inclusion in global sustainability index.	Re-inclusion in global sustainability index.
	Non-concrete initiative on firm or subsidiary level.

Table 4.6: *Recategorization of strength categories.*

4.3.1. Univariate Analysis

Table 4.7 shows the results of a comparative analysis of the two strengths piano and forte using a two sided t-test and a Wilcoxon rank sum test. Forte is significantly different (more negative) from piano on the 1 % level in the [-1,1] window, and on the 10 % level for the [-2,2] window. For the shortest event window no such effect can be found.

	CAAR (%)		**T-test**	**Wilcoxon rank sum**
Event window	*Piano*	*Forte*	*T-statistic*	*Z-statistic*
[0,1]	-0.088	-0.545	-0.042	0.586
[-1,1]	0.172	-1.149	2.407**	2.628***
[-2,2]	0.237	-0.842	1.464	1.670*

* p-value < 0.10; ** p-value < 0.05; *** p-value < .01
All tests are two-sided.

Table 4.7: *Comparison of the CAAR for piano and forte.*

4.3.2. Cross-Sectional Analysis

Table 4.8 shows regressions 1, 6, 9, and 10 run with the forte dummy instead of the medium and strong dummies. As regressions 9 and 10, regressions 13 and 14 were first run including the firm dummies, but as none of these had a significant effect in the models, they were removed. Thus all four regressions in table 4.8 are models that are run without firm dummies.

	Weighted Least Squares Regression			
Independent variables	*(11)*	*(12)*	*(13)*	*(14)*
Forte dummy	-0.0117	-0.0122	-0.0128	-0.0129
t-value	*-2.50***	*-2.69****	*-2.56***	*-2.81****
Award dummy	*-0.0129*	*-0.0124*	*-0.0124*	*-0.0158*
t-value	-2.64***	-2.66***	-2.54**	-2.88***
Certification dummy	-0.0130	-0.0124	-0.0132	-0.0118
t-value	*-1.88**	*-1.84**	*-1.73**	*-1.75**
LN of 12mth press hits	*0.0031*	*0.0031*	*0.0032*	*0.0038*
t-value	1.03	1.05	1.02	1.25
Crude oil price (NOK)	-0.0000	-0.0000	-0.0000	-0.0000
t-value	*-2.88****	*-3.06****	*-3.01****	*-3.06****
Market-to-Book	*0.0015*			
t-value	0.95			
Sweden dummy	-0.0000			
t-value	*0.00*			
Polluting industry dummy	*0.0046*			
t-value	0.74			
Sales 2nd quartile	-0.0079	-0.0069	-0.0066	-0.0069
t-value	*-1.17*	*-1.11*	*-1.00*	*-1.11*
Sales 3rd quartile	*0.0014*	*0.0022*	*0.0026*	*0.002*
t-value	*0.20*	*0.33*	*0.37*	*0.30*
Sales 4th quartile	*-0.0083*	*-0.0068*	*-0.0064*	*-0.006*
t-value	*-1.07*	*-0.96*	*-0.85*	*-0.85*
Medium * Award				0.0087
t-value				1.16
Medium * Certification			*0.0027*	
t-value			*0.26*	
Sweden * LN of 12mth press hits			-0.0001	
t-value			-0.12	
Constant	-0.0142	-0.0083	-0.0082	-0.0164
t-value	-0.37	-0.22	-0.22	-0.43
Firm-Specific Effect	-	-	No	No
F-statistic of the model	2.34**	3.13***	2.47**	2.95***
Adjusted R-squared	0.1144	0.1303	0.1142	0.1332
Number of press releases	115	115	115	115

* p-value < 0.10; ** p-value < 0.05; *** p-value < 0.01

Table 4.8: *Results of regressions 10-14. Coefficients in absolute terms.*

The forte dummy is significantly negative on the 1 % or 5 % level in all four regression models. The coefficient varies between -1.17 % and -1.29 %. It follows naturally that the coefficient of the forte dummy lies between the coefficient of the medium dummy and the strong dummy; some of the announcements originally classified as medium are here classified

as piano and some as forte. In the same way as the medium and strong dummies, the forte dummy also aims to capture a strength effect in the regressions. Also, the award dummy is significant on the 1 % or 5 % level in all the regressions in table 4.8. Moreover, the certification dummy is significant on the 10 % level in the four models. The coefficients of both the type dummies are negative in all models. These results are in line with what we find when medium and strong are used as strength dummies.

The price of brent crude oil is negatively significant on the 1 % level in all four regression models. The variables LN 12mth press hits, market-to-book and polluting industry dummy all have positive and insignificant coefficients in all models they are included. None of the sales quartile dummies are significant in the regressions, but they have the same signs as in the models with medium and strong as strength dummies; sales 2nd quartile is negative, sales 3rd quartile positive and sales 4th quartile negative.

Both the interaction term for the medium award and for the medium certification have positive coefficients in the regressions where they are included. The interaction term Sweden*LN 12mth press hits has a negative coefficient in the regression in which it is included. None of these interaction terms are significant. Although the signs of the medium certification and Sweden*LN 12mth press hits in regressions 11-14 are opposite of those in regressions 1-10, the difference is not notable – none of these two variables are significant in any of the regressions.

The adjusted-R^2 of the regression models in table 4.8 ranges from 11.42 % to 13.32 %, which is approximately the same as the average of the regressions 1-10. None of the variables seem to have a notably different effect in the regressions where forte is used as strength variable instead of medium and strong, and the results are thus mostly consistent with the findings of the first classification. We therefore continue to base our analysis on the categorization weak, medium and strong.

4.4. Discussion

Having presented the results of the univariate and cross sectional analyses, this next section will concisely answer the research questions presented, and go beyond merely reporting the numbers – we will answer why, and not just what.

4.4.1. Overall Analysis

As the cross-sectional analysis looks mainly at the differential effects between the press releases, it is the univariate analysis that is mainly used to test hypothesis 1. In this analysis

we found a preponderance of negative cumulative average abnormal returns for all the event windows. This result goes against the findings of Ambec and Lanoie (2008), who indicate a clear overweight of studies showing a positive economic impact following a positive environmental behavior. The negative effect following the disclosure of a voluntary, environmentally positive announcement is more in line with the findings of Fisher-Vanden and Thorburn (2011). Our findings are, however, not statistically significant, except for at the 10% level in the shortest event window, and it is the view of the authors that we cannot reject the null hypothesis 1 of no overall effect. We see three possible explanations for no overall effect of the announcements.

The first, and most obvious, explanation is that there is no economic gain or loss from investing in environmentally friendly policies. Two different views may explain this phenomenon. The first view assumes that all markets are efficient, there are no super profits, and no projects that give a higher rate of return than the risk adjusted hurdle rate. All managers, presumed to be maximizing shareholder value, will then initiate those environmental policies which meet this profit criterion, and reject those that do not. This will neither create nor destroy value for the shareholders, and the investors will not care about the environmental announcements of a firm. The second view is that markets are not perfect, and managers have imperfect information on the expected return of the projects, or act in a manner that does not always generate shareholder value. Some projects will then make money, and others will lose money. The investors have their own consensus view of the profitability of the projects, and no overall significant effect on the share price means that an equal amount of projects are profitable and not profitable. This means that environmental projects are no different from other projects, and investors do not believe managers start unprofitable environmental initiatives for personal reasons. If managers, on the other hand, had initiated beyond-compliance and unprofitable policies, we would have found an overall observable negative effect. The conclusion under this first explanation is that going green is not unprofitable as long as the project is assessed with the same profitability criteria as every other project. Or, from another point of view, projects that are friendly towards the environment are not frowned upon by investors just for that reason.

The second explanation for why we find no overall effect is that investors may not be able themselves to identify the profitability of the projects. If investors are not able to identify whether the environmental policies are Type 1 or Type 2 policies, i.e. whether the implementation of the policy will meet the profit criterion or not, they cannot reach a

consensus view that will be reflected in a movement in the stock price. For example, if a firm reduces its greenhouse gas emissions by increasing the efficiency of its production line, it is likely that the implementation will be costly, but the changes might also lead to reduced electricity bills and emission permit costs. If the firm does not communicate the costs and savings of the project directly, investors in a semi-efficient market might not be able to identify whether the project meets the profit criterion or not. The result is that investors see some projects as profitable, and others as unprofitable, and we find no overall significant reaction to the environmental announcements. This conclusion would be the same regardless of whether the managers believe the project to be profitable or not, as the only part we can measure are the investors.

The third possible explanation is that there are indeed effects, but that this study cannot identify them using an aggregate analysis. We have included many types of environmental actions, policies, awards, and certifications for very different firms, and the effects on the stock price following these will vary. It may be that investors are able to see which announcements meet the profit criterion or not, but that we cannot identify them in the overall analysis. To find any such effects, we have to look at subgroups of our sample; here in categories of country and strength.

4.4.2. Norway vs. Sweden

When looking at Norwegian and Swedish companies by themselves in subsection 4.1.1, we cannot find any significant difference from zero cumulative average abnormal return. Also when comparing the countries directly, we cannot identify any differences between the samples. This result is also confirmed by the cross-sectional analysis, where the dummy variable Sweden is not found to have any effect on CAR in any of the regressions.

This means that even though inhabitants in Norway and Sweden show different priorities when it comes to the environment versus the economy (WVS, 2005-2008), we cannot identify different effects from environmentally beneficial press releases in the two countries. In formulating the hypothesis of difference, we assumed it was the inhabitants of the two countries which bought and traded the shares based on environmental performance. It is, however, probable that it is largely the same pool of global and diversified investors that trade stocks on both Oslo Stock Exchange and Sweden Stock Exchange, and therefore show the same attitudes toward the environment in both countries. Dividing the sample into the country of origin does not help explain why there is no significant effect in the overall sample, and we therefore keep hypothesis 2.

4.4.3. Strength

As the results have shown, dividing our sample based on the strength of the announcement might be a more suitable explanation for the differences in CAR over the press releases. Both sets of tests in the univariate analysis, against zero effect and multiple comparisons, find significance for various comparisons, strengths and event windows. This indicates that strength does indeed have a large impact on the reaction to the announcement. The first univariate tests in subsection 4.1.1. show that both strong and medium announcements vary significantly from zero, and in a negative direction. However, the effect of medium announcements seems to be strongest in the shortest event window, while the effect of the strong announcements is greater for the longest event window. These results might indicate that the market takes more time to react to stronger environmental commitments than it does to less committing announcements. A possible explanation is that there are more leakage effects for larger and more important announcements, and that these are captured by the longer event window. However, since we have no other indications of leakage effects this explanation seems somewhat implausible. The effect could also be totally random, and a consequence of the small sample we have in the strong category.

When comparing the three categories directly in 4.1.3., we find a significant difference when looking at the two longest event windows. Here the effect becomes more negative for the announcements with a higher strength, a result confirmed in the cross-sectional analysis. Though the variable medium is negative compared to the baseline of weak in all the regressions, it is only significant when we control for medium awards. The variable strong on the other hand, is always highly significant and has a more negative coefficient than medium, indicating that the effect becomes more negative as the commitment becomes stronger. Reclassifying the strengths into piano and forte also shows a significant difference related to strength for both the univariate and cross-sectional analyses.

These findings indicate that investors become more sceptical as the commitment to the environment rises, and the potential costs become higher. This implies that investors do not mind a little caring about the environment as long as it does not become too much, involves too much prestige or is a too large and potentially costly commitment. Using Prakash's (2000) definition, we can argue that the announcements in the weak category are Type 1 policies, i.e. policies that meet the profit criteria, while announcements in the medium and strong categories are Type 2 policies that do not meet the profit criteria. A valid question is then why this is the case - they are all awards, certifications, SRI inclusions and initiatives, so why

should there be a difference? A possible explanation for this is that investors believe that signaling environmental responsibility may increase the firm's reputation and revenues equal to or above any related costs, while a too large commitment will benefit the environment more than the corporate environmental reputation. This would imply that there is not a linear relationship between environmental performance and profitability, but a decreasing return on investment as the commitment becomes larger. If consumers think of companies as environmentally friendly or not, and do not care (or have enough information to know) exactly how friendly they are, these results show that a weak commitment will approximately break-even as the company then can be perceived as environmentally friendly. If the commitment is too strong and costly however, investors do not believe it will pay off, and consequently punish the stock.

A corollary of this discussion is that the only profit opportunity pertaining from environmental investments is through improved reputation. This can increase revenues through better access to certain markets and differentiating products; while costs may be cut by better risk management and relations with external stakeholders, and lower cost of labour (Ambec and Lanoie, 2008). However, improved environmental performance will not at all increase profits through higher efficiency, which was the first idea first proposed by Porter (1991) and Porter and van der Linde (1995a, 1995b). An important question not discussed here is why some managers initiate these Type 2 policies, even though they destroy shareholder value. Prakash (2000) studies this to some extent.

Though our initial categorization of the press releases into weak, medium and strong is not based on any existing theory, the idea behind it was that strong announcements have greater impact on firm value than do weak announcements. The fact that we find somewhat high significance based on our categorization may indicate that investors do indeed perceive differences between the categories in a similar manner to us, meaning that our categorization may be used for further research into under which circumstances investors perceive it to be profitable to adopt an environmental policy. This also applies for the recategorization into piano and forte, though using only two categories may not allow for much leeway in the classification process.

4.4.4. Other Findings

In addition to testing the three hypotheses, especially the cross-sectional analysis has brought up several other results and problems worth discussing.

The first issue is the low coefficient of determination, and the possibility that the omitted variable firm strategy may somehow explain why the effects of a press release differs from company to company. Although we find significant effect of some of the variables in the regression models, it is still a problem that none of the models explain much of the variation in the CAR; the adjusted-R^2 is at most 15.97 %. This means that 84 % of the variation in CAR remains unexplained. Although we have tested for omitted variables bias (see Appendix F), and cannot prove any such problem, it seems reasonable that there are other variables that can better explain the variation in the cumulative abnormal returns. As suggested by Telle (2006), such variables might for example be management quality or employee motivation. In our case, management quality might be reflected in the extent to which environmental initiatives are in line with the overall strategy of the company, and thus how an initiative is perceived by the investors.

The second notable result (or lack thereof) is the effect from the size of the company (measured by sales). We cannot find that this has any significant effects on CAR for any of the regressions, and though this does not lead us to conclude that there is no relationship between the cumulative abnormal return related to the announcement and the size of the company, it means we cannot prove that any such relationship exists. If we do suppose that there is no such relationship, it would mean that the expectations about environmental policy toward companies of different sizes are similar; investors interpret the action of taking environmental responsibility equally for small and large firms. Since larger companies generally have more media coverage, this would also imply that media coverage and the frequency with which news arrive has no impact on the reaction to the announcement. Though it may seem a bit counterintuitive, it is in line with the assumptions about market efficiency we have described earlier in the thesis, where all relevant information is spread efficiently to investors.

The third and somewhat surprising result is the negative coefficient for the award dummy variable. It does not seem intuitive that receiving an award for outstanding environmental performance should lead to a more negative CAR than implementing an initiative to reduce the environmental impact of the firm. While the direct costs of an initiative can be substantial, the costs directly related to receiving an award can hardly be imagined to be of any significance. An explanation may be found in the fact that while the firm is in control of press releases concerning initiatives, and releases them for the sake of reputation, the award is an external part telling investors that the firm is environmentally friendly. If this is the first time

the investors learn about the firm's environmental profile, or if they fear that the award might encourage the CEO to initiate new and unprofitable environmental initiatives, they may punish the firm by selling the stock. An alternative explanation for why the average CAR falls is that investors do indeed value environmental initiatives, but value less awards that show little opportunity to cut costs or increase revenues. A conspicuous element is that the medium dummy becomes significantly negative when we control for the more positive medium awards. An interpretation of this is that strength does not have the same effect on awards as on other categories. The interaction term is however not significant, so we cannot draw too firm conclusions from it.

Also for certifications we observe a significant negative effect compared to initiatives, with roughly the same magnitude as the awards. This is in line with other studies (e.g. Cañón-de-Francia and Garcés-Ayerbe, 2009, Paulraj and de Jong, 2011) which have identified a negative effect from announcing environmental certifications. This may be either because (1) environmental certifications and management systems like the ISO 14001 are too expensive to implement and do not generate real savings, (2) the certifications do not enhance a company's environmental reputation enough to generate additional cash flow, or (3) a combination of the two.

The price of oil has a highly significant impact on how environmental announcements are perceived by the investors. However, the effect is in the opposite direction of what we would expect; an increase in the oil price corresponds to a decrease in the profitability of the press release. This is counter-intuitive; one would think that environmental initiatives would be more profitable if the oil price (and the cost of energy) is higher.

The variable market-to-book is not significant in any regressions. This indicates that there are no differences between what we can consider as growth (high M/B) and mature (low M/B) firms when it comes to the perceived costs and benefits of being environmentally friendly. We can deduce that investors do not believe that stringent environmental standards will specifically limit growth opportunities (although they can still influence profitability), a finding that is not consistent with Fisher-Vanden and Thorburn (2011) who discover that the CAR is lower for high-growth firms.

We cannot find any consistent relationship between climate press hits (strongly correlated with year) and the cumulative abnormal returns. An inference of this is that the effect has been consistent over time, and is not directly related to the public emphasis on climate issues. There are three possible explanations for why the variable is not significant: (1) Investors do

not relate to common societal attitudes and thus do not care about the public interest; (2) investors have been taking the climate and its possible risks and gains into account since the start of the measured period, or (3) the variable we have identified is not a good proxy for environmental interest in Norway and Sweden.

Looking for firm-specific effects identified the Norwegian firm Atea to have a strong positive effect on CAR for the event window [-1,1]. This firm is a Nordic IT infrastructure solutions and services company, and there is no obvious reason why it should be different from all the others in our sample. Taking Atea into account in the regression increases the explanatory power of the model, but does not explain why. The positive coefficient may well be related to the unobserved variable firm strategy or management quality, but this is difficult to know without a firm-specific analysis.

To sum up the findings of this chapter, we cannot strongly reject the null hypothesis number 1 of no overall effect of the press release related to an environmental policy. Though at the aggregate level we find weak significance for one event window, there is no such effect for the other two. Three possible explanations for this is that (a) there is no economic effect from these policies, (b) investors are unable to correctly identify the profitability of the projects, or (c) there is an effect, but we are unable to uncover it at an aggregate level.

Studying proposition (c) more closely we divide the sample into subgroups based on the country and the strength of the press release. When examining the differences between Norwegian and Swedish companies we cannot identify any effects, and thus we keep the null hypothesis number 2. Analyses of the differences in CAAR divided by strength indicate that as the announcement becomes stronger, the cumulative abnormal returns for a company become more negative. This makes a division on strength a more likely explanation as to why we find no overall effect in the sample. It seems that being slightly environmentally friendly can help a company as long as it increases its reputation, but that investors believe any activity above this will only destroy value. We therefore reject hypothesis 3 and accept the alternative hypothesis of different reactions related to the strength of the environmental announcement.

4.5. Implications and Limitations

Now that we have discussed the findings of our research, it is important to identify the implications these might have, and the sort of research that should be considered in the following. A notice on the limitations of the thesis is also in place.

In order to confirm the findings of our thesis, we suggest more research into the stock price reaction related to both the strength and the type of the environmental press release. Our recategorization shows that the strength effect is not random, but both categorizations would benefit from further research.

This is also the first paper, to our knowledge, that seeks to answer the elusive question "Does is pay to be green?" through more than one proxy of environmental performance. By comparing these proxies to find which were more appreciated by investors, we have acknowledged that this question may not have one definitive answer, and have instead sought to answer "When does it pay to be green?". Confirming the strength and type effect we have found, but with another sample, may help in the development of a model which allows managers to optimize their environmental efforts within the goal of maximizing shareholder value – satisfying both investors and environmental lobbyists.

It would also be valuable to understand why some managers still initiate unprofitable environmental policies. Though Prakash (2000) looks at this to some extent, it may also be prudent to research it from a non-neoclassical view and accept that managers do not only act rationally in order to maximize shareholder value.

There are also some limitations to the work we have done, one of which is our sample selection. We have twice as many announcements from companies listed on the Stockholm Stock Exchange than on Oslo Stock Exchange, and there is therefore a "Swedish bias" in our overall sample. Moreover, as we have several observations from some companies and just one observation from others, some companies and their specific characteristics are overrepresented in the sample. There is also a "self-selection bias" in the sample; only firms that announce their environmental commitments are included in the study while those that are revealed through private channels or public channels other than press releases and newspapers are excluded. Next, our sample consists of a variety of environmental announcements: initiatives, certifications and awards. It is the view of the authors that this is a large strength in the comparison analysis, but a weakness when looking for overall effects. Finally, the small number of strong press releases is a shortcoming not insignificant to the analysis and results.

5. Conclusion

The question “Does it pay to be green?” has been met with a host of research the last couple decades, but findings are mixed, and the answer remains elusive. This thesis has tried to contribute to the research by looking at only companies listed in Norway and Sweden, and also by taking into account the amount of commitment the companies announce.

We have researched the connection between environmental and economic performance by looking at the stock market reaction to any news announcements related to an environmental award, certification, or voluntary initiative. Cumulative abnormal returns have been used to measure the above or below normal returns for the stock of a company following such a news announcement. Through both a univariate and a cross-sectional analysis, we discover that although there is no overall effect - or any difference between Norway and Sweden - of a positive environmental announcement, the average cumulative abnormal return decreases as the strength of the announcement increases. This indicates that the market does not mind a small environmental commitment, but that it is bothered by larger and potentially more expensive ones. A possible explanation for this is that small environmental initiatives and certifications are seen as a cheap “signal” of a company being green, while stronger initiatives indicate expenses beyond what is necessary in order to convince customers of the company’s environmental friendliness. An implication of this is that the only profits investors expect from “going green” are related to enhanced corporate reputation or diversification opportunities, while not at all from increased efficiency or waste managements, as first proposed by the Porter Hypothesis (1991).

The cross-sectional analysis also identified a difference between varying types of press releases regarding whether they concern an environmental award, initiative, or certification. We find that awards and certifications alike are met with a more negative reaction than initiatives.

If new research can confirm our results with regard to both the strength and the type effect, managers may soon be able to maximize their environmental efforts within that framework, thus initiating policies that help both the environment and investors. New research would also show whether large and impactful commitments to the environment can ever be initiated by managers, or if government bodies have to introduce regulations to curb greenhouse gas emissions and secure other environmental concerns.

References

AL-TUWAIJRI, S. A., CHRISTENSEN, T. E. & HUGHES II, K. E. 2004. The relations among environmental disclosure, environmental performance, and economic performance: a simultaneous equations approach. *Accounting, Organizations & Society,* 29**,** 447.

AMBEC, S. & LANOIE, P. 2007. When and why does it pay to be green? *Cahier de recherche.* HEC Montréal.

AMBEC, S. & LANOIE, P. 2008. Does It Pay to Be Green? A Systematic Overview. *Academy of Management Perspectives,* 22**,** 45-62.

ASLAKSEN, I. & SYNNESTVEDT, T. 2003. Ethical investment and the incentives for corporate environmental protection and social responsibility. *Corporate Social Responsibility & Environmental Management,* 10**,** 212-223.

BANZ, R. W. 1981. The relationship between return and market value of common stocks. *Journal of Financial Economics,* 9**,** 3-18.

BATHKE JR, A. W., LOREK, K. S. & WILLINGER, C. L. 1989. Firm-Size and the Predictive Ability of Quarterly Earnings Data. *Accounting Review,* 64**,** 49.

BROWN, K. C., HARLOW, W. V. & TINIC, S. M. 1988. RISK AVERSION, UNCERTAIN INFORMATION, AND MARKET EFFICIENCY. *Journal of Financial Economics,* 22**,** 355-385.

BROWN, S. J. & WARNER, J. B. 1985. USING DAILY STOCK RETURNS: The Case of Event Studies. *Journal of Financial Economics,* 14**,** 3-31.

CAMPBELL, J. Y., LO, A. W. & MACKINLAY, A. C. 1997. *The Econometrics of Financial Markets,* Princeton, N.J., Princeton University Press.

CARHART, M. M. 1997. On Persistence in Mutual Fund Performance. *Journal of Finance,* 52**,** 57-82.

CAÑÓN-DE-FRANCIA, J. & GARCÉS-AYERBE, C. 2009. ISO 14001 Environmental Certification: A Sign Valued by the Market? *Environmental & Resource Economics,* 44**,** 245-262.

COLLINS, D. W., ROZEFF, M. S. & DHALIWAL, D. S. 1981. The economic determinants of the market reaction to proposed mandatory accounting changes in the oil and gas industry: A cross-sectional analysis. *Journal of Accounting and Economics,* 3**,** 37-71.

CORRADO, C. J. 1989. A nonparametric test for abnormal security-price performance in event studies. *Journal of Financial Economics,* 23**,** 385-395.

CORRADO, C. J. 2011. Event studies: A methodology review. *Accounting & Finance,* 51**,** 207-234.

COWAN, A. R. 1992. Nonparametric Event Study Tests. *Review of Quantitative Finance & Accounting,* 2**,** 343-358.

ELKINGTON, J. 2006. Governance for Sustainability. *Corporate Governance: An International Review,* 14**,** 522-529.

FABOZZI, F. J. 2009. *Finance : capital markets, financial management, and investment management,* Hoboken, N.J., Wiley.

FACTIVA 2012. Dow Jones.

FAMA, E. F. 1970. EFFICIENT CAPITAL MARKETS: A REVIEW OF THEORY AND EMPIRICAL WORK. *Journal of Finance,* 25**,** 383-417.

FAMA, E. F. & FRENCH, K. F. 1995. Size and Book-to-Market Factors in Earnings and Returns. *Journal of Finance,* 50**,** 131-155.

FISHER-VANDEN, K. & THORBURN, K. S. 2011. Voluntary corporate environmental initiatives and shareholder wealth. *Journal of Environmental Economics & Management,* 62**,** 430-445.

FREUND, R. J., SA, P. & WILSON, W. J. 2006. *Regression analysis : statistical modeling of a response variable,* Amsterdam, Elsevier.

FRIEDMAN, M. 1970. A Friedman doctrine--: The Social Responsibility Of Business Is to Increase Its Profits A Friedman business doctrine. *The New York Times*.

GILLEY, K. M., WORRELL, D. L., DAVIDSON III, W. N. & EL-JELLY, A. 2000. Corporate Environmental Initiatives and Anticipated Firm Performance: The Differential Effects of Process-Driven Versus Product-Driven Greening Initiatives. *Journal of Management,* 26**,** 1199-1216.

GREENE, W. H. 2008. *Econometric analysis,* Upper Saddle River, N.J., Pearson Prentice Hall.

GRIFFITHS, W. E., HILL, R. C. & JUDGE, G. G. 1993. *Learning and practicing econometrics,* New York, Wiley.

HART, S. L. 1995. A NATURAL-RESOURCE-BASED VIEW OF THE FIRM. *Academy of Management Review,* 20**,** 986-1014.

HART, S. L. & DOWELL, G. 2011. Invited Editorial: A Natural-Resource-Based View of the Firm: Fifteen Years After. *Journal of Management,* 37**,** 1464-1479.

JOHNSEN, T. & GJØLBERG, O. 2009. Management of the Norwegian Oil Fund: The challenges and costs of being ethical. *Beta - Scandinavian Journal of Business Research,* 23**,** 1-26.

KLASSEN, R. D. & MCLAUGHLIN, C. P. 1996. The impact of environmental management on firm performance. *Management Science,* 42**,** 1199-1214.

KOLARI, J. W. & PYNNONEN, S. 2011. Nonparametric rank tests for event studies. *Journal of Empirical Finance,* 18**,** 953-971.

KOLARI, J. W. & PYNNÖNEN, S. 2010. Event Study Testing with Cross-sectional Correlation of Abnormal Returns. *Review of Financial Studies,* 23**,** 3996-4025.

KONAR, S. & COHEN, M. A. 2001. DOES THE MARKET VALUE ENVIRONMENTAL PERFORMANCE? *Review of Economics & Statistics,* 83**,** 281-289.

MACKINLAY, A. C. 1997. Event Studies in Economics and Finance. *Journal of Economic Literature,* 35**,** 13-39.

MACROBOND 2012. Macrobond. Malmo: Macrobond Financial AB.

MCWILLIAMS, A. & SIEGEL, D. 1997. EVENT STUDIES IN MANAGEMENT RESEARCH: THEORETICAL AND EMPIRICAL ISSUES. *Academy of Management Journal,* 40**,** 626-657.

MELNYK, S. A., SROUFE, R. P. & CALANTONE, R. 2003. Assessing the impact of environmental management systems on corporate and environmental performance. *Journal of Operations Management,* 21**,** 329.

MICKEY, R. M., DUNN, O. J. & CLARK, V. A. 2004. *Applied statistics : analysis of variance and regression,* Hoboken, N.J., Wiley-Interscience.

NAKAMURA, E. 2011. DOES ENVIRONMENTAL INVESTMENT REALLY CONTRIBUTE TO FIRM PERFORMANCE? AN EMPIRICAL ANALYSIS USING JAPANESE FIRMS. *Eurasian Business Review,* 1**,** 91-111.

NEWBOLD, P., CARLSON, W. L. & THORNE, B. 2010. *Statistics for Business and Economics,* New Jersey, Pearson Education, Inc.

NHH 2012. NHH Børsprosjektet. Bergen: Norwegian School of Economics.

PATELL, J. M. 1976. Corporate Forecasts of Earnings per Share and Stock Price Behavior: Empirical Tests. *Journal of Accounting Research,* 14**,** 246-276.

PATELL, J. M. & WOLFSON, M. A. 1979. ANTICIPATED INFORMATION RELEASES REFLECTED IN CALL OPTION PRICES. *Journal of Accounting & Economics,* 1**,** 117-140.

PAULRAJ, A. & DE JONG, P. 2011. The effect of ISO 14001 certification announcements on stock performance. *International Journal of Operations & Production Management,* 31**,** 765-788.

PEARSON, E. S., D'AGOSTINO, R. B. & BOWMAN, K. O. 1977. Tests for Departure from Normality: Comparison of Powers. *Biometrika,* 64**,** 231-246.

PORTER, M. E. 1991. America's green strategy. *Scientific American,* 264**,** 168.

PORTER, M. E. & VAN DER LINDE, C. 1995a. Green and Competitive: Ending the Stalemate. *Harvard Business Review,* 73**,** 120-134.

PORTER, M. E. & VAN DER LINDE, C. 1995b. Toward a New Conception of the Environment-Competitiveness Relationship. *The Journal of Economic Perspectives,* 9**,** 97-118.

PRAKASH, A. 2000. *Greening the firm: the politics of corporate environmentalism,* Cambridge, Cambridge University Press.

ROYSTON, P. 1995. Remark AS R94: A Remark on Algorithm AS 181: The W-test for Normality. *Journal of the Royal Statistical Society. Series C (Applied Statistics),* 44**,** 547-551.

SCOTT, R. H. 1995. *Money, financial markets, and the economy,* Singapore ; London, Prentice Hall.

SHANE, P. B. & SPICER, B. H. 1983. Market Response to Environmental Information Produced Outside the Firm. *Accounting Review,* 58**,** 521-538.

SHARMA, S. & VREDENBURG, H. 1998. Proactive corporate environmental strategy and the development of competitively valuable organizational capabilities. *Strategic Management Journal,* 19**,** 729-753.

SNEDECOR, G. W. & COCHRAN, W. G. 1967. *Statistical Methods,* Ames, Iowa, U.S.A., The Iowa State University Press.

STATACORP 2011. Stata Statistical Software. 12 ed. College Station, Texas: Stata Corporation.

STUDENMUND, A. H. 2006. *Using econometrics : a practical guide,* Boston, Mass., Pearson Education.

TELLE, K. 2006. "It Pays to be Green" - A Premature Conclusion? *Environmental & Resource Economics,* 35**,** 195-220.

WAI KONG CHEUNG, A. 2011. Do Stock Investors Value Corporate Sustainability? Evidence from an Event Study. Springer Science & Business Media B.V.

WESOLOWSKY, G. O. 1976. *Multiple regression and analysis of variance: an introduction for computer users in management and economics,* New York.

WOOLDRIDGE, J. M. 2009. *Introductory econometrics : a modern approach,* Mason, Ohio, South-Western Cengage Learning.

WVS. 2005-2008. *Values Survey Databank* [Online]. World Values Survey Association. Available: http://www.worldvaluessurvey.org [Accessed April 11th 2012].

ZIEGLER, A., BUSCH, T. & HOFFMANN, V. H. 2011. Disclosed corporate responses to climate change and stock performance: An international empirical analysis. *Energy Economics,* 33**,** 1283-1294.

Appendices

Appendix A: Description of Press Releases

#	Company	Cou-ntry	Date	Strength	Description	Factiva Confounding Effects
1	Aker BioMarine	N	25.05.2010	Medium	Awarded for environmental excellence	None
2	Aker BioMarine	N	16.05.2011	Medium	Certification for environmental sustainability	+2 Significant supply agreement
3	ASSA ABLOY	S	31.08.2009	Weak	Subsidiary receives environmental award	None
4	Atea	N	31.03.2008	Medium	Green IT and ISO 14001 is and will be implemented in all business units/subsidiaries	None
5	Atea	N	19.06.2008	Strong	Whole group will implement ISO 14001, goal of being CO2 neutral in 2009	None
6	Atea	N	05.06.2009	Weak	Subsidiary ISO 14001 certified	None
7	Atea	N	27.08.2009	Medium	Whole group ISO 14001 certified	None
8	Atea	N	01.06.2011	Strong	CO2 emissions reduced by 14.8% since 2007, Goal to reduce by 25% within 2015	None
9	Atlas Copco	S	15.02.2000	Weak	Subsidiary in U.S. ISO 14001 certified	-1 ‘99 Earnings released, dividend announcement
10	Atlas Copco	S	17.08.2000	Weak	Facilities in Sweden ISO 14001 certified	None
11	Atlas Copco	S	12.11.2001	Weak	Subsidiary in China ISO 14001 certified	None
12	Atlas Copco	S	13.03.2002	Weak	Subsidiary in Britain ISO 14001 certified	+2 Subsidiary announces share buyback
13	Atlas Copco	S	24.06.2002	Weak	Site in Sweden ISO 14001 certified	None
14	Atlas Copco	S	06.07.2005	Weak	ISO 14001 certification in China	None
15	Atlas Copco	S	10.02.2006	Weak	Site in China ISO 14001 certified	None
16	Atlas Copco	S	28.01.2010	Weak	Global top 100 (Davos) - fifth year in a row	None

17	Axfood	S	30.01.2009	Medium	Joins climate network (BLICCC), Members have reduced environmental impact by 25 % last 3 y.	+2 Annual report
18	Axfood	S	29.10.2009	Weak	Subsidiary into collaboration with Naturskyddsföreningen	-2 New product line
19	Axfood	S	15.12.2009	Strong	Will reduce its environmental impact by 75 % within 2020	None
20	Axfood	S	09.09.2010	Medium	Subsidiary builds two wind mills on storage locations	None
21	Axfood	S	15.06.2011	Weak	Subsidiary receives environmental award from Green Cargo	-2 New purchasing manager
22	Copeinca	N	22.03.2011	Weak	Subsidiary ISO 14001 certified	None
23	DNB	N	21.12.2007	Weak	One of 14 founders of Klimagevinst	None
24	Eidesvik Offshore	N	08.06.2011	Weak	Awarded for environmental performance	None
25	Eidesvik Offshore	N	14.12.2011	Medium	Collaboration on cutting emissions	None
26	Electrolux	S	28.04.2009	Strong	Will cut energy consumption by 15 % within 2012 compared to 2008 levels.	None
27	Eltek	N	10.11.2011	Weak	Award from city of Richardson	None
28	H&M	S	30.11.2011	Weak	Engages with French government on environmental product labelling	-1 Collaboration w/ designer
29	H&M	S	02.12.2011	Weak	H&M brands ranked among 20 most sustainable brands by GoedeWar	None
30	Holmen	S	24.09.2009	Medium	Receives Drottning Kristinapriset for its environmental work	+2 Cuts 200 jobs, trim capacity
31	Holmen	S	01.06.2010	Weak	Site receives award from the Community of Madrid	None
32	JM	S	25.08.2006	Medium	Named one of the world's top 20 leading environmental companies	-2 Profit release
33	JM	S	02.02.2009	Weak	All new offices will be at least 25 % below requirements on energy consumption	None
34	JM	S	18.05.2009	Medium	Whole car fleet has become green (as defined by the Swedish Tax Agency)	None
35	JM	S	04.08.2009	Strong	Will reduce energy consumption with 50 %	None

36	JM	S	20.02.2011	Weak	Will compensate for its air travels by investing in UN's CDM project	None
37	Lundin Petroleum	S	11.12.2009	Weak	Heads local climate report ranking	None
38	Marine Harvest	N	23.04.2008	Weak	Partnership with WWF Norway	None
39	NCC	S	08.12.2008	Weak	Joins Stockholm's Klimatpakt	-2 1.2 BSEK project, +2 480MSEK profit
40	NHY	N	21.12.2007	Weak	One of 14 founders of Klimagevinst	-2 JV with Ascent Solar
41	NHY	N	12.01.2010	Strong	Aims to be global leader in fighting climate change within aluminium	None
42	NHY	N	16.08.2011	Medium	Investment in SO2 capture in Årdal	-2 CEO purchases shares
43	Nokia	S	03.07.2009	Weak	Best electronics company in the world according to Greenpeace	+2 650MUSD bid approved
44	Nokia	S	21.09.2009	Strong	Best technology company in the world according to Dow Jones SRI	None
45	Nokia	S	30.09.2009	Weak	Best electronics company in the world according to Greenpeace	None
46	Norske Skog	N	07.04.2003	Medium	Included in SRI index in Belgium	None
47	Norske Skog	N	24.08.2005	Weak	Best in Norway in climate reporting	None
48	Norske Skog	N	14.05.2007	Weak	Climate initiative in Thai schools with WWF	None
49	Norske Skog	N	28.09.2009	Medium	Best in the Nordic region in CDP	-2 Sale of 800MNOK
50	Nordic Semiconductor	N	31.03.2004	Weak	Chose semiconductor component that was "green"	None
51	Odfjell	N	14.05.2009	Weak	Planned green certification for 18 ships by Lloyds	None
52	Odfjell	N	04.12.2011	Weak	Commits to UN Global Compact goals	None
53	Orkla	N	21.12.2007	Weak	One of 14 founders of Klimagevinst	None
54	PGS	N	04.09.2003	Weak	Establishes HSE Committee	None
55	PGS	N	26.04.2004	Weak	Award from Alaska Department of Natural Resources	None
56	Photocure	N	02.10.2003	Medium	Acknowledged by the Kempen/SNS SRI index	None

57	RCL	N	08.12.2006	Weak	Joins “Scream if You’re Going Green”	-2 Starts cruising Singapore, +2 declares dividend
58	RCL	N	18.06.2010	Medium	Implements new technology to reduce climate gasses	None
59	REC	N	02.09.2011	Medium	White paper on sustainability and climate commitment	None
60	SAAB	S	05.02.2008	Strong	Joins clean skies program, researching to reduce emissions by 20-40%	None
61	Sandvik	S	01.10.2004	Weak	Plant ISO 14001 certified	-1 Buys a German firm
62	Sandvik	S	26.10.2011	Weak	Listed on top 250 Newsweek green rankings	None
63	SAS	N	25.09.2008	Weak	Joins group for research on alternative biofuels	None
64	SAS	N	23.09.2010	Medium	First airline in world to get both EMAS and ISO14001	-2 Agrees to sell Estonian Airlines
65	SCA	S	27.01.1999	Weak	More than two million hectares of forest have been certified FSC	+2 Profit release
66	SCA	S	03.11.2006	Medium	Best Sustainability company in Sweden	None
67	SCA	S	15.05.2007	Strong	Reduced CO2 emissions by 4% last year	None
68	SCA	S	01.06.2007	Strong	Second most environmentally friendly in the world, by EIRIS	None
69	SCA	S	07.12.2007	Weak	Best sustianability report in paper industry, according to WWF	None
70	SCA	S	08.02.2008	Medium	One of 100 most sustainable companies in the world by Innovest (top 5%)	None
71	SCA	S	09.06.2008	Medium	Ranked one of the most ethical companies in the world (top 2%) by Etisphere 1. year	None
72	SCA	S	10.12.2008	Strong	SCA sets a new environmental goal, reduce Co2 by 20%	None
73	SCA	S	30.01.2009	Weak	Ranked top 100 sustainable companies in the world by CCK 5th year	-1 Financial press release
74	SCA	S	16.03.2009	Weak	Ranked one of the most ethical companies in the world by Etisphere 2. year	-2 Annual report

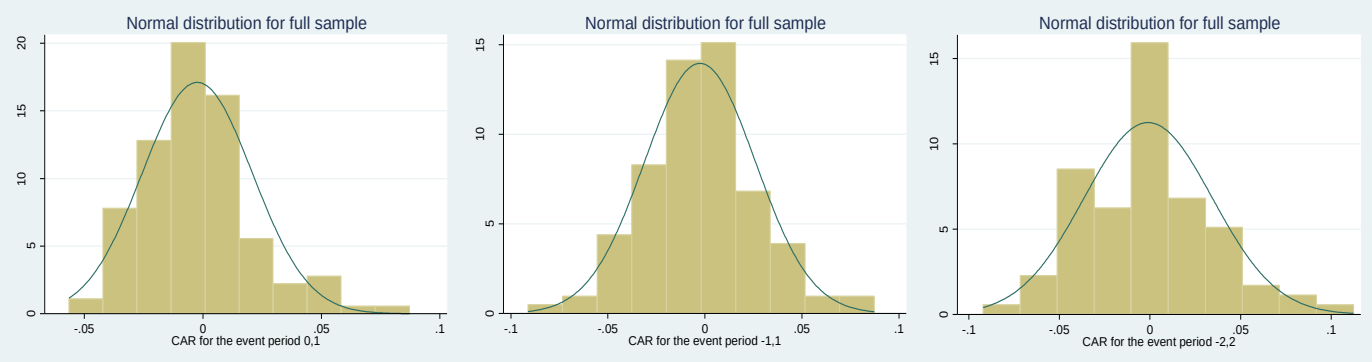
75	SCA	S	30.03.2009	Weak	Sustainability report confirming Co2 reduction targets, 20% by 2020	-1 Restructures Italy and France
76	SCA	S	07.12.2010	Weak	Awarded for best sustainability reporting	None
77	SCA	S	28.11.2011	Medium	Will reduce water consumption in stressed regions	None
78	Scania	S	10.11.1998	Medium	Won EKO price 98 for ecology and economy	None
79	Scania	S	16.04.1999	Medium	Entire Sweden operation receives ISO 14001 certification	-2 Q1 report
80	Scania	S	18.09.2008	Weak	Has started environmental training program for drivers	None
81	SEB	S	03.04.2007	Medium	Adopts Equator Principles	-2 Sells car financing
82	Skanska	S	07.09.1999	Weak	Two US subsidiaries ISO 14001 certified	None
83	Skanska	S	20.12.2000	Medium	Achieved ISO 14001 for entire Skanska	None
84	Skanska	S	21.09.2001	Strong	Tops list of construction companies on the DJ sustainability index	None
85	Skanska	S	15.05.2008	Weak	Top ten Sunday Times green UK companies	None
86	Skanska	S	10.02.2009	Weak	Introduces LEED certification for all buildings	-2 Annual report
87	Skanska	S	27.04.2009	Weak	Calls for all construction to join in fight against climate change	None
88	Skanska	S	11.11.2010	Medium	Receives US green building award	None
89	Skanska	S	12.06.2011	Medium	Top of the list, Sunday Times green UK companies	None
90	SKF	S	13.01.1999	Medium	Whole group ISO 14001 certified	-2 Cuts American production
91	SKF	S	16.01.2004	Weak	Awarded for best sustainability report in Sweden from SIPA	None
92	SKF	S	15.02.2007	Medium	Will install green technology in production process to cut CO2 emissions	None
93	SKF	S	13.11.2009	Medium	Joined cooperation with UK consultants to create energy efficient solutions	None
94	SKF	S	24.11.2009	Weak	Joined cooperation with industry competitor to make sustainable industry	None

95	SKF	S	15.12.2009	Weak	Tops the Folksam list for environmental issues and human rights	None
96	Statoil	N	17.08.2005	Medium	Among best petroleum companies on environment in the world according to International Association of Oil & Gas Producers	None
97	Stora Enso	S	13.10.2000	Weak	Sustainable forest certified in North America	-1 Sells a mill worth 250 MSEK
98	Stora Enso	S	11.07.2001	Medium	Included in FTSE4Good, 1st time	None
99	Stora Enso	S	29.01.2009	Medium	One of 100 most sustainable companies in the world at the WEF in Davos	None
100	Stora Enso	S	17.03.2011	Weak	Ranked one of the most ethical companies in the world by Etisphere 4. year	None
101	Stora Enso	S	10.06.2011	Weak	EU award for innovative recycling	None
102	Telenor	N	24.04.2008	Medium	Launches ambitious CO2 cuts in Hungary	+2 Subsidiary reports earnings
103	Telenor	N	23.08.2008	Medium	Launches very ambitious cuts (50%) in Malaysia	+2 Sues IBM for 100 MNOK
104	Telenor	N	26.11.2009	Medium	Sets CO2 cut targets for Bangladesh	-1 New CFO, +2 increases stake in Unitech
105	TeliaSonera	S	05.03.2002	Weak	Cuts travel budget by 25% by promoting virtual meetings	+2 Disfavourable PTS ruling
106	TeliaSonera	S	02.10.2007	Strong	Switched to only green power, Reducing Co2 by 20%	-2 Subsidiary reports earnings
107	TeliaSonera	S	25.01.2012	Medium	Ranked the 13th most sustainable company in the world at the WEF in Davos	None
108	TGS	N	19.01.2004	Medium	Written into the Kempen/SNS SRI index	None
109	Veidekke	N	21.12.2007	Weak	One of 14 founders of Klimagevinst	-1 Awarded 292 MNOK contract
110	Volvo	S	24.03.1998	Medium	Aims to become among leading automotive companies in terms of environmentally compatible products and processes	+2 Announces trucks to be made in China

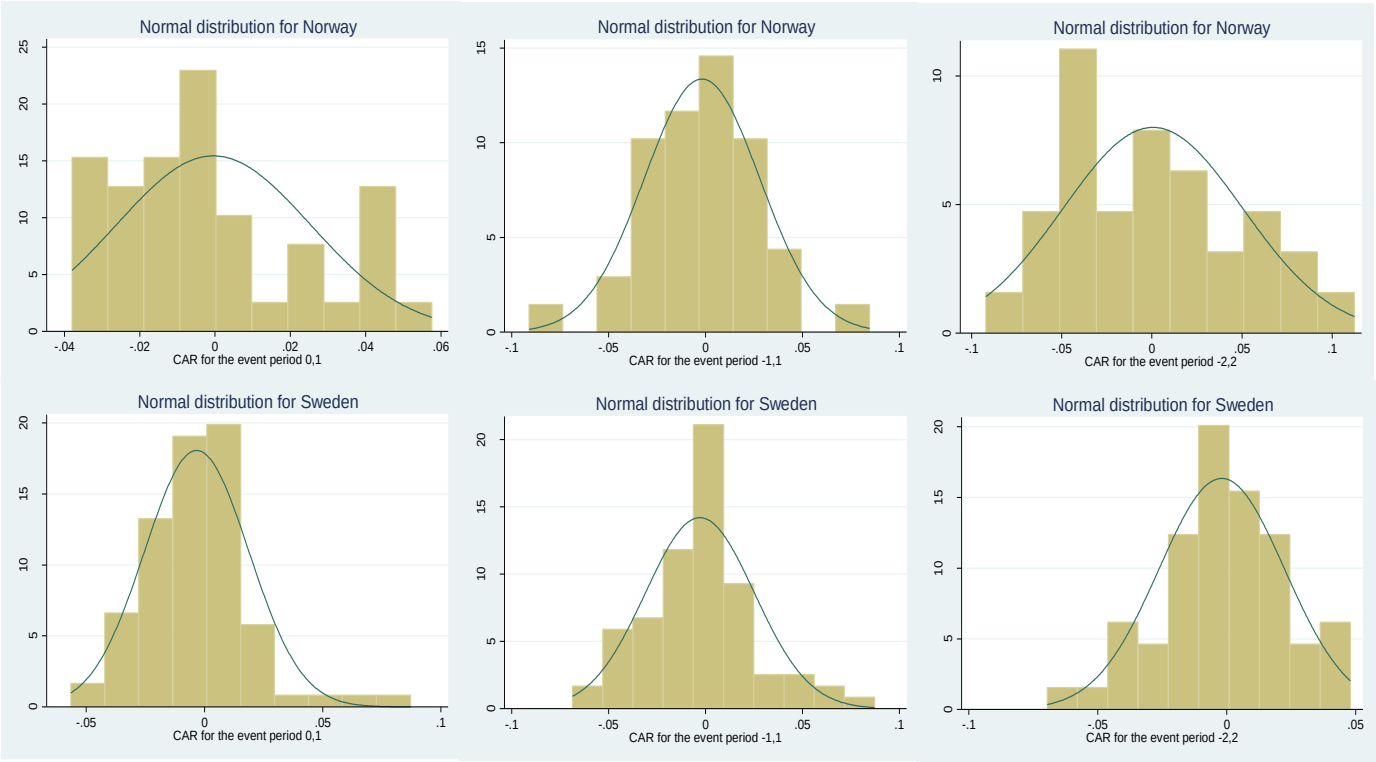
111	Volvo	S	26.06.2000	Weak	Launches internet based global environmental education initiative	None
112	Volvo	S	08.10.2002	Weak	Plant in Sweden cuts energy consumption by 90 per cent	None
113	Volvo	S	15.02.2005	Weak	Subsidiary participates in program for environmentally sound aircraft engines	-2 Share buyback
114	Volvo	S	27.09.2005	Medium	Launches world's first CO2-free automotive plant	-1 Truck deliveries announced
115	Volvo	S	22.02.2006	Medium	Subsidiary makes assembly plant in Belgium CO2 free	None
116	Volvo	S	28.06.2007	Weak	Joint environmental program with US and Swedish Governments	None
117	Volvo	S	20.09.2007	Medium	Plant in Ghent first in the world with CO2 free vehicle production	+2 Truck deliveries announced
118	Volvo	S	22.01.2008	Medium	Subsidiary helps suppliers reduce CO2 emissions by 20%	+2 1 BSEK loan
119	Volvo	S	16.06.2008	Weak	Solar energy makes Volvo dealers climate-neutral	None
120	Volvo	S	10.10.2008	Weak	US Environmental Protection Agency recognizes subsidiary for CO2 reductions	-2 Fires 4000 employees
121	Volvo	S	04.11.2010	Medium	Partnership with WWF to reduce CO2 emissions	-1 Truck deliveries announced
122	Volvo	S	25.05.2011	Medium	More efficient logistics reduced carbon footprint by 22 per cent, Plant in Vara is carbon neutral	None
123	Wilh. W	N	18.04.2011	Medium	Reduced CO2 emissions in 2009, continues this year	None
124	Wilh. W	N	21.11.2011	Weak	Continue collaboration with Bellona	None
125	Yara	N	21.12.2007	Weak	One of 14 founders of Klimagevinst	None

Appendix B: Data Description

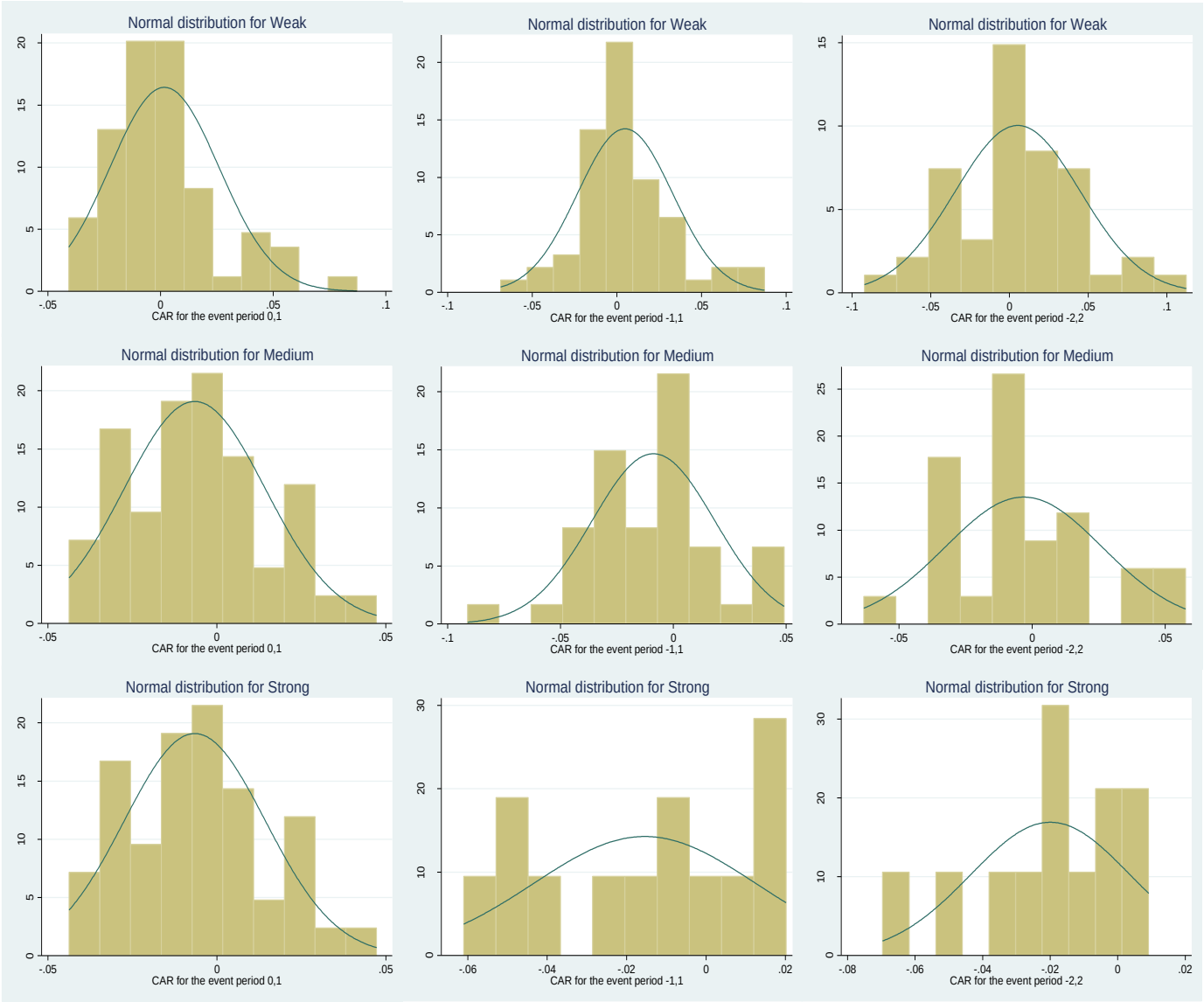
B.1. Frequency Plots of all Event Windows for Full Sample



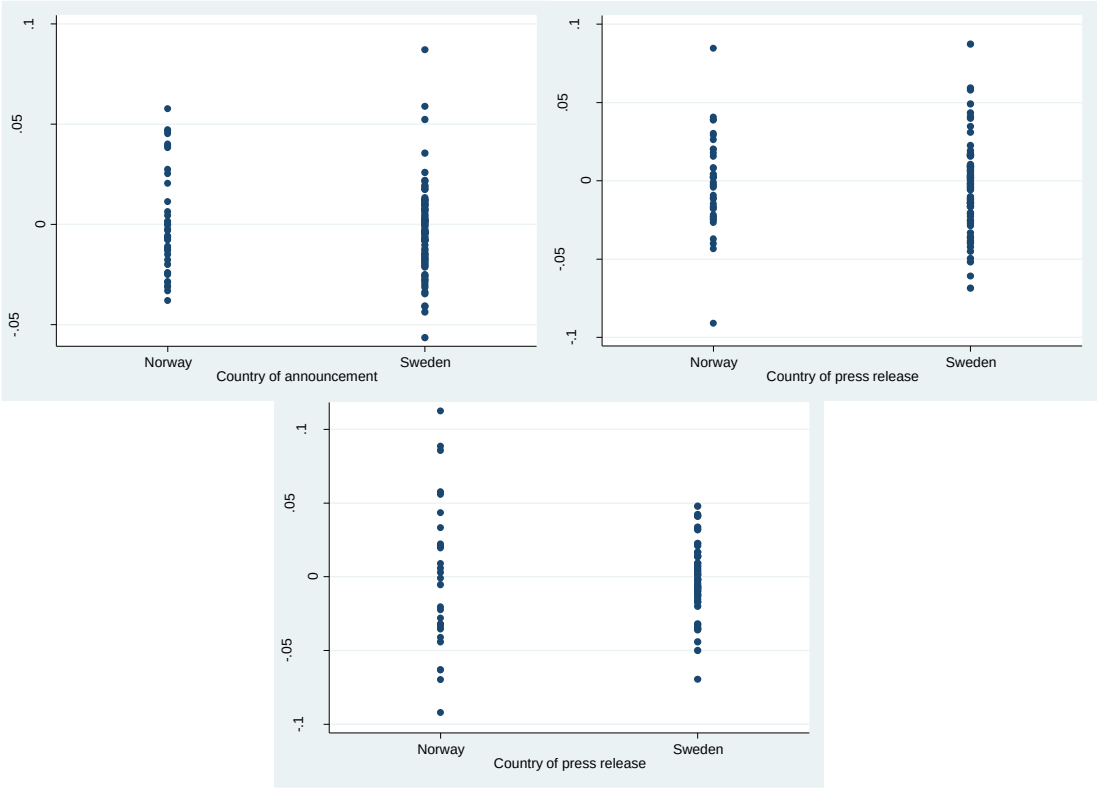
B.2. Frequency Plots of all Event Windows by Country



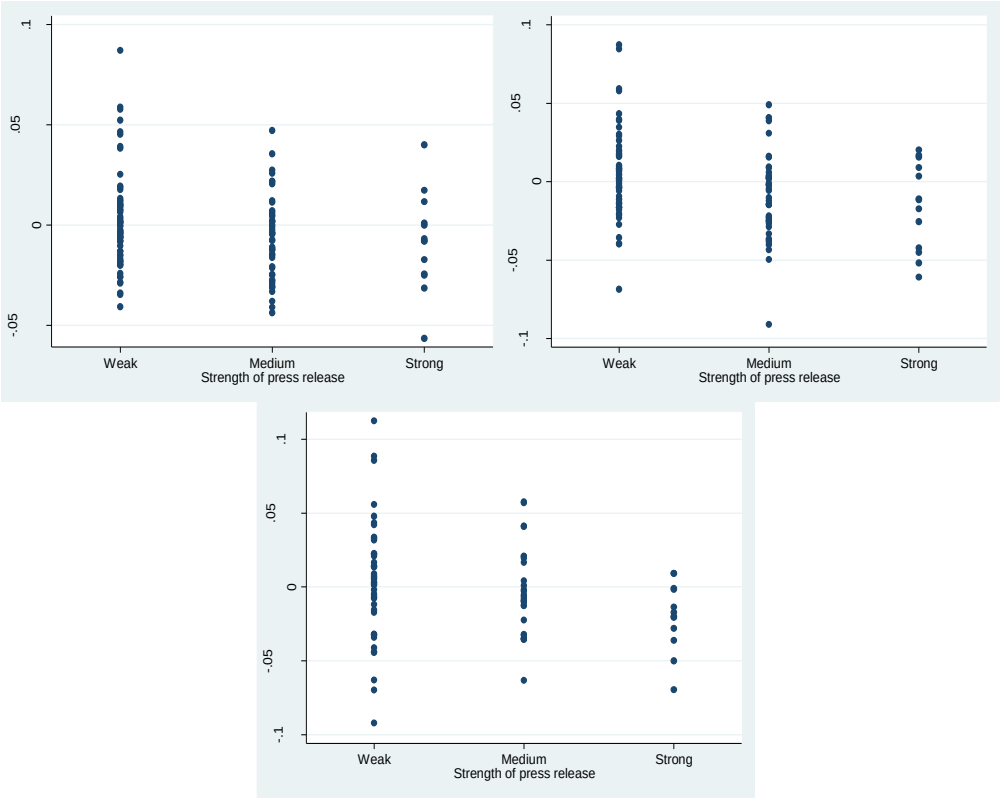
B.3. Frequency Plots of all Event Windows by Strength



B.4. Dot Plots of CAR [-1,1] by Country



B.5. Dot Plots of CAR [-1,1] by Strength



Appendix C: Statistical Tests – Univariate Analysis

C.1. Tests of Zero Effect

When we test whether environmental press releases have an effect on the stock price of a firm, we test the hypothesis:

$$H_0: CAAR_{(T_1,T_2)} = 0$$

$$H_A: CAAR_{(T_1,T_2)} \neq 0$$

We use three different tests to test such hypotheses; the Patell test (Patell, 1976), the Generalized sign test (Cowan, 1992) and the Generalized rank t-test (Kolari and Pynnonen, 2011). The Patell test is a parametric test based on the assumption of normally distributed stock returns, while the non-parametric Generalized sign test and Generalized rank t-test do not make any assumptions about the underlying distribution of the abnormal returns. These may give better results if the underlying stock prices are not normally distributed. The tests of zero effect are especially interesting when testing hypothesis 1.

C.1.1. Patell Test

The Patell test was developed by James Patell (1976), and is commonly used in event studies. The test is based on the assumption of normally distributed returns. Furthermore, it is assumed that abnormal returns are uncorrelated:

$$Cov\left(\widehat{AR}_{i,t}, \widehat{AR}_{j,t}\right) = \begin{cases} 0, & i \neq j \\ C_{i,t}\sigma_i^2, & i = j \end{cases}$$

σ_i^2 is the variance of the residuals for press release *i* from the market model during the estimation period. $C_{i,t}$ is an adjustment factor that accounts for the increase in variance that results from prediction outside of the estimation period (Patell, 1976):

$$C_{i,t} = 1 + \frac{1}{T} + \frac{\left(R_{m,t} - \bar{R}_m\right)^2}{\sum_{t=\tau_1}^{\tau_2}\left(R_{m,t} - \bar{R}_m\right)^2}$$

where $T = \tau_2 - \tau_1 + 1$, the number of days in the estimation period, and the average market return is calculated during the estimation period:

$$\bar{R}_m = \frac{1}{T}\sum_{t=\tau_1}^{\tau_2} R_{m,t}$$

Under these conditions and the OLS assumptions, the standardized abnormal return is student-t distributed with T-2 degrees of freedom:

$$V_{i,t} = \frac{\widehat{AR}_{i,t}}{s_i\sqrt{C_{i,t}}}$$

Where s_i is an unbiased estimate of σ_i:

$$s_i^2 = \frac{\sum_{t=\tau_1}^{\tau_2} \hat{\epsilon}_{i,t}^2}{T-k-1}$$

Where T is the number of days in the estimation period and k is the number of explanatory variables in the regression, which in this case is 1 (the market return). The numerator is the sum of squared residuals from the OLS regression, while the denominator is the degrees of freedom.

The standardized cumulative abnormal return is then:

$$W_{i,(T_1,T_2)} = \sum_{t=T_1}^{T_2} \frac{\widehat{AR}_{i,t}}{s_i\sqrt{(T_2-T_1+1)C_{i,t}}}$$

where $T_2 - T_1 + 1$ is the length of the event window. There is one such test statistic for each of the press releases in each event window length. The test statistic is Student-t distributed with T-2 degrees of freedom (when T is the number of days in the estimation period). Each of these test statistics has the following expectation and variance:

$$E\left(W_{i,(T_1,T_2)}\right) = 0$$

$$Var\left(W_{i,(T_1,T_2)}\right) = \frac{T-2}{T-4}$$

Under the assumption that $W_{i,(T_1,T_2)}$ is Student-t distributed, the Central Limit Theorem implies that the following test statistic is normally distributed:

$$Z_{W,(T_1,T_2)} = \frac{\sum_{i=1}^{n} W_{i,(T_1,T_2)}}{\sqrt{n * \left(\frac{T-2}{T-4}\right)}}$$

which is the standardized sum of $W_{i,(T_1,T_2)}$ statistics over all press releases. *n* is the number of press releases. The test statistic is specified for each event window length, and is what we will refer to as the Patell-Z test.

C.1.2. Generalized Sign Test

Sign tests are often used in event studies. These use the normal approximation to the binomial distribution to test whether the fraction of negative to positive CAR's in the event window significantly deviates from 0.5 (Cowan, 1992). The null hypothesis of no effect in the event window is thus interpreted as if there should be an equal split between positive and negative abnormal returns. The generalized sign test, however, compares the proportion of negative to positive cumulative abnormal returns in the event window to the proportion of negative to positive abnormal returns in the estimation period, represented by $\hat{p}$. Cowan (1992) uses the inverse proportion, positive to negative results, to estimate $\hat{p}$. The inferences from the test will naturally be the same, but the test statistic will in our case be positive for negative abnormal returns.

Using the notation as in chapter 3, $\hat{p}$ is calculated by

$$\hat{p} = \frac{1}{n}\sum_{i=1}^{n}\frac{1}{\tau_2 - \tau_1}\sum_{t=\tau_1}^{\tau_2} Y_{i,t}$$

where

$$Y_{i,t} = \begin{cases} 1 \;\; if \;\; \widehat{AR}_{i,t} < 0 \\ 0 \;\; otherwise \end{cases}$$

Defining *w* as the number of stocks for which the CAR in the event window is negative, the generalized sign test statistic is

$$Z_G = \frac{w - n\hat{p}}{\sqrt{n\hat{p}(1-\hat{p})}}$$

where Z_G is standard normally distributed with a zero mean and unit variance.

C.1.3. Generalized Rank Test

A rank test developed by Corrado (1989), has been widely used by researchers since its introduction. An underlying problem with the test is that it can only be applied to event windows of one day, and all solutions to this problem reduce the power and applicability of the test (Kolari and Pynnönen, 2010, Cowan, 1992). Kolari and Pynnonen (2011) have developed a new test to account for this problem, the generalized rank test (GRANK). As opposed to Corrado (1989), this test also accounts for event induced volatility, cross correlation from event-day clustering, and also demonstrates power equal to or greater than other both parametric and non-parametric tests. The notation used here is also consistent with what has been used in earlier chapters.

To take into account different variances in the stocks (i.e. risk), we find the standardized abnormal returns (SAR) as in Patell (1976).

$$\widehat{SAR}_{i,t} = \frac{\widehat{AR}_{i,t}}{s_{AR_i}}$$

where s_{AR_i} is the estimated standard deviation of the abnormal returns, approximated as in MacKinlay (1997) as the standard deviation of the regression prediction errors (RMSE, root of mean squared errors from the market model of each press release). $\widehat{CAR}_{i,(T_1,T_2)}$ is calculated as in section 3.2. Next, the standardized cumulative abnormal return ($\widehat{SCAR}_{i,(T_1,T_2)}$) for each press release *i* and event window (T_1, T_2) is found by:

$$\widehat{SCAR}_{i,(T_1,T_2)} = \frac{\widehat{CAR}_{i,(T_1,T_2)}}{s_{CAR_{i,(T_1,T_2)}}}$$

where the standard deviation of $\widehat{CAR}_{i,(T_1,T_2)}$ is again approximated as in MacKinlay (1997) to be

$$s_{CAR_{i,(T_1,T_2)}} = s_{AR_i} * \sqrt{T_2 - T_1 + 1}$$

that is the standard deviation of the abnormal return times the length of the event window. To account for event induced volatility, the standardized cumulative abnormal return is again standardized with the cross-sectional standard deviation. The re-standardized $\widehat{SCAR}_{i,(T_1,T_2)}$ is

$$\widehat{SCAR}_i^* = \frac{\widehat{SCAR}_{i,(T_1,T_2)}}{s_{SCAR,(T_1,T_2)}}$$

where

$$s_{SCAR,(T_1,T_2)} = \sqrt{\frac{1}{n-1}\sum_{i=1}^{n}(\widehat{SCAR}_{i,(T_1,T_2)} - \overline{SCAR}_{(T_1,T_2)})^2}$$

and $\overline{SCAR}_{(T_1,T_2)}$ is the arithmetic average of $\widehat{SCAR}_{i,(T_1,T_2)}$ for all press releases.

Using $\widehat{SCAR}_i^*$ as the standardized abnormal returns in the event period, we can compare this to the standardized abnormal returns in the estimation period and assign them a rank where 1 is the lowest and 252 is the highest (251 estimation days and one period for the event window). Formally, Kolari and Pynnonen (2011) define the generalized standardized abnormal returns ($\widehat{GSAR}_{i,t}$) as

$$\widehat{GSAR}_{i,t} = \begin{cases} \widehat{SCAR}_i^* \; for \; T_1 \leq t \leq T_2 \\ \widehat{SAR}_{i,t} \; for \; t = \tau_1, \; \tau_1 + 1, \ldots, \tau_2 \end{cases}.$$

The demeaned standardized abnormal ranks of the generalized abnormal returns are then defined as

$$U_{i,t} = \frac{Rank\left(\widehat{GSAR}_{i,t}\right)}{T+1} - 1/2$$

where $T = \tau_2 - \tau_1 + 1$, and $t \in \{\tau_1, \ldots, \tau_2, 0\}$ is a set of time indexes where 0 is the event window. Under the null hypothesis of no mean effect on the stock price following the press release, $U_{i,0}$ should have an expectation equal to zero for all releases. Using this, the authors define a single t-ratio that can be used for all event window lengths.

$$t_{GRANK} = Z\sqrt{\frac{T-2}{T-1-Z^2}}$$

where

$$Z = \frac{\overline{U}_0}{s_{\overline{U}}}; \qquad s_{\overline{U}} = \sqrt{\frac{1}{T}\sum_{t \in TT} \overline{U}_t^2}; \text{ and } \overline{U}_t = \frac{1}{\mathrm{n_t}}\sum_{i=1}^{n_t} U_{it}.$$

where $\mathrm{n_t}$ is the number of valid generalized standard abnormal returns ($\widehat{GSAR}_{i,t}$) available at time t, t ∈ T. This t-ratio is approximately student-t distributed with T-2 degrees of freedom. We will refer to this test statistic as GRANK-T. Though this test by Kolari and Pynnonen is rather methodically difficult (it is not included in any software), the fact that it allows for a non-parametric rank testing of abnormal returns over several days outweighs any negative side effects.

It also corrects any event-induced volatility, the fact that the volatility in stock returns tends to increase in the days surrounding an event due to temporary increased systematic risk (e.g. Patell and Wolfson, 1979, Brown et al., 1988) . Without taking into account the event induced volatility, test statistics will be artificially high, which will lead to rejection of the null hypothesis too often (Brown and Warner, 1985).

C.2. Comparison of Two Groups

The tests described until now all test for significant deviations from a cumulative average abnormal return (CAAR) of zero in the event windows. In order to compare the cumulative

abnormal returns of Norway and Sweden we need to test for significant deviations from equal CAARs, and not differences from zero.

Rewriting hypothesis number 2, we have

$$H_0: CAAR_{(T_1,T_2),N} = CAAR_{(T_1,T_2),S}$$
$$H_A: CAAR_{(T_1,T_2),N} \neq CAAR_{(T_1,T_2),S}$$

where $CAAR_{(T_1,T_2),N}$ is the CAAR of Norwegian press releases in event window (T_1, T_2) and $CAAR_{(T_1,T_2),S}$ the CAAR of Swedish press releases in the same window.

The two tests used to compare the CAARs of Norwegian and Swedish firms are the two-sided t-test and the non-parametric Wilcoxon signed rank sum test.

C.2.1. Two-Sided T-test

The two-sided t-test is a fairly standard test for studying the difference between the means of two populations. In our case we have shown the variances in CAR to be different in Norway and Sweden, a fact that determines the degrees of freedom in the t-statistic.

Using the method of Newbold et al. (2010), the degrees of freedom are calculated by Satterwaite's approximation, defined as

$$v = \frac{\left[\frac{s_N^2}{n_N} + \frac{s_S^2}{n_S}\right]^2}{\frac{\left(\frac{s_N^2}{n_N}\right)^2}{(n_N - 1)} + \frac{\left(\frac{s_S^2}{n_S}\right)^2}{(n_S - 1)}}$$

where s_N^2 is the sample variance in CAR from the Norwegian press releases, s_S^2 the equivalent for the Swedish, and n_N and n_S are the respective number of press releases.

When the variances in the two samples are unequal (refer to chapter 3.4), the test statistic is given by:

$$t = \frac{\widehat{CAAR}_N - \widehat{CAAR}_S}{\sqrt{\frac{s_N^2}{n_N} + \frac{s_S^2}{n_S}}}$$

And we will reject the null hypothesis if

$$|t| > t_{v,\frac{\propto}{2}}$$

where $t_{v,\frac{\propto}{2}}$ is the number for which $P(t_v > t_{v,\propto}) =$ α, and α is the significance level to be checked.

C.2.2. Wilcoxon Rank Sum Test

The non-parametric Wilcoxon Rank Sum test compares the medians of the two populations and checks if they deviate significantly. Also here we use the method used by Newbold et al. (2010).

We start by pooling all the press releases from both Norway and Sweden together, and sorting them in ascending order of $\widehat{CAR}$ in the event period. We then assign them ranks where one is rank of the lowest $\widehat{CAR}$. V denotes the sum of the ranks for the Norwegian press releases. If the null hypothesis is true, the Wilcoxon rank sum statistic, V, will have the mean and variance

$$E(V) = \frac{n_N(n_N + n_S + 1)}{2}, \qquad Var(V) = \sigma_V^2 = \frac{n_N n_S(n_N + n_S + 1)}{12}.$$

For samples where both n_N and n_S are larger than 10, the distribution of the random variable

$$Z = \frac{V - E(V)}{\sigma_V}$$

is approximately normal, and can be used as a test statistic. For a large number of ties, the variance will be different, making the test more difficult to apply correctly (Newbold et al., 2010). This is not a problem for our dataset, and neither is the minimum requirement to number of observations.

C.3. Tests for Multiple Comparisons

When we test whether there are any differences in the cumulative abnormal returns related to the strength of the environmental announcement with ANOVA and Kruskal-Wallis, we test the hypothesis:

$$H_0: CAAR_{(T_1,T_2),Weak} = CAAR_{(T_1,T_2),Medium} = CAAR_{(T_1,T_2),Strong}$$

$$H_A: At\ least\ one\ CAAR_{(T_1,T_2),l}\ is\ different\ from\ the\ others$$

In the Scheffe test of multiple comparisons, however, we test the hypothesis:

$$H_0: CAAR_{(T_1,T_2),m} = CAAR_{(T_1,T_2),l}$$

$$H_A: CAAR_{(T_1,T_2),m} \neq CAAR_{(T_1,T_2),l}$$

Where *m* and *l* are the strength categories; weak, medium or strong.

C.3.1. One-way ANOVA and Multiple Comparison

Analysis of variance tests check whether the means of two or more samples are the same, i.e. whether we can prove for a given significance level whether at least one of the means is different from the others (Mickey et al., 2004). It assumes that all populations tested are normally distributed, that the populations have the same variance, and that all observations are independent.

A normal ANOVA only tells us whether one of the populations (weak, medium or strong) is different from the others, it doesn't tell us which one(s) and by how much. This can be done through a Scheffe multiple comparison test, which does a simultaneous pairwise comparison of all the samples at once. Though we could have compared one mean with another using an ordinary t-test, this would significantly increase the probability of making a Type I error (due to the fact that many tests are made) (Mickey et al., 2004). This is the strength of multiple comparison tests like Scheffe, which in advance limit the experimentwise error rate to e.g. 5%. Though the Bonferroni multiple comparison method gives somewhat smaller confidence intervals, and is therefore more precise, we choose to use the Scheffe method due to its close link to the F-test – if the F-test (ANOVA) is not significant, then the Scheffe will not find any significance either. However, in our case the inferences will be the same. Wesolowsky (1976) suggests using the Scheffe comparison for exploratory analysis.

The test calculates the absolute difference between two and two means, and then tests whether this is significantly different from a comparison value calculated by

$$\sqrt{(a-1)F_{1-\alpha,v_1,v_2}MSE(\frac{1}{n_l}+\frac{1}{n_m})}$$

Where a is the number of categories (3: weak, medium, strong), $F_{1-\alpha,v_1,v_2}$ is the 1-a percentile of and F distribution with respectively a-1 and N-a degrees of freedom. MSE (mean squared error) is from the ANOVA test, and multiplied by the sum of the inverse of the respective number of observations in each population (weak/medium/strong).

If the assumptions of normality and equal variances in the Scheffe and ANOVA tests do not hold, one must turn to non-parametric tests.

C.3.2. Kruskal-Wallis

In the same way that ANOVA is an extension of a two sided t-test, Kruskal-Wallis is an extension of the Wilcoxon rank sum test (Mickey et al., 2004). This test is weaker if the data is actually normally distributed, but will work better if that is not the case. But it still assumes that the different populations have identical distributions.

The test ranks all the observations from smallest to largest and then performs an ANOVA on the ranked data, calculating the test statistic as the ratio of the factor sum of squares to the mean sum of squares (effectively testing how much the fact that observations come from different populations explain the variance). Often though, this test will give the same results as an ANOVA test, but should be run if we are uncertain about the normality of the data (Mickey et al., 2004).

C.4. Bartlett's Test of Homogeneity of Variances

The Bartlett's test of homogeneity of variance allows us to test whether a group of samples has the same inter-sample variance. Equal variances are assumed both in the Scheffe multiple comparison test and the ANOVA test. We here follow the description of Snedecor and Cochran (1967).

With *a* estimates (weak, medium, strong) with a variance s_l^2 and degrees of freedom v_l each, and a null hypothesis that each s_l^2 is an estimate of the same σ_l^2, the test estimator is

$$\chi^2 = \frac{M}{C}$$

with (*a-1)* degrees of freedom where

$$M = \ln 10\,[(\sum v_l)\ln \bar{s}^2 - \sum v_l \ln s_i^2];\ \ \bar{s}^2 = \frac{\sum v_l s_l^2}{\sum v_l}$$

$$C = 1 + \frac{1}{3(a-1)}\left[\sum \frac{1}{v_l} - \frac{1}{\sum v_l}\right]$$

A weakness of the test is that it is very sensitive to non-normality in the data, particularly to kurtosis (Snedecor and Cochran, 1967).

Appendix D: WLS Assumptions

The general assumptions in the WLS multiple regression are the following (Wooldridge, 2009):

1. There is a linear relationship between the dependent variable and the independent variables, i.e. the model can be written as

   $$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_k x_k + \varepsilon$$

   Where ε is an unobservable random error/disturbance term.
2. The sample is random.
3. None of the independent variables are constant, and there a perfect correlation between any of the independent variables (no perfect colinearity).
4. The independent variables are exogenous (zero conditional mean):

   $$E(\varepsilon | x_1, x_2, \dots, x_k) = 0$$

5. The variance in the error term is constant (homoskedasticity):

   $$Var(\varepsilon | x_1, x_2, \dots, x_k) = \sigma^2$$

6. The error term ε is independent on the explanatory variables, and is normally distributed with zero mean and variance σ^2; $\varepsilon \sim \mathrm{N}(0, \sigma^2)$.

These assumptions hold for the WLS equation if the same assumptions, with or without the homoskedasticity assumption, hold for the corresponding OLS equation. The sixth assumption, the normality assumption, is made in order to perform statistical inference based on the regressions (Wooldridge, 2009).

Violation of the WLS assumptions can lead to biased estimators and incorrect standard deviations. Incorrect standard deviations give incorrect test statistics and can thus cause wrong conclusions; either the rejection of true null hypotheses (type I error) or the acceptance of false null hypotheses (type II error).

Multicollinearity is not a direct violation of any of the WLS assumptions, but is a problem that occurs when there is high correlation between independent variables in the regression (Wooldridge, 2009). Although the reliability of the overall model is not affected, the interpretation of the regression coefficients is generally not very useful; the marginal effect of a specific variable cannot be evaluated since a variable cannot be held constant when changing a highly correlated variable (Freund et al., 2006). The multicollinearity problem can be solved by dropping one of the correlated variables.

Appendix E: Correlation Matrix

	Medium	Strong	Award	Cert	LN of 12mth Press Hits	Crude Oil Price, Brent	Sweden	Polluting Industry	Sales 2nd Quartile	Sales 3rd Quartile	Sales 4th Quartile	Medium* Award	Medium* Cert	Sweden* Oil Price	Sweden* LN of 12mth Press hits	Atea - Firm Dummy	M/B	MVE	Sales
Medium	1																		
Strong	-0.260	1																	
Award	-0.022	-0.049	1																
Certification	-0.038	0.012	-0.340	1															
LN of 12mth Press Hits	-0.001	0.118	0.171	-0.360	1														
Crude Oil Price, Brent	0.115	0.002	0.168	-0.430	0.428	1													
Sweden	-0.103	0.071	0.192	-0.047	-0.154	-0.185	1												
Polluting Industry	-0.041	-0.138	0.053	0.024	-0.225	-0.202	0.210	1											
Sales 2nd Quartile	-0.093	-0.014	-0.088	0.239	-0.120	-0.250	0.125	0.069	1										
Sales 3rd Quartile	-0.030	0.161	0.142	-0.219	0.093	0.252	0.058	0.080	-0.337	1									
Sales 4th Quartile	0.100	-0.135	0.033	-0.121	-0.179	-0.158	0.283	0.193	-0.330	-0.337	1								
Medium*Award	0.447	-0.116	0.525	-0.179	-0.003	0.107	0.015	0.096	-0.074	0.161	-0.074	1							
Medium*Certification	0.365	-0.095	-0.181	0.531	-0.163	-0.189	-0.069	-0.033	0.055	-0.163	-0.017	-0.095	1						
Sweden*Oil Price	-0.048	0.039	0.275	-0.265	0.032	0.296	0.833	0.082	-0.012	0.234	0.161	0.081	-0.145	1					
Sweden*LN of 12mth Press Hits	-0.106	0.084	0.218	-0.094	-0.040	-0.149	0.992	0.181	0.115	0.069	0.261	0.012	-0.082	0.850	1				
Atea - Firm Dummy	0.014	0.198	-0.132	0.191	0.117	0.097	-0.292	-0.327	-0.117	-0.120	-0.117	-0.070	0.101	-0.243	-0.290	1			
M/B	0.074	-0.060	0.055	-0.047	0.160	0.130	-0.123	-0.280	-0.003	-0.021	-0.060	0.151	0.028	0.013	-0.100	-0.074	1		
MVE	0.016	0.008	0.137	-0.211	0.040	0.098	0.123	-0.167	-0.214	0.156	0.452	0.022	-0.152	0.204	0.137	-0.145	0.214	1	
Sales	0.084	-0.012	0.165	-0.241	-0.070	0.000	0.331	0.133	-0.299	0.017	0.769	0.027	-0.130	0.325	0.329	-0.156	0.016	0.8047	1

Appendix F: Regression Diagnostics

All the following tests are calculated in Stata version 12 (StataCorp, 2011), and use the work of Wooldridge (2009) as a reference.

F.1. Variance Inflation Analysis

This analysis tests for multicollinearity in the regressions. Any VIF values above 10, or 1/VIF below 0.1, indicate multicollinearity between explanatory variables.

Regression	(1)		(2)		(3)		(4)		(5)		(6)		(7)	
Indicator	VIF	1/VIF	VIF	1/VIF	VIF	1/VIF	VIF	1/VIF	VIF	1/VIF	VIF	1/VIF	VIF	1/VIF
Sales 4th Quartile	2.65	0.3780									2.26	0.4433	2.63	0.3807
Sales 3rd Quartile	2.49	0.4023									2.16	0.4634	2.55	0.3928
Sales 2nd Quartile	2.34	0.4266									2.06	0.4856	2.41	0.4150
Certification	1.74	0.5738			1.44	0.6942	1.44	0.6931	1.45	0.6903	1.71	0.5859	2.31	0.4321
Crude Oil Price, Brent	1.64	0.6100	1.19	0.8396	1.38	0.7249	1.39	0.7184	1.53	0.6522	1.49	0.6722	1.96	0.5107
LN of 12mth Press Hits	1.32	0.7598	1.2	0.8345	1.22	0.8207	1.25	0.8032	1.27	0.7874	1.29	0.7741	1.38	0.7224
Polluting Industry	1.50	0.6646							1.40	0.7147				
Strong	1.32	0.7578	1.11	0.8991			1.14	0.8808	1.21	0.8298	1.24	0.8083	1.36	0.7368
Sweden	1.27	0.7901							1.11	0.9008				
M/B	1.24	0.8054							1.22	0.8190				
Award	1.27	0.7888			1.14	0.8769	1.16	0.8640	1.24	0.8079	1.18	0.8446	2.14	0.4665
Medium	1.15	0.8693	1.11	0.8997			1.12	0.8954	1.14	0.8785	1.13	0.8812	2.52	0.3971
Medium*Award													2.78	0.3603
Medium*Certification													2.05	0.4885
Sweden*Oil Price													1.58	0.6313
Atea - Firm Dummy													1.35	0.7393
Forte														
Sweden*LN of 12mth Press Hits														
Average VIF	1.66		1.15		1.30		1.25		1.29		1.61		2.08	

Regression	(8)		(9)		(10)		(11)		(12)		(13)		(14)	
Indicator	VIF	1/VIF	VIF	1/VIF	VIF	1/VIF	VIF	1/VIF	VIF	1/VIF	VIF	1/VIF	VIF	1/VIF
Sales 4th Quartile	2.58	0.3873	2.59	0.3858	2.47	0.4052	2.72	0.3677	2.25	0.4449	2.52	0.3973	2.27	0.4411
Sales 3rd Quartile	2.54	0.3939	2.56	0.3900	2.45	0.4074	2.43	0.4110	2.10	0.4762	2.35	0.4256	2.10	0.4758
Sales 2nd Quartile	2.38	0.4194	2.44	0.4096	2.26	0.4423	2.34	0.4274	2.06	0.4861	2.29	0.4373	2.06	0.4861
Certification	1.76	0.5673	2.31	0.4331	1.74	0.5749	1.82	0.5501	1.76	0.5675	2.22	0.4509	1.77	0.5638
Crude Oil Price, Brent	1.93	0.5188	1.56	0.6393	1.56	0.6423	1.58	0.6315	1.47	0.6825	1.50	0.6684	1.47	0.6825
LN of 12mth Press Hits	1.38	0.7239	1.38	0.7261	1.38	0.7239	1.31	0.7612	1.28	0.7790	1.37	0.7316	1.33	0.7528
Polluting Industry							1.44	0.6927						
Strong	1.36	0.7374	1.37	0.7313	1.34	0.7484								
Sweden							1.26	0.7964						
M/B							1.21	0.8246						
Award	2.06	0.4863	1.27	0.7875	1.94	0.5159	1.24	0.8063	1.17	0.8576	1.24	0.8079	1.62	0.6185
Medium	1.86	0.5384	1.37	0.7308	1.85	0.5393								
Medium*Award	2.46	0.4059			2.46	0.4065							1.50	0.6663
Medium*Certification			1.82	0.5506							1.73	0.5791		
Sweden*Oil Price	1.58	0.6336												
Atea - Firm Dummy	1.35	0.7394	1.33	0.7526	1.28	0.7799								
Forte							1.13	0.8839	1.09	0.9197	1.28	0.7809	1.10	0.9075
Sweden*LN of 12mth Press Hits			1.35	0.7417							1.3	0.7716		
Average VIF	1.94		1.78		1.88		1.68		1.65		1.78		1.69	

F.2. Cook-Weisberg Test for Heteroskedasticity

Regression	(1)	(2)	(3)	(4)	(5)	(6)
Chi^2	0.14	1.82	0.14	0.00	0.01	0.24
P-value	0.7110	0.1771	0.7067	0.9738	0.9379	0.6214
Regression	(7)	(8)	(9)	(10)		
Chi^2	0.90	1.13	0.45	0.78		
P-value	0.3424	0.2883	0.5030	0.3670		
Regression	(11)	(12)	(13)	(14)		
Chi^2	0.74	0.26	0.24	0.19		
P-value	0.3879	0.6113	0.6263	0.6619		

This test checks whether there are any problems with the assumption of homoscedasticity (constant variance in the error term) in the regression models. All p-values are well above any significance level of 10%, leading us to conclude that the assumption is not violated.

F.3. Ramsey RESET test of Omitted Variables

Regression	(1)	(2)	(3)	(4)	(5)	(6)
F-statistic	0.69	0.36	0.98	0.27	0.17	0.22
P-value	0.5582	0.7844	0.4054	0.8488	0.9171	0.8802
Regression	(7)	(8)	(9)	(10)		
F-statistic	0.65	0.79	0.91	0.63		
P-value	0.5861	0.5027	0.4398	0.5954		
Regression	(11)	(12)	(13)	(14)		
F-statistic	0.88	0.59	0.32	0.18		
P-value	0.4548	0.6233	0.8079	0.9064		

The Ramsey RESET test looks for omitted variables, i.e. explanatory variables not included which may help explain more of the variance in the dependent variable. Also here all p-values are well above the weakest of acceptable significance levels, and we cannot prove that there are omitted variables.

F.4. Shapiro-Wilk Test for Normality of Residuals

Variable	Obs	W	V	z	Prob>z
res1	115	0.9819	1.677	1.156	0.124
res2	115	0.9780	2.045	1.599	0.055
res3	115	0.9829	1.590	1.037	0.150
res4	115	0.9816	1.709	1.198	0.115
res5	115	0.9803	1.830	1.351	0.088
res6	115	0.9826	1.618	1.076	0.141
res7	115	0.9791	1.937	1.478	0.070
res8	115	0.9792	1.933	1.473	0.070
res9	115	0.9809	1.775	1.282	0.100
res10	115	0.9763	2.202	1.764	0.039
res11	115	0.9764	2.188	1.750	0.040
res12	115	0.9774	2.103	1.662	0.048
res13	115	0.9774	2.100	1.658	0.049
res14	115	0.9755	2.277	1.839	0.033

The assumption that the residuals (res # of regression) are normally distributed is an important one in a multiple regression. Shapiro-Wilk allows us to test this formally, and we can see from the table that several of the regressions have a p-value (Prob>z) of less than 5%, indicating that the residuals are in fact not normally distributed.