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How do investors value “doing good” and “being green”?

A study on the stock market reaction to environmental reports and regulations

Abstract

This study examines the stock market reaction of Social and ‘Non-Social’ companies to negative environmental reports and regulations between 1992 and 2016. With the use of an event study focusing on seven key events and a cross-sectional test, I find an answer to the research question that is fundamental in this study. The event study shows that the stock price of companies in the self-developed Social Index based on the MSCI KLD ESG Index responds more positively to the reports and regulations than firms in the Compustat Universe. However, the cross-sectional test suggests there is no real difference between the reaction of companies in the Social Index and the Compustat Universe firms. The effect of the firm size is investigated based on Total Assets and Market Capitalization. Total Assets show positive effects on the stock market response, whereas Market Capitalization is neutral in its effect. Furthermore, Book-to-Market Ratio and Return-on-Assets are positively valued by investors. Existing literature does not find that socially aware companies do really influence investors in their investment decisions. However, this study shows that ESG factors become more important for companies and “doing good” and “being green” is valued by investors.

Keywords: Socially Responsible Investing, ESG factors, Event Study, Corporate Social Responsibility

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1. Introduction

Climate change is and has always been a reoccurring issue in the world. The debate concerning carbon dioxide emissions (CO₂) is going on for multiple years and is still a hot topic. Carbon emissions rose to an all-time high in 2019, and CO₂ pollution has risen by 1.7% in 2018 (Bloomberg, 2019). Furthermore, fossil fuel companies are responsible for a large amount of these emissions. Amongst these companies, many of which are investor-owned firms (TheGuardian, 2019). From the 1990s onwards, actions are taken by governments and, for example, the European Union to reduce the effects of climate change, especially to reduce the emissions of CO₂. Regulations are put in place that limits governments in their emissions and impact companies and their emissions.

The most important treaty and the first event that I cover in this study is the United Nations Framework Convention on Climate Change (UNFCCC) in 1992 by the United Nations. This research also makes use of other acts and agreements that cover a period of 25 years, from 1992 to 2016. The reports and regulations have a global impact and impact the companies' environmental practices that I investigate. As part of the UNFCCC, multiple protocols are put into place in the past years. The Kyoto protocol of 1997 is thoroughly discussed as an event in this study. Also, the American Clean Energy and Security Act of 2009 (ACES) is described, and the investor behaviour to the approval of this Act is investigated. Lastly, the most recent Agreement signed in Paris in 2016 is studied to see the effect of this signing on the stock market.

Over the years, investors' interest switch from only looking at companies' financial results towards a broader view. Primarily corporate social responsibility (CSR) is increasingly more critical for investors. This also led to the rise of socially responsible investing (SRI), where investors look more towards the social aspects of the companies they want to invest in. By looking at the stock market reactions around the events that I discuss, I analyze investors' behaviour.

This research examines the relationship between climate change reports and regulations and the stock price of companies in the United States and attempts to answer the following research question:

“How do investors react to climate change reports and regulations?”

To examine this relation, I conduct an event study where the events are the releases of climate change reports and the introduction of climate change regulations based on various acts and agreements. I use seven key events that impact the companies and explore the stock market reaction to these events. The reports show how the emissions of CO₂ have changed during the past years and what kind of measures need to be taken to reduce the emissions. It is interesting to see how investors react to these announcements and how stock prices reflect these announcements. I expect that companies known to have adverse environmental characteristics see a drop in their stock price. In contrast, companies engaging in sustainable operations see a rise in their stock price.

I use a self-developed Social Index based on the MSCI ESG KLD Index to distinguish between the different companies as the MSCI KLD 400 Social Index data is not available. I use several indicators closely linked to the research question and hereby, I generate an Index that exists of socially responsible companies. I then compare this Social Index with the North American Compustat Universe using an event study. The event study that I use investigates the cumulative average abnormal returns (CAAR) around the different event dates of both firms in the Social Index and the Compustat Universe. I use the market-adjusted model with two different event windows. The cross-sectional test looks at the effects of firm characteristics on the CAAR.

The event study shows that the Social Index firms have significantly higher CAARs for five of the seven events. Investors value the various events more for the companies in the Social Index than for companies in the Compustat Universe. Also, investors see more perspective on the firms' financial performance in the Social Index after the various reports and regulations. The other two events show higher CAARs for the firms in the Compustat Universe. The cross-sectional test looks at how different firm characteristics influence the CAARs in different events. Overall, the size of the company shows to have a positive effect on the CAAR as the effect of Total Assets is mostly positive and the effect of Market Capitalization is neutral throughout the events. The CAARs also react positively to an increase in the Book-to-Market Ratio and the Return-on-Assets. The cross-sectional suggest there is no real difference between the companies in the Social Index and the Compustat Universe firms as it shows a significant value for the inclusion in the Social Index for one event.

Existing literature is divided into multiple groups. The biggest group primarily focuses on the effects of CSR on financial performance. Another group focuses more on the effect of

SRI, where investors take a close look at how the firm characterizes itself to the outside world. Also, closely linked to this research is the effects of environmental tragedies and outside information on financial performance. This research contributes to the existing literature as it focuses on specific events in time to see how investors react to developments related to climate change. Mainly, I look at the effect of negative environmental reports and regulations on companies' stock price.

Most studies focus on corporate news, whereas I look at global news and how that affects the various companies. SRI is a returning subject in the thesis as this may explain why investors react to climate change and, more specifically, CO₂ announcements. I expect this research to show that investors are less willing to invest in companies with harmful environmental practices and are not seen as a “socially responsible investment”. CSR is an important aspect for the companies themselves where investors look at to see if investing is worthwhile. Thus, this research is also seen as a link between how CSR practices are embedded in investors' investment decisions. The study gives important insights into the investment behaviour of investors at certain events related to climate change. Also, it can generate incentives for companies to engage in becoming more “sustainable”. Therefore, this study is also closely linked to the environmental, social, and governance factors related to investors (ESG). Investors use these factors to evaluate companies in their advancements concerning sustainability (Robeco, n.d.).

However, research on different events related to climate change reports and regulations is limited. It is interesting to see if there is a relation between those events and how investors react to these events. Previous literature that focuses on the effects of CSR on financial performance does not show a real preference for a positive or negative effect. However, most studies agree that CSR is becoming more important throughout the years and that companies must focus on CSR in the future. Furthermore, an explanation for a higher CAAR for companies in the Social Index is SRI. This involves investors applying both financial and social criteria to their investment decisions (Sauer, 1997). Also, the ESG criteria have seen greater importance throughout the years concerning the behaviour of investors. Studies regarding the effects of environmental tragedies and the effect on the financial performance show a negative relation. However, if this reaction is related to the environmental interest of investors is unclear. Investors also take into account other costs related to these tragedies that harm the company. Studies regarding the relation of financial performance and outside

information are mostly negative (Hughes K. E., 2000; Shane & Spicer, 1983; Sariannidis, Zafeiriou, Giannarakis, & Arabatzis, 2013))

The rest of the paper follows the following structure. The next section elaborates on the existing literature that is strongly connected to this research. I develop the hypothesis that helps to answer the research question in the third section. The fourth part focuses on the methodology and the data that I use to examine the market reactions. The fifth section gives the results of the event study and the cross-sectional test. Lastly, I discuss the conclusion, limitations, and recommendations for future research.

2. Literature Review

Prior literature on environmental criteria and firms' financial performance primarily focused on CSR of the firms being studied. The main focus is on the disclosures related to environmental practices. Study on the stock price movements related to the reports and regulations on environmental impact is scarce.

The existing literature is distinguished into multiple groups. Firstly, existing literature regarding CSR practices and the financial performance of a firm is frequent. Secondly, a topic closely linked to CSR is SRI. Thirdly, the effect of environmental tragedies on the financial performance and stock price of companies. Closely linked to the tragedies and the effect throughout the market are the disclosures by the different firms. Lastly, I review the effect of regulations and outside information as it has the closest link to the research topic.

2.1. Corporate Social Responsibility

A common subject of research is the relationship between CSR and the financial performance of a firm. One of the most cited studies conducted on CSR practices and financial performance is by McWilliams & Siegel (2000). Their research focuses on the inconsistency in the views of research regarding the impact of CSR on financial performance. They conclude that the impact of CSR on financial performance is neutral.

That view is opposing to that of Porter & Linde (1995), who argue that improving the CSR leads to better economic performance and does not only increase the cost of "doing good". van Beurden & Gössling (2008) also argue that most literature is more bounded to the

positive correlation of CSR and financial performance. Furthermore, according to their literature review, a negative correlation is mainly based on outdated material.

CSR also becomes a crucial component of corporate strategy and an instrument to minimize conflict with stakeholders (Becchetti, Ciciretti, & Hasan, 2009). Their research looks at the market reactions after a company enters the Domini 400 Social Index, a CSR benchmark index. They find that an exit from the Domini 400 Social Index shows negative abnormal returns. Their main conclusion is that corporations need to refocus from maximizing shareholder value to maximize a broader set of stakeholders' goals.

2.2. Socially Responsible Investing

A topic that has a close link to the environmental practices of companies is SRI. In the United States, the phenomenon of SRI is growing since the late 20th century and is seen as an industry on its own at this moment (Schueth, 2003). Berry & Junkus (2013) state that the definition is still quite vague, but overall is seen as investors integrating their values and societal concerns into their investment decisions. Their research concludes that investors' main components of interest are the company's environmental and sustainability aspect.

Sauer (1997) also states that socially responsible investors apply both financial and social criteria to ensure that their investments reflect their values and beliefs. In his research, Sauer focuses on the MSCI KLD 400 Social Index. This index is only affected by social concerns and how companies deal with these concerns. Additionally, Sparkes & Cowton (2004) stress the influence of SRI becoming more important throughout the years, and SRI is showing a more significant relationship with CSR. SRI is a returning subject in this research as this may explain why investors react to climate change reports and regulations.

Renneboog, Horst, & Zhang (2008) provide a literature review on SRI and identify the importance of social and financial goals. The beginning of the 21st century sees a growth in the importance of SRI, and this is due to the awareness of investors to the ESG criteria. Using an extensive study of more than 2000 empirical studies, Friede, Busch, & Bassen (2015) find that the relation between ESG and financial performance is mostly positive. This relationship also seems to be stable over time.

Cho, Guidry, Hageman, & Patten (2012) perform a likewise study on the effect of environmental performance and the firm's reputation and disclosures. Unlike Sauer, who used the MSCI KLD 400 Social Index, they look at the Dow Jones Sustainability Index (DJSI) and if

the firms' environmental performance is associated with inclusion in the DJSI. They find a negative relation between environmental performance and both reputation and inclusion in the DJSI. As possible explanation, they state that firms that are performing worse usually disclose more. This paper's main conclusion is that the voluntary disclosure of environmental performance resolves reduced environmental performance on the reputation. Most troublesome is that inclusion in the DJSI is not based on the firms' actions but on what they say. This results in firms not improving their environmental performance at all.

A recent study by Aureli, Gigli, Medei, & Supino (2020) investigates the relationship between sustainability and firms' financial performance. Their main firms of interest were, like Cho et al. (2012), listed on the DJSI. Thirty-three event windows are analyzed, and their main conclusion is that the significance level of the reports increased since 2013.

2.3. Environmental tragedies and financial performance

Bowen, Castanias, & Daley (1983) find that after the nuclear accident at Three Mile Island, the electric utility companies' industry sees declines in their stock prices. Hill & Schneeweis (1983) also look at the accident's impact and find the same results. They also state that investors' reaction is driven by concerns regarding the regulatory costs related to nuclear energy generation. Dowdell, Govindaraj, & Jain (1992) examine whether the pharmaceutical industry reacted to the Tylenol tampering in 1982. Although the manufacturer of Tylenol sees a decline in its share price, the industry itself is spared.

Blacconiere & Patten (1994) find that when an environmental catastrophe occurred in India, chemical firms' whole industry reacts negatively. However, when companies disclose their environmental practices before the catastrophe, the market reacts less negatively. This indicates that investors see this as a positive sign when companies disclose more information concerning the environment and react accordingly. However, they also state that firms can disclose more good news instead of bad news. When environmental disclosures are already present before certain news events, investors see this as a positive sign.

Chan & Milne (1999) also perform research on how environmental disclosures affect the decisions of investors. They look at both positive and negative disclosures on environmental performance. Investors react strongly to the negative news, but there is no significant reaction to the positive disclosures. They also find that investors react in a less severe way to no mention of environmental performance. Regarding the positive disclosures,

there are two possible explanations for the behaviour of the investors. Some investors invest in the leading environmental position, while other investors consider the environment's investments unnecessary. Overall, they state that their results are consistent with firms not disclosing any environmental information unless obliged.

2.4. Effect of outside information

Concerning environmental regulations, Hughes K. E. (2000) looks at the impact of the introduction of the Clean Air Act Amendments in 1990. The share price of the electric utility companies involved sees a decline by 16 per cent around the introduction of the Act. Hughes states that the decline is due to exposure to future environmental liabilities. The Act's introduction especially targets the high polluting firms, and these firms show the most substantial declines. Furthermore, the firms not targeted show no significant relation.

Lorraine, Collison, & Power (2004) examine the relation of publicity regarding companies' environmental performance and these companies' share prices. They focus on both fines and recommendations regarding environmental practices. Their main results show that the reaction of investors is primarily concerned with fines. The other factors do not give any explanation for the reaction.

Earlier research by (Shane & Spicer (1983) focuses on environmental information produced outside the company. Social performance information provided by the Council on Economic Priorities (CEP) with its primary focus on pollution control is investigated. It shows that the investors' reaction was consistent with the information provided by the CEP.

Jacobs, Singhal, & Subramanian (2010) look at announcements on information that the company puts out and third parties' announcements on its environmental performance. Their results are surprising as no immediate reaction is found between these announcements and the market reaction. However, they find that specific subsections do raise significant market reactions. Overall, the reaction varies across the different announcements and is even negative.

An empirical survey by Sariannidis, Zafeiriou, Giannarakis, & Arabatzis (2013) on the financial performance of socially responsible firms regarding CO₂ emissions finds an increase of global CO₂ emissions resulted in negative performances of the firms being studied. As a possible explanation, they give the costs for implementing environmental policies and

attitudes of investors. However, they do not focus on the difference between socially responsible firms and other firms that do not have their primary focus on being socially responsible.

In the next section, I develop the hypothesis that focuses on the effect of negative environmental reports and regulations on the stock price movements for companies present in the Social Index and companies present in the Compustat Universe.

3. Hypothesis Development

Existing literature focuses on what companies do with their CSR practices and their relationship with their financial performance. However, these studies do not show that these practices have a real impact on investors or cause a change in investors' behaviour. This research contributes to the existing literature as it focuses on specific dates and events in time to see how investors react to publicly available developments related to climate change. The focus is on the negatively orientated climate change reports and regulations and the impact on investors' investment decisions. When looking at climate change announcements, CO2 emissions are an important topic that is the cause of many climatological debates in recent years. The research expects to show that investors are less willing to invest in firms where CO2 emissions are known to be high and are not seen as a 'socially responsible investment'. Hereby also showing a difference between the firms, where the more socially responsible companies show a less severe reaction to the negative news or even a positive reaction. CSR is an important aspect for the companies themselves where investors look at to see if investing is worthwhile. Thus, this research is also seen as a link between how CSR practices are embedded in investors' investment decisions.

Empirical evidence indicates that stock price changes almost always have a cause and are not random (Fama, Fisher, Jensen, & Roll, 1969). Markets are expected to be efficient and adjust rapidly to new information. I expect that a reaction is noticeable around the publishing of specific reports and regulations on climate change. When looking at the shareholder value of CSR practices, Godfrey, Merrill, & Hansen (2009) find that when a company integrates CSR practises, it poses a type of goodwill for the investor. When a company gets involved in a scandal or other negative event that involves the company, CSR practices reduce the

negativity for shareholders on these companies. Also, Flammer (2013) finds that CSR has a positive effect on shareholder value. She finds that firms that focus on environmental CSR generate new and competitive resources. Companies that do not engage in CSR practices see a decrease in their shareholder view over the same period. However, she thinks that environmental CSR becomes more like an insurance for investors.

Existing literature tends to show that the stock price reaction to reports and regulations are aligned, where good news leads to positive market reactions for both 'normal' companies and social companies, and bad news leads to negative market reactions. However, the effect on social companies is less severe concerning bad news. Investors may react negatively to industries where emissions are high and can expect negative outcomes for those companies if they need to alter their operations. Hence, leading investors to be discouraged from investing in companies in that industry. Alternatively, industries with a good track record related to their environmental footprint can show less negative and even positive results as investors want to invest in these companies. Besides, the impact of the negative reports and regulations can show no impact on investment decisions. As empirical evidence suggests, investors can show no reaction because they are suspicious of the reports and regulations' results.

Some studies focus their research on sustainable indices that reflect both the social and economic goals of investors. This study uses a self-developed Social Index based on the MSCI ESG KLD Index, which is the strongest social index for environmental practices (Statman, 2006). The MSCI ESG KLD Index helps investors in investing in companies that have positive ESG characteristics. Companies are only included in the index if they reach the criteria set (MSCI Inc., 2020). These criteria include a minimum MSCI ESG rating of BB on a seven-point scale ranging from CCC to AAA. The MSCI Controversies score must be at least 2 on a 10-point scale, with 0 meaning severe controversy. The return on this index has outperformed the S&P 500 index from 1990 till 2004. However, it is interesting to see if the abnormal returns around specific event dates also differ between the companies in the Social Index and the firms in the Compustat Universe.

Shareholders might have higher expectations of the firms in the Social Index when it comes to the environmental impact, leading to a more negative share price reaction due to the negative news. However, the effect on the Social Index can also be less severe and even positive because investors change their investment decisions to companies that are more

socially responsible. Especially when investors care about society's opinion, investing in socially responsible firms could lead to a better reputation after a negative announcement. Overall, the existing literature regarding climate change is mostly negatively biased regarding the financial performance of the companies studied. However, the effect on the stock price of social companies is mostly ambiguous.

All these arguments lead to the following alternative hypothesis:

H_a: Negative environmental reports and regulations have a less negative effect on the stock price of companies in the Social Index than for companies in the Compustat Universe.

4. Research Design

This section provides the methods used in answering the research question. I explain the key events investigated in this research, and I clarify the sample selection. Also, I describe the development of the Social Index thoroughly. Subsequently, the data is defined, and lastly, the methodology is explained, including the various tests conducted.

4.1. Key events

To answer the research question, I conduct an event study to examine the relationship between the different reports and regulations and investors' reaction. The event study first introduced by Ball & Brown (1968) is used to investigate the impact of a specific event on the share price of the companies investigated. The first step in an event study is to give a detailed description of the events used for this research. The events used in this study are the releases of global reports and regulations on climate change and CO₂ emissions, as these global announcements make sure that relevant events are isolated. I choose these specific events as they have the greatest impact on the companies, as the regulations affect every company and country. Also, the reports released during the specific events all show global effects of climate change. Although the event dates are mostly known to the public beforehand, the specific reports and regulations that are released are not known till the event date itself. Therefore, the anticipatory reaction is rather small and mostly based on guessing.

As for the entering into force of the regulations there might be some anticipatory reaction. However, there is some time between the announcement of the regulations and the entering into force of the regulations itself. Investors may therefore react even more intense to these events as the actual regulations are implemented and more interest is focused on the companies that benefit from the regulations or experience more negative effects of the regulations imposed. The events occur between 1992 and 2016 as the MSCI ESG KLD index data is available from 1991 onwards. Table 1 includes the specific event dates and their descriptions.

Table 1

List of event dates and description of the events

Event date	Description
May 9, 1992	The adoption of the United Nations Framework Convention on Climate Change (UNFCCC)
March 21, 1994	UNFCCC enters into force
December 11, 1997	The Signing of the Kyoto Protocol
February 16, 2005	The Kyoto Protocol became effective
June 26, 2009	The American Clean Energy and Security Act of 2009 (ACES) is approved by the House of Representatives
April 22, 2016	The Signing of the Paris Agreement
November 4, 2016	The Paris Agreement became effective

The UNFCCC is a treaty established in 1992 by the United Nations, signed during the Earth Summit in Rio de Janeiro. The treaty's primary goal is to reduce greenhouse gas emissions and, through this reduction, prevent the further consequences of climate change. The framework sets limits to greenhouse gases, but it does not contain any enforcement mechanisms. However, the framework forms the basis for international agreements for the treaties to be in accordance with the objective of the UNFCCC. Article 2 states the main objective of the UNFCCC as¹:

¹ United Nations Framework Convention on Climate Change, retrieved by <https://unfccc.int/resource/docs/convkp/conveng.pdf>

“... stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner”.

Article 3 (1)² states that the focus of the Parties involved is on the benefit of present and future generations and their protection of the climate system, accordingly. Also, the protection is based on equity and their common but differentiated responsibilities and respective capabilities. Lastly, it states that developed countries need to take the lead in combating climate change and the adverse effects thereof. As of the 21st of March 1994, the UNFCCC enters into force.

During the first “Conference of Parties” in 1995, the Parties outlined specific emission targets for the years to come. In 1997 in Kyoto, Japan, the Parties conclude that their emission goals are not met. This leads to the introduction of the Kyoto Protocol, which is put in place to meet the objectives of the UNFCCC. Even though it is signed by the United States, it is never ratified by the Senate. Contrary to the UNFCCC, the Kyoto protocol has binding agreements for the Annex I countries, which are the developed countries and include amongst others the European Union. These binding agreements include emissions targets which are binding under international law. The Kyoto Protocol has two commitment periods, the first one starting from 2008 till 2012 and the second period starting from 2013 till 2020. The Kyoto Protocol becomes effective as of the 16th of February 2005.

In 2005, the European Union launched an emissions trading scheme to fight global warming. It uses a ‘cap and trade’ principle in which a maximum of greenhouse gases is allowed to be emitted. On the 26th of June 2009, the House of Representatives approved the ACES³. This bill is the United States equivalent to the emissions trading scheme by the European Union. After the financial crisis, the Act helps economic recovery by investing in

² United Nations Framework Convention on Climate Change, retrieved by <https://unfccc.int/resource/docs/convkp/conveng.pdf>

³ Retrieved from: <https://www.congress.gov/bill/111th-congress/house-bill/2454>

clean energy and creating millions of jobs⁴. Even though the bill is never brought to the Senate, I use it as an event as this would have impacted companies on a large scale.

At the Climate Summit of Paris in 2015, the Kyoto Protocol's successor emerged in the Paris Agreement. The Paris Agreement consists of even more stringent emissions reductions for the coming years⁵. Also, the main objective of the introduction of the Paris Agreement is the target of lowering global warming to 1.5 degrees Celsius this century. The Agreement aims for countries to strengthen the ability to deal with the impact of climate change. Furthermore, it aims for more assistance for developing countries in their battle with climate change. Contrary to the Kyoto Protocol, the Paris Agreement makes all Parties have nationally determined contributions. This includes, amongst others, that Parties regularly report on their emissions and implementation efforts. The Paris Agreement is signed on the 22nd of April 2016 and enters into force on the 4th of November 2016.

4.2. Sample selection

Next, I explain the sample selection procedure. The selection consists of two separate samples to test my hypothesis and answer my research question. I use a sample consisting of a Social Index based on the MSCI ESG KLD Index and all 'Non-Social' Compustat Universe companies. The companies present in the Compustat Universe are available in the database of the Wharton Research Data Services (WRDS). The MSCI ESG KLD Index has its own Social Index. However, WRDS does not include the companies in this MSCI ESG KLD Social Index. WRDS only includes the MSCI ESG KLD Index. Therefore, more steps are necessary to develop my own Social Index for this research. Finally, I end up with a Social Index that includes all the companies from the North American Compustat Universe that I perceive as being social according to the various indicators. The 'Non-Social' Compustat Universe consists of all North American Compustat Universe companies and excludes the companies in the Social Index.

WRDS provides indicators assessing the positive and negative ESG Performance for the MSCI ESG KLD Index with 167 different variables. In WRDS, the database contains the indicators as strengths and concerns in multiple categories, like the environment. The

⁴ Retrieved from: <https://www.nrdc.org/sites/default/files/ACESLegFS.pdf>

⁵ Retrieved from: <https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement>

strengths are indicators that positively affect the company's ESG performance, whereas the concerns have a negative effect. Accordingly, to develop the Social Index, multiple variables are chosen that have the strongest link to this research. I choose twenty different binary variables that return a '1' if the company meets the assessment criteria established for that specific indicator and a '0' if the company does not meet these criteria. Also, companies return nor '1' nor '0' if this company is not examined for that ESG indicator. There are both positive and negative effects on the social rating from the variables chosen, so a continuous score shows which companies have the highest social rankings and have an inclusion in the Social Index.

From the 167 indicators, I include only the indicators that show the strongest link to the hypothesis tested, like Environmental Opportunities and Climate change. Other indicators like charitable giving, support for housing or education, the gender of the board of directors, CEO, and many others that have no specific link to the research are not included. Table 15 in the Appendix provides the various indicators and their description. Also, the classification as a strength or concern is included.

Table 2 shows how many companies are present in the MSCI ESG KLD Index before including the indicators to generate the Social Index. The number of companies increases from 647 companies in 1991 to 7426 companies in 2018. This shows a need for an index that covers the ESG performance of companies, especially for investors.

Table 2
Number of companies present in MSCI ESG KLD Index in WRDS

Year	Number of Companies	Year	Number of Companies
1991	647	2005	3016
1992	652	2006	2963
1993	651	2007	2937
1994	643	2008	2923
1995	647	2009	2912
1996	652	2010	3012
1997	653	2011	2848
1998	658	2012	2799
1999	662	2013	4980
2000	663	2014	5245
2001	1107	2015	2416
2002	1108	2016	2377
2003	2963	2017	5547
2004	3034	2018	7426

I include the indicators to develop the Social Index used for the research itself. The indicators that I perceive as strengths return a +1 and concerns return a -1 to the continuous score. The Social Index developed only contains companies with at least a score of '1', as these companies contain more positive than negative characteristics relating to their ESG performance. These companies are then matched with the Compustat Universe to separate the Social from the Non-Social companies. Table 3 contains the companies present in the Social Index. The table also contains the percentage of companies in the Social Index with respect to the MSCI ESG KLD Index after including all the indicators.

Table 3

Number of companies in Social Index and percentage of companies compared to Table 2

Year	Number of Companies	%	Year	Number of Companies	%
1991	133	21%	2005	291	10%
1992	143	22%	2006	261	9%
1993	165	25%	2007	272	9%
1994	189	29%	2008	287	10%
1995	212	33%	2009	283	10%
1996	201	31%	2010	515	17%
1997	212	32%	2011	516	18%
1998	203	31%	2012	661	24%
1999	210	32%	2013	1464	29%
2000	210	32%	2014	1665	32%
2001	233	21%	2015	676	28%
2002	238	21%	2016	703	30%
2003	273	9%	2017	1914	35%
2004	278	9%	2018	2519	34%

4.3. Data

This study examines the stock market reaction following the events specified. The data used is gathered from the database of the WRDS system. The WRDS system contains specific information on firms' economic, financial, and accounting data around the world. When the specific sample of companies is selected, I merge it with North American Compustat and the Center for Research in Security Prices (CRSP) database within WRDS, which contains company and stock price information.

Table 4 shows how the event windows are defined. I use a time window of three days and seven days centred on the event. The three days event window ranges from one day

before and after the announcement date and the seven days event window ranges from three days prior and three days after the announcement date. I only use these two event windows, as Chen (2014) stated that a shorter time horizon is more reliable than a longer horizon.

Table 4
Event windows and dates for key events

Event Date	Event window [-1, +1]	[-3, +3]
May 9, 1992	May 8 – May 11, 1992	May 6 – May 13, 1992
March 21, 1994	March 18 – March 22, 1994	March 16 – March 24, 1994
December 11, 1997	December 10 – December 12, 1997	December 8 – December 16, 1997
February 16, 2005	February 15 – February 17, 2005	February 11 – February 21, 2005
June 26, 2009	June 25 – June 29, 2009	June 23 – July 1, 2009
April 22, 2016	April 21 – April 25, 2016	April 19 – April 27, 2016
November 4, 2016	November 3 – November 7, 2016	November 1 – November 9, 2016

As several studies show, there is a positive relationship between ESG factors and financial performance. Drempetic, Klein, & Zwergel (2019) also find a positive relationship between companies' firm size and ESG ratings. Table 5 shows the descriptive statistics of the companies in the Compustat Universe and the companies included in the Social Index from 1992 till 2016. Both the Compustat Universe and the Social Index are merged with the CRSP database in WRDS to conduct all the tests. The variables show where I establish the difference between the Compustat Universe and the Social Index. The descriptive statistics show the Assets, Liabilities, Net Income, Revenue, Employees, and Market Capitalization. The Social Index shows higher amounts in all aspects, highlighting the positive relation between firm size and ESG ratings. The observations in Panel A represent the number of companies in all the years between 1991 and 2018 of the Compustat Universe. Panel B represents the number of companies in the Social Index.

Table 5

Descriptive statistics

Panel A: Compustat Universe						
	Observations	Mean	Standard Deviation	25 th Percentile	Median	75 th Percentile
Assets	149,054	7,372	70,765	59	298	1,506
Liabilities	149,054	5,993	66,270	19	137	920
Net Income	149,054	122	1,156	-4	4	41
Revenue	149,054	2,330	12,389	35	168	840
Market Capitalization	149,054	2,876	14,039	50	228	1,107
Employees	149,054	7,670	35,610	147	685	3,600

Note: all financial data amounts are displayed in millions

Panel B: Social Index						
	Observations	Mean	Standard Deviation	25 th Percentile	Median	75 th Percentile
Assets	8,165	40,547	177,134	1,538	5,294	18,055
Liabilities	8,165	33,373	160,652	747	3,236	11,606
Net Income	8,165	951	2,889	35	201	761
Revenue	8,165	10,853	24,341	845	2,979	9,913
Market Capitalization	8,165	19,203	46,104	1,378	4,707	15,865
Employees	8,165	31,757	74,417	2,139	7,903	29,865

Note: all financial data amounts are displayed in millions

4.4. Methodology

This research uses the event study methodology, as this research investigates the stock market response to specific reports and regulations. Any type of event is studied in the direction and magnitude of the stock price change using the event study methodology (MacKinlay, 1997). The effects of the specific events are immediately reflected in the stock prices, and thus capital markets reflect all the information in the firms' stock price. Another important study that focused on the event study methodology and its effects is that of Fama (1970). Positive changes reflect the expectations of investors to be positive regarding the profitability of the companies. Negative changes apply to negative expectations of investors.

I measure the stock price reaction by using the CAAR around the event dates. The abnormal return is used to isolate the effect of the market return and to only look at the return attributable to the announcement of environmental changes. My research considers a time window of one day and three days before the events to see if there are expectations related to the reports and regulations. I consider one day and three days after the events to see if the

reactions are permanent. Only a small time window is used, as using a more extended time window may result in bias in the results, and a shorter horizon is more reliable than a longer horizon event study (Brown & Warner, 1985).

The event study methodology involves multiple steps to come to the abnormal returns. First, I identify the events and event windows. Second, I perform the prediction of the 'normal' return during the estimation window ranging from 60 days to 5 days before the event date. Third, the estimation of the abnormal returns during the event window, where the abnormal return is the difference between the actual return and the market return. Lastly, testing whether these abnormal returns are statistically different from zero. The abnormal return for stock i on day t is defined in the market-adjusted model as:

$$AR_{it} = R_{it} - R_{mt} \quad (1)$$

where R_{it} is the return of stock i on day t and R_{mt} is the market return on day t . The market return is established using the estimation window before the event and incorporates the market return of the Standard & Poor's 500 (S&P 500) Index during this estimation window. The equation is also interpreted as the difference between the actual and the expected return of stock i on day t . The following equation measures the cumulative abnormal return:

$$CAR_{it} = \sum_{t-k}^{t+l} AR_{it} \quad (2)$$

where l and k represent the days after and before the event date. However, the data consists of multiple firms, and the CARs are summed to get the average in the form of the CAAR. To test the hypothesis, we look at the CAAR, which is defined by the following formula:

$$CAAR_{it} = \frac{1}{N} \sum_{i=1}^N CAR_{it} \quad (3)$$

where N represents the sample size. When the CAAR is significantly different from zero, the hypothesis is accepted. This means that the effect of negative environmental reports and regulations is more negative for companies in the Compustat Universe than for companies in the Social Index.

To test the hypothesis, I conduct a two-sample t-test using the following equation:

$$T_{CAAR} = \frac{X_{Social} - X_{Compustat}}{S_p \sqrt{\frac{1}{N_{Social}} + \frac{1}{N_{Compustat}}}} \quad (4)$$

where

$$S_p^2 = \frac{(N_{Social} - 1)s_{Social}^2 + (N_{Compustat} - 1)s_{Compustat}^2}{N_{Social} + N_{Compustat} - 2} \quad (5)$$

where X represents the sample mean, N represents the sample size, s^2 represents the sample variance, and S_p represents the pooled standard deviation. As the hypothesis shows a less negative or more positive direction for the Social Index, the two-sample t-test is one-sided. With a t-statistic larger than 1.645, the CAAR is significantly higher for firms in the Social Index than for firms in the Compustat Universe at the 5% level. This results in the acceptance of the hypothesis. Thus, the reaction of firms in the Social Index is significantly different from that of the Compustat Universe companies.

To test how the firm characteristics impact the stock market reaction, I use a cross-sectional test. It tests the association between the variables and includes control variables that could link the dependent and the independent variable. The Predictive Validity Framework (Libby Boxes) presented in Table 16 in the Appendix reveals how the conceptual relation is operationalized. As an independent variable, I use the event dates, and as a dependent variable, I use the cumulative abnormal returns around the event dates. Moreover, the Libby Boxes include the control variables used in the multivariate regression.

$$CAAR = \alpha_1 + \beta_1 Total\ Assets + \beta_2 Market\ Capitalization + \beta_3 Book\ to\ Market\ Ratio + \beta_4 Social\ Index + \beta_5 Solvency + \beta_6 Shareholder\ Equity\ Ratio + \beta_7 Return\ on\ Assets + \beta_8 Leverage + \sum \beta_f(Industry) + \varepsilon \quad (6)$$

The dependent variable in the multivariate regression is the stock market reaction to the key events. This is measured as the CAAR in the two event windows specified in the previous section. The independent variables include the Social Index, a dummy variable that equals 1 if the company is present in the Social Index and 0 otherwise, and control variables.

Furthermore, I include industry fixed effects to control for systematic differences across the industries. The industry fixed effects are based on the different Standard Industrial Classification (SIC) codes for each firm. I compile the different ranges of SIC codes into ten different divisions in which I categorize the firms⁶. Furthermore, to prevent the influence of outliers on the different variables, I winsorize at 1% and 99%.

The firm size consists of Total Assets and Market Capitalization. These variables are control variables as firm size could impact the inclusion in the Social Index. Also, larger companies tend to be more stable, have more pollution control measures, and access information more quickly (Guo, Kuai, & Liu, 2020). First, Total Assets are used to reflect the magnitude of the company. Also, Market Capitalization is used as Banz (1981) showed a relationship between the market value and the stock return. Both variables are measured based on their decile ranks.

I use different variables to measure the financial characteristics of the firms investigated. First, the Book-to-Market Ratio is used as a control variable as Fama & French (1992) found that it could explain the stock return. The Book-to-Market Ratio is measured as the difference between the assets and the liabilities divided by the Market Capitalization. Second, Solvency is measured as the total assets divided by the total liabilities. Solvency measures how capable a firm is to pay off its debts in the future. Third, the Shareholder Equity Ratio measures how much of the company is owned by shareholders. It shows the ratio of the Shareholders' Equity to the Total Assets of the firm. Fourth, the Return-on-Assets is measured as the earnings before interest divided by the Total Assets. The Return-on-Assets measures how profitable a company is, and it is expected that an increase in the Return-on-Assets results in a higher stock return. Lastly, the Leverage is calculated as the total debt divided by total equity. It measures how much of the capital comes from debt. If the Leverage is high, it indicates that a firm must first repay all its debt before paying the shareholders, which is a bad perspective for investors.

⁶ Retrieved from: <https://www.osha.gov/data/sic-manual>

5. Results

This section presents the results of the empirical analysis. I study the CAAR for the seven different events and their corresponding event windows. Furthermore, I conduct a t-test to show whether the CAARs are significantly different from zero. Finally, I present the cross-sectional tests of the different events.

5.1. Results of the event study

I focus on the effects of global reports and regulations on climate change and CO₂ emissions on stock prices. The stock price of the firms in the Social Index and the companies in the Compustat Universe are analyzed and compared with each other. The Social Index is made up of fewer companies than the Compustat Universe and is characterized by companies with a good track record concerning environmental characteristics. Especially, the stock price reactions of the companies included in the Social Index are expected to be stronger than the reactions of the companies included in the Compustat Universe because of these environmental characteristics of the social companies. Investors take these characteristics into account, which leads to higher CAARs for the companies in the Social Index. This empirical analysis uses the event study methodology presented in the methodology section. As there is no specific reaction present amongst all the events, each event is analyzed separately. Table 6 presents the overall results of the event study. In this table, the CAARs of the firms in the Social Index and the Compustat Universe are compared.

Table 6

The difference in cumulative average abnormal returns and T-statistic by event and event windows

Event and event window	The difference in CAAR between Social Index and Compustat Universe	T-statistic
Event 1: May 9, 1992		
3 days	0.22%***	17.76
7 days	0.98%***	39.30
Event 2: March 21, 1994		
3 days	-0.67%***	54.01
7 days	-0.56%***	31.47
Event 3: December 11, 1997		
3 days	0.04%***	2.65
7 days	0.53%***	22.75
Event 4: February 16, 2005		
3 days	-1.25%***	22.31
7 days	0.08%*	1.38
Event 5: June 26, 2009		
3 days	0.30%***	36.46
7 days	0.70%***	32.04
Event 6: April 22, 2016		
3 days	-0.12%***	19.25
7 days	0.58%***	47.07
Event 7: November 4, 2016		
3 days	1.13%***	90.03
7 days	1.96%***	97.24

This test is one-sided. Significance levels are 1.28 for 10%, 1.65 for 5% and 2.33 for 1%. ***, **, * denote significance at the 1%, 5%, and 10% level, respectively.

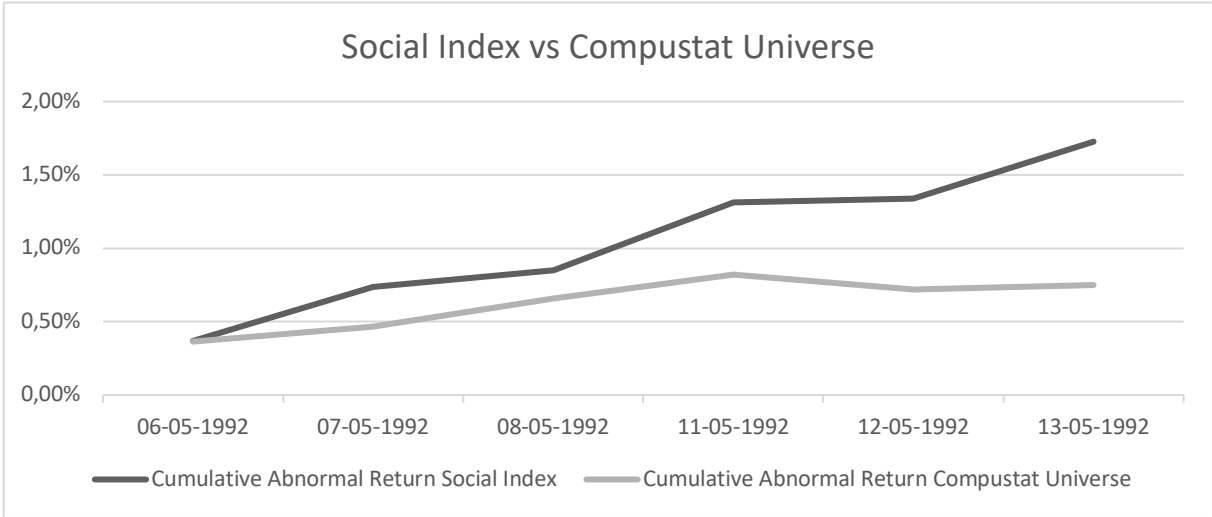
5.1.1. Event 1: May 9, 1992

The first event I cover is the adoption of the UNFCCC on May 9, 1992. The treaty's goal is to reduce greenhouse gas emissions and thereby lower the consequences of climate change. The treaty sets limits to greenhouse gases but has no enforcement mechanisms. Figure 1 gives the development of the CAARs and shows that the CAAR is higher for the Social Index companies across both the event windows. Also, the development of the CAAR is visible. After the announcement, the CAAR of the Social Index companies increases whilst the CAAR of the Compustat Universe companies decreases. The event itself occurs on the weekend, where no

trading is present on the stock market. This results in the CAAR increasing considerably with 0,50% on May 11 for the companies in the Social Index.

Table 6 shows that the CAAR for the firms in the Social Index is more positive than for the companies in the Compustat Universe by 0.22% for the 3-day event window and 0.98% for the 7-day event window. This shows that it takes the investors some time to react to the event itself, and that reaction is reflected in the stock price. The CAAR is significant for both event windows, advocating the difference in reaction of investors. The difference also shows that investors expect this treaty to positively affect the firms in the Social Index. However, it is notable to see that the Compustat Universe companies also have a positive CAAR. An explanation is that even though the treaty wants to reduce emissions, it does not enforce it.

Figure 1
Development of the cumulative average abnormal returns for event 1



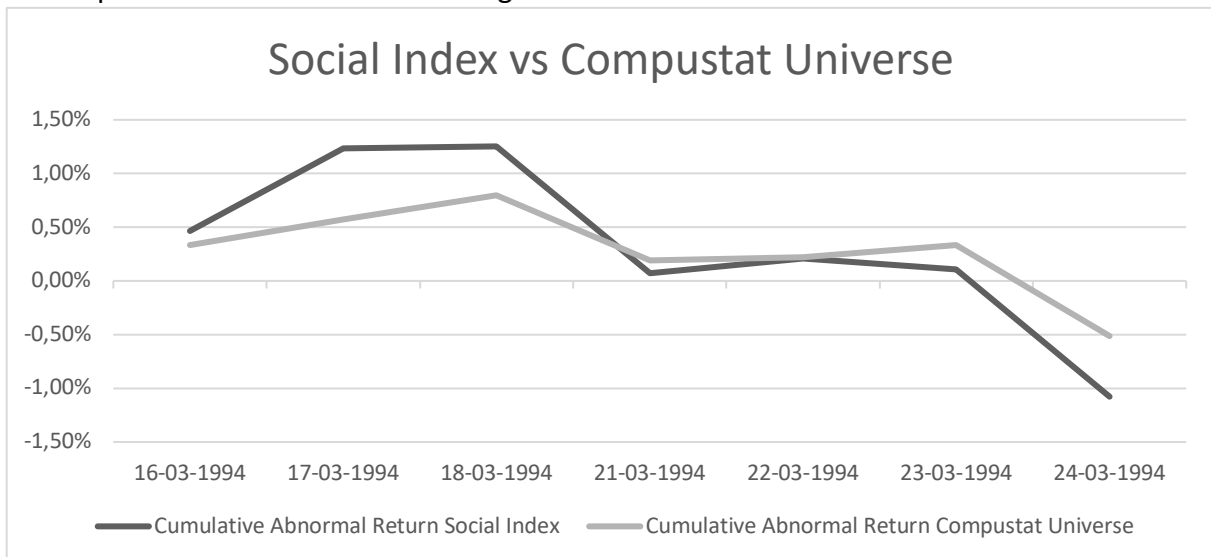
5.1.2. Event 2: March 21, 1994

The second event is the UNFCCC entering into force on March 21, 1994. From that day on, countries take measures to reduce the emissions of greenhouse gases. Surprisingly, when looking at Figure 2, the reaction on the event date of the firms in the Social Index is more severe than that of firms in the Compustat Universe. Especially when looking at both event windows, the firms in the Social Index have a more positive CAAR before the event date but a more negative CAAR after the event date compared to the Compustat Universe firms. This probably shows that investors are more positive in the days leading up to the UNFCCC entering into force, but shortly after become more negative. Especially, the drop of more than one per

cent in the CAAR on March 18 is very noticeable. Though, this drop is also expected because investors do not react much too old news. The drop also explains why the difference in the CAAR is more negative for the 3-day event window than for the 7-day event window. Overall, the trends show a negative reaction to the enforcement of the treaty.

Figure 2

Development of the cumulative average abnormal returns for event 2



5.1.3. Event 3: December 11, 1997

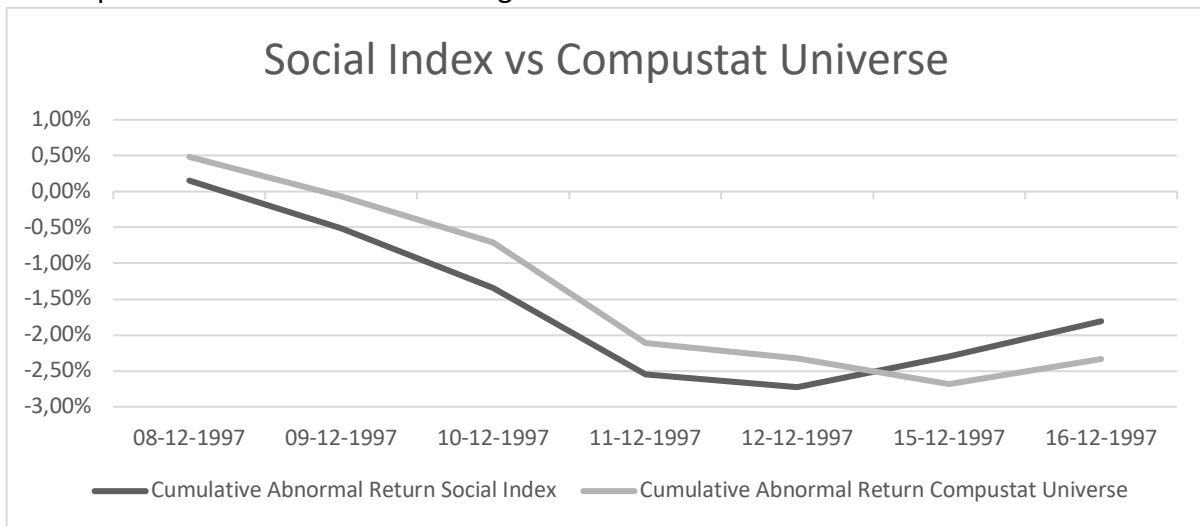
The third event is the signing of the Kyoto Protocol on December 11, 1997. As the previous years' emissions goals are not met, the Kyoto Protocol is put into place to meet the objectives of the UNFCCC. Different from the UNFCCC, the targets of the Kyoto Protocol are binding. Table 6 shows that these binding agreements influence the investors as the difference in CAAR is highly significant, especially for the 7-day event window. Where the CAARs are nearly identical in the 3-day event window, the 7-day event window shows a 0.53% more positive CAAR for the companies in the Social Index.

On the event date itself, the CAARs are negative for both the companies in the Social Index as the Compustat Universe firms. This shows that investors feel that the new Kyoto Protocol has an impact on both indices. However, the CAAR is less negative for the firms in the Social Index because of these companies' environmental characteristics. When looking at Figure 3, the difference in CAAR from Table 6 is visible, as the CAAR of companies in the Social Index changes from a negative to a positive direction after the event date. The signing of the Kyoto Protocol shows investors that change is necessary, and because of the binding

agreements, companies need to adapt. As the Social Index firms already have or are implementing these changes in their companies, investors see this as a good prospect for the future. Also, the companies in the Compustat Universe need to make significant investments for their companies to meet all the new requirements.

Figure 3

Development of the cumulative average abnormal returns for event 3

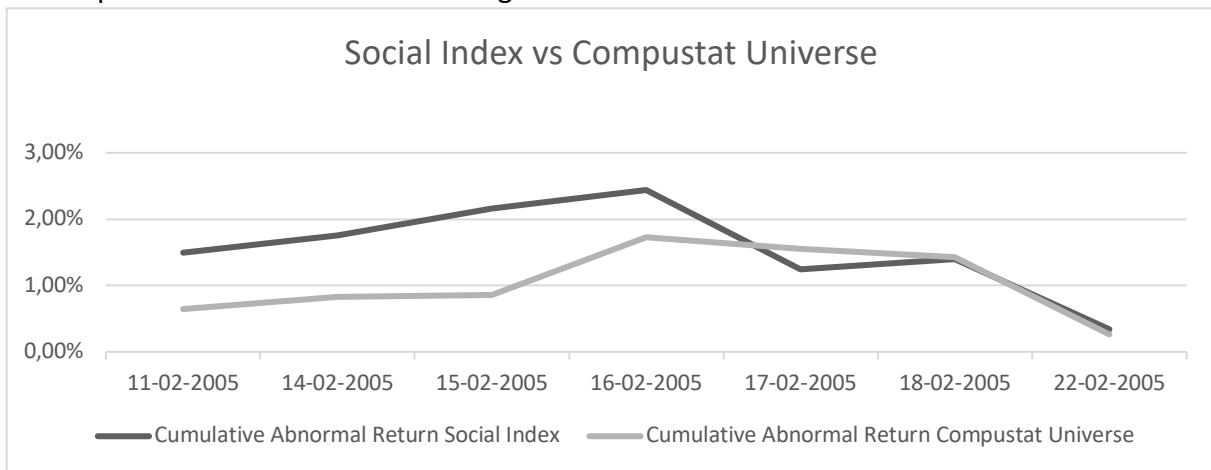


5.1.4. Event 4: February 16, 2005

Although the United States dropped out of the Kyoto Protocol in 2001, the Kyoto Protocol's enforcement was on February 16, 2005. It is interesting to see how investors in the United States react to the actual implementation. As seen in Figure 4, there is a real reaction visible directly after the enforcement. The CAAR of the companies in the Social Index drops heavily, resulting in a significantly more negative CAAR. However, the more positive CAAR for the Social Index firms in the days leading up to the event date results in an insignificant positive difference of 0.08%.

A reason for the drop after the event date is that investors' interest to invest in socially responsible companies in the United States weakens, and they may switch to socially aware companies in Europe. As Figure 4 shows, the CAARs of both the companies in the Social Index and the firms in the Compustat Universe are nearly identical a few days after the event date. This implies that investors see no real difference in the future perspective of the two indices.

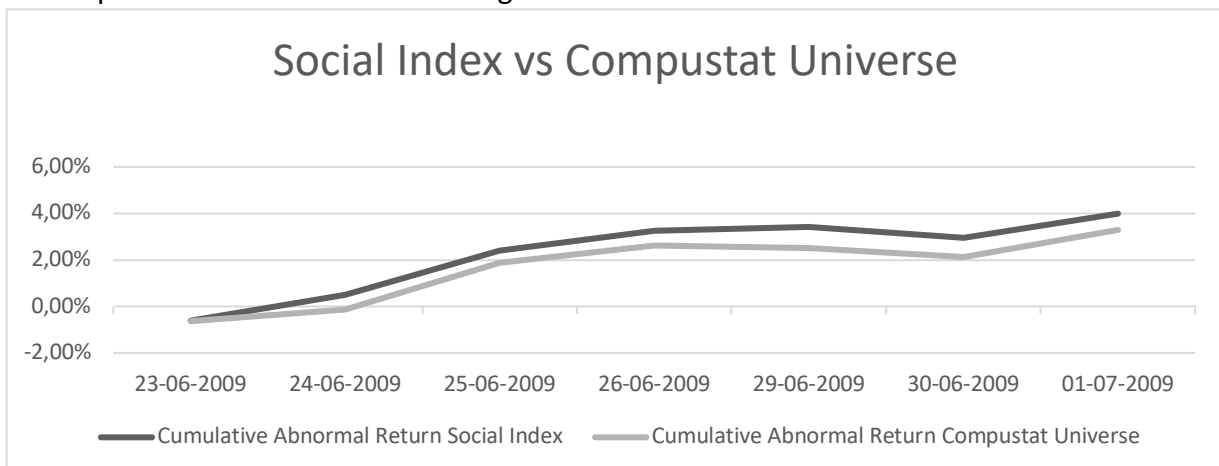
Figure 4
Development of the cumulative average abnormal returns for event 4



5.1.5. Event 5: June 26, 2009

The fifth event is the approval of the ACES by the House of Representatives on June 26, 2009. As stated, even though the bill is never brought to the Senate, it is seen as the equivalent of the European Unions' method to fight climate change. Overall, the effect of the approval is comparable to the effect of the first event. The CAAR is significantly more positive over the two event windows for the companies in the Social Index, which is in accordance with what to expect from the approval of the ACES. The reaction of the socially orientated investors differs significantly from the reaction of Compustat orientated investors because of socially orientated investors that value the positive effects from this event for the companies in the Social Index. When looking at Figure 5, the two indices have similar patterns. However, the magnitude of the firms in the Social Index is more positive in both event windows.

Figure 5
Development of the cumulative average abnormal returns for event 5



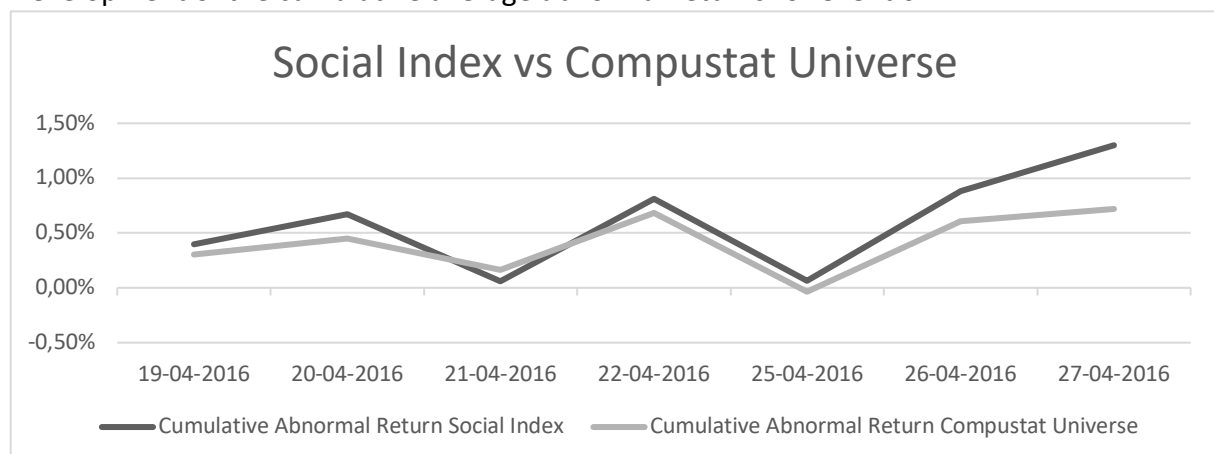
5.1.6. Event 6: April 22, 2016

In 2015, the Kyoto Protocol's successor emerged with even more stringent emissions reductions in the Paris Agreement. One of the main objectives is the lowering of global warming to 1.5 degrees. Also, more assistance is needed for developing countries. Other than the Kyoto Protocol, the Paris Agreement aims for more reporting on emissions and implementation efforts. A few months later, the sixth event occurs when the Signing of the Paris Agreement is completed on April 22, 2016. At first glance, there is no actual pattern in Figure 6. The CAARs of both the companies in the Social Index and the companies in the Compustat Universe change from positive to negative before the event date.

In the 7-day event window, the firms in the Social Index respond more positively to the event. This results in a significant positive difference of 0.58% for this event window and is probably due to the effect the Paris Agreement has on the various firms. Compared to social firms, non-social firms suffer more from the new regulations the Paris Agreement imposes on them through the government. Also, incorporating the latest information on the stock price takes some time. It is most evident from April 25 onwards, as the CAAR of companies in the Social Index is more positive from that date on.

Figure 6

Development of the cumulative average abnormal returns for event 6



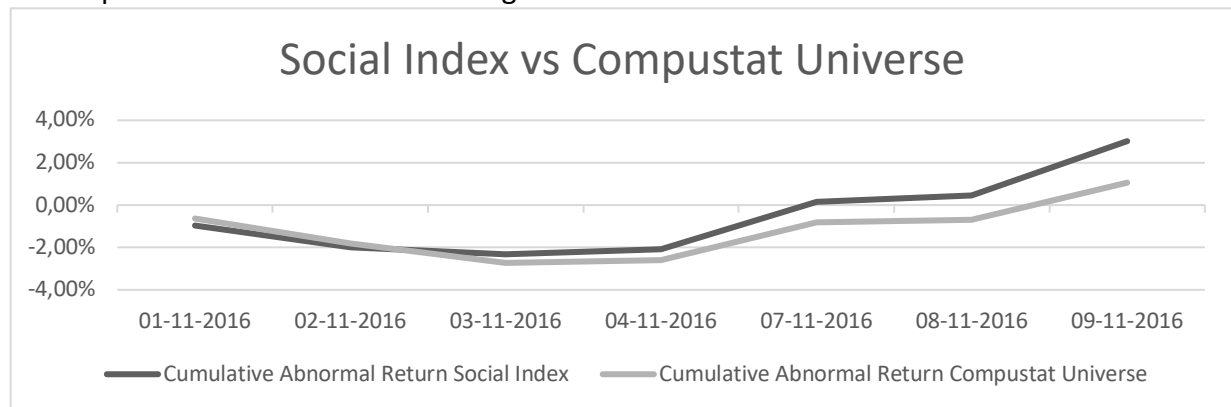
5.1.7. Event 7: November 4, 2016

The last event is the enforcement of the Paris Agreement as of November 4, 2016. From this day on, Parties need to report on their emissions and implementation efforts. Also, more stringent reductions are put in place for the coming years. Contrary to the UNFCCC and

the Kyoto Protocol's enforcement, the difference in CAARs from Table 6 is much larger and significant for both event windows. Overall, the difference in CAAR is most noticeable for this event compared to the other events. An explanation for the change in magnitude is the more stringent rules that are put into place in the Paris Agreement. Looking at Figure 7, the spikes after the event date are most noticeable and cause the difference in CAAR from Table 6. It is remarkable that investors do not anticipate the event and that the reaction is only noticeable after the enforcement. It also tells us that it takes investors some time to feature the latest information in the stock price itself.

Figure 7

Development of the cumulative average abnormal returns for event 7



5.1.8. Summary

In general, the event study results show a more positive CAAR for the firms in the Social Index than for the companies in the Compustat Universe. Especially event one, five, and seven show a significant positive CAAR for the Social Index companies. Investors perceive these events as positive for Social Index companies, leading to a higher CAAR. Also, these results show that SRI becomes more evident in the stock market reaction throughout the events. Especially, event seven shows the largest difference between the Social Index firms and the companies in the Compustat Universe. When looking at event two, the results are significantly more negative for the companies in the Social Index, implying that investors see the enforcement of the UNFCCC as more negative for the socially aware companies.

With the help of these results, I can conclude that the market reaction of the firms in the Social Index is less negative and more positive regarding environmental reports and regulations compared to companies in the Compustat Universe. This leads to an acceptance

of the alternative hypothesis. Overall, the differences between the Social Index and Compustat Universe are not as significant as I first anticipated. Both the firms in the Social Index and the firms in the Compustat Universe react mostly positively to the different announcements.

5.2. Results of the cross-sectional test

In this section, I analyze the results of the cross-sectional test. First, the descriptive statistics are discussed. Then, I use the regression analysis based on equation 6 to explain the stock market reaction to the different events. It is interpreted based on different firm characteristics. To analyze the effect of the company's size, I use the Total Assets and the Market Capitalization based on deciles. I use the Social Index as a dummy variable that equals '1' if the company exists in the Social Index. Other control variables include the Book-to-Market Ratio, Solvency, Shareholder Equity Ratio, Return-on-Assets, and Leverage. The dependent variable is the CAAR of each event window per event. I perform the results of the cross-sectional test per event as the events all occur in different years.

5.2.1. Descriptive Statistics

Table 7 shows the descriptive statistics of the sample I use for the cross-sectional test. In contrast to the descriptive statistics in Table 5 that uses the observations in all the years from 1992 till 2016, Table 7 only includes the observations in the years of the specific events. Panel A shows the statistics for firms included in the Compustat Universe, and Panel B shows these statistics for firms included in the Social Index. I consider the mean, standard deviation, median, and the 25th and 75th percentile to understand the sample for the cross-sectional test. The Compustat Universe consists of 33,461 observations for the seven events, while the Social Index consists of 1,882 observations throughout the different events.

The Total Assets and Market Capitalization are based on their decile value. Table 17 in the Appendix presents the different deciles and their minimum and maximum value. When looking at the two panels, it is evident that the firms in the Social Index have, on average, significantly more Total Assets and a significantly higher Market Capitalization than the firms in the Compustat Universe.

At first glance, the Book-to-Market Ratio is nearly identical among the two indices. However, the Compustat Universe firms have a significantly higher Book-to-Market Ratio than the Social Index companies. The Solvency of firms in the Compustat Universe is also significantly higher than the Solvency of companies in the Social Index. Compustat Universe firms have, on average, three times more assets than liabilities, while firms included in the Social Index have two times more assets than liabilities. This suggests that the firms in the Compustat Universe are more financially healthy and are, on average, more capitalized than firms in the Social Index. On average, the firms in the Compustat Universe have a significantly higher Shareholder Equity Ratio than the Social Index firms, suggesting the firms in the Social Index have lower equity compared to their assets than firms in the Compustat Universe. This means that Social Index firms use more debt to pay for their assets than Compustat Universe firms. Also, shareholders of firms in the Compustat Universe have, on average, a higher residual claim on the assets than shareholders of companies in the Social Index do.

Firms in the Social Index are significantly more profitable than the firms in the Compustat Universe, as shown by the Return-on-Assets. This also could explain why the stock market reaction of the Social Index firms is higher than that of the Compustat Universe companies, as it seems more attractive for investors to invest in companies present in the Social Index. Lastly, the Leverage of firms in the Social Index is significantly higher than the Leverage of Compustat Universe firms. This is also suggested by the lower Shareholder Equity Ratio of the firms in the Social Index compared to the firms in the Compustat Universe. On average, Social Index companies have more debt than equity than firms in the Compustat Universe.

Table 7
Descriptive Statistics

Panel A: Compustat Universe						
	Observations	Mean	Standard Deviation	25 th Percentile	Median	75 th Percentile
Total Assets	33,461	5.50	2.87	3	5	8
Market Capitalization	33,461	5.50	2.87	3	5	8
Book-to-Market Ratio	33,461	1.08	0.30	1.00	1.00	1.01
Solvency	33,461	334.63%	446.12%	143.75%	196.34%	324.61%
Shareholder Equity Ratio	33,461	49.28%	25.06%	30.44%	49.07%	69.19%
Return-on-Assets	33,461	0.11%	21.77%	-0.56%	4.78%	10.11%
Leverage	33,461	0.96	1.82	0.04	0.40	1.05

Note: Total Assets and Market Capitalization are displayed as decile ranks

Table 7 (continued)

Panel B: Social Index						
	Observations	Mean	Standard Deviation	25 th Percentile	Median	75 th Percentile
Total Assets	1,882	5.49	2.87	3	5.5	8
Market Capitalization	1,882	5.49	2.87	3	5.5	8
Book-to-Market Ratio	1,882	1.04	0.14	1.00	1.00	1.01
Solvency	1,882	216.06%	194.48%	133.52%	164.82%	219.40%
Shareholder Equity Ratio	1,882	40.50%	21.28%	25.11%	39.33%	54.42%
Return-on-Assets	1,882	6.99%	10.69%	2.59%	7.12%	12.02%
Leverage	1,882	1.13	1.90	0.28	0.64	1.17

Note: Total Assets and Market Capitalization are displayed as decile ranks

The T-test in means between Panel A and Panel B					
	Book-to-Market Ratio	Solvency	Shareholder Equity Ratio	Return-on-Assets	Leverage
T-statistic	5.39***	11.47***	14.90***	-13.62***	-3.84***

This test is one-sided. Significance levels are 1.28 for 10%, 1.65 for 5% and 2.33 for 1%. ***, **, * denote significance at the 1%, 5%, and 10% level, respectively.

5.2.2. Event 1: May 9, 1992

Table 8 shows the regression results of the first event on May 9th, 1992. On this date, the UNFCCC is adopted to prevent further consequences of climate change. For this event, no relationship is found between the independent variables and the dependent variable as none of the variables is significant at the 5% level. Also, the R-squared is relatively low in all of the events and event windows. This tells us that the model has low explanatory power for the variance in the dependent variable. However, I expect the low R-squared as it is very difficult to explain stock market returns.

Table 8

Cross-sectional results event 1

Event 1: May 9, 1992				
Variable	[+1, -1] Coefficient	t-statistic	[+3, -3] Coefficient	t-statistic
Intercept	-0.273	-0.61	-0.614	-0.76
Total Assets	-0.034	-0.27	0.058	0.26
Market Capitalization	0.062	0.52	-0.036	-0.16
Book-to-Market Ratio	0.286	1.06	0.616	1.26
Social Index	-0.032	-0.05	0.836	0.67
Solvency	0.009	0.60	-0.021	-0.78
Shareholder Equity Ratio	0.301	0.54	1.349*	1.33
Return-on-Assets	0.115	0.26	-0.294	-0.37
Leverage	0.018	0.36	0.029	0.32
Industry Fixed Effects	Yes		Yes	
R2	0.001		0.001	
Adjusted R2	0.000		0.000	
Observations	4,705		4,705	

OLS regressions are performed with CAAR as the dependent variable. This test is one-sided. Significance levels are 1.28 for 10%, 1.65 for 5% and 2.33 for 1%. ***, **, * denote significance at the 1%, 5%, and 10% level, respectively.

5.2.3. Event 2: March 21, 1994

Table 9 shows the regression results of the second event. The second event is the UNFCCC entering into force on March 21, 1994. Developed countries need to lead in battling climate change and be an example to all other countries. For the 3-day event window, none of the variables is significant at the 5% level for the alternative hypothesis, whereas the 7-day event window shows multiple significant variables indicated in bold. The variables that I use as a proxy for the firm size show different significant coefficients. Total Assets is positively significant, whereas Market Capitalization is negatively significant. When a firms' Total Assets increase by one decile, the CAAR increases on average by 0.386%. If the Market Capitalization increases with one decile, the CAAR decreases on average by 0.389%. These two variables do not show how the firm size influences the stock market reaction as they cancel each other out throughout event one.

Solvency also shows a negatively significant coefficient of -0.082% and a negative market reaction to an increase in the solvency ratio. However, Solvency is based on the total assets divided by the total liabilities. If solvency increases, it means that the firm has more

assets than liabilities. This is a good sign for investors, so, surprisingly, the investors react more negatively to this event if this ratio increases. The Shareholder Equity Ratio, which is computed as the equity divided by total assets, also has a positively significant coefficient of 1.757. This implies that when this ratio increases by 1%, the CAAR on average increases by 1.757%. Furthermore, this reaction is expected as the ratio increase means that the company is more conservative, meaning they have more funding from investors than debt. This also means that the company is a less risky asset to invest in as it can pay off its debts more easily.

Table 9
Cross-sectional results event 2

Event 2: March 21, 1994				
Variable	[+1, -1] Coefficient	t-statistic	[+3, -3] Coefficient	t-statistic
Intercept	-0.133	-0.26	-0.766	-0.99
Total Assets	0.100	0.80	0.386**	2.01
Market Capitalization	-0.093	-0.80	-0.389**	-2.18
Book-to-Market Ratio	-0.132	-0.42	-0.525	-1.09
Social Index	-0.152	-0.24	0.467	0.49
Solvency	0.017	0.82	-0.082***	-2.52
Shareholder Equity Ratio	-0.518	-0.79	1.757**	1.74
Return-on-Assets	0.032	0.08	-0.748	-1.25
Leverage	-0.044	-0.71	0.059	0.62
Industry Fixed Effects	Yes		Yes	
R2	0.001		0.003	
Adjusted R2	0.000		0.000	
Observations	5,619		5,619	

OLS regressions are performed with CAAR as the dependent variable. This test is one-sided. Significance levels are 1.28 for 10%, 1.65 for 5% and 2.33 for 1%. ***, **, * denote significance at the 1%, 5%, and 10% level, respectively.

5.2.4. Event 3: December 11, 1997

Table 10 shows the results of the third event. Event three shows the same effect of the company's size on the CAAR for the 7-day event window, as is evident in the second event. On December 11, 1997, the Kyoto Protocol was introduced to fight climate change even more as the previous goals laid out in the UNFCCC are not met. When looking at the Total Assets, the coefficient is significantly positive. However, Market Capitalization shows a significant negative coefficient. Again, no actual conclusion is made based on the companies' size and

their effect on the CAAR. The coefficients of the Book-to-Market Ratio are significant for both event windows. However, the ratio shows a positive reaction for the first event window, whereas the reaction is negative for the second window. This implies that when the Book-to-Market Ratio increases by 1%, the CAAR for the first event window increases by 0.573%. For the second event window, the CAAR decreases by 0.956%.

Table 10
Cross-sectional results event 3

Event 3: December 11, 1997				
Variable	[+1, -1] Coefficient	t-statistic	[+3, -3] Coefficient	t-statistic
Intercept	-0.994**	-2.02	-3.179***	-4.22
Total Assets	-0.154	-1.15	0.539***	2.63
Market Capitalization	0.02	0.16	-0.330**	-1.75
Book-to-Market Ratio	0.573**	2.13	-0.956***	-2.33
Social Index	0.892*	1.37	0.125	0.13
Solvency	0.102***	3.74	0.112***	2.67
Shareholder Equity Ratio	-3.696***	-5.22	-0.370	-0.34
Return-on-Assets	1.045***	2.76	3.574***	6.18
Leverage	-0.112**	-1.76	-0.015	0.15
Industry Fixed Effects	Yes		Yes	
R2	0.008		0.015	
Adjusted R2	0.006		0.013	
Observations	6,902		6,902	

OLS regressions are performed with CAAR as the dependent variable. This test is one-sided. Significance levels are 1.28 for 10%, 1.65 for 5% and 2.33 for 1%. ***, **, * denote significance at the 1%, 5%, and 10% level, respectively.

Solvency has an almost identical significant reaction on the stock market for both windows. If Solvency increases by 1%, the effect on the CAAR is approximately 0.1%. In contrast to Solvency, the Shareholder Equity Ratio shows completely different results. The ratio is highly negatively significant for the first event window but not significant for the second window. A 1% increase in the ratio suggests a decrease in the stock market reaction of 3.696%. This result is very shocking as an increase in the Shareholder Equity Ratio is mostly a positive prospect for investors.

The third event is the first that has a significant coefficient for the Return-on-Assets. The results are not surprising as the Return-on-Assets is a measure of a company's profitability. An increase in this profitability has a positive market reaction of 1.045% for the

first event window and 3.574% for the second window. Lastly, the Leverage has a negative coefficient of -0.112, implying a negative reaction of 0.112% to an increase in the Leverage by 1. This is also not surprising as an increase in Leverage means that debt is growing in proportion to equity.

5.2.5. Event 4: February 16, 2005

Unlike the third event, the results of the fourth event in Table 11 only show significant coefficients for the Book-to-Market Ratio and the Solvency. The fourth event covers the Kyoto Protocol becoming effective on February 16, 2005. The Book-to-Market Ratio coefficient has the same sign for both event windows. For the first event window, a 1% increase in the ratio increases the CAAR by 1.334%. For the second event window, the stock market reaction increases by 1.154%. Also, Solvency has the same effect as is shown in the third event. A 1% increase in Solvency leads to an increase in the CAAR of 0.045%.

Table 11

Cross-sectional results event 4

Event 4: February 16, 2005				
Variable	[+1, -1] Coefficient	t-statistic	[+3, -3] Coefficient	t-statistic
Intercept	-1.905***	-4.65	-2.918***	-4.27
Total Assets	0.045	0.51	0.088	0.59
Market Capitalization	-0.018	-0.22	0.045	0.34
Book-to-Market Ratio	1.334***	4.39	1.154**	2.28
Social Index	-0.081	-0.28	0.715*	1.48
Solvency	0.045**	1.73	0.064*	1.49
Shareholder Equity Ratio	-0.044	-0.08	0.541	0.60
Return-on-Assets	0.124	0.36	-0.646	-1.12
Leverage	-0.032	-0.83	-0.064	-0.99
Industry Fixed Effects	Yes		Yes	
R2	0.005		0.006	
Adjusted R2	0.002		0.002	
Observations	5,032		5,032	

OLS regressions are performed with CAAR as the dependent variable. This test is one-sided. Significance levels are 1.28 for 10%, 1.65 for 5% and 2.33 for 1%. ***, **, * denote significance at the 1%, 5%, and 10% level, respectively.

5.2.6. Event 5: June 26, 2009

Table 12 shows the regression results of the fifth event. The ACES was approved by the House of Representatives on June 26, 2009. It consists of a cap-and-trade scheme regarding the maximum amount of greenhouse gases that are emitted. The Market Capitalization coefficient shows different results than previous events, as the coefficient is positively significant for both windows. A one-decile increase in the Market Capitalization leads to an increase in the CAAR of 0.330% and 0.787% for the first and second window, respectively. This event implies that the size of the company has a positive impact on the stock market reaction. The coefficient for the Book-to-Market Ratio is also positive, leading to an increase in the stock market reaction for the second event window. Investors see the increase of the Book-to-Market Ratio as a positive sign and thus react likewise. The Return-on-Assets sees an almost identical reaction to the CAAR in event 5 as in event 3. A 1% increase in the Return-on-Assets results in a 1.591% increase to the CAAR in the first event window, whilst in the second event window, the reaction is even higher, with 3.617%.

Table 12
Cross-sectional results event 5

Event 5: June 26, 2009				
Variable	[+1, -1] Coefficient	t-statistic	[+3, -3] Coefficient	t-statistic
Intercept	2.682***	4.14	-1.226	-1.28
Total Assets	-0.207*	-1.41	-0.232	-1.07
Market Capitalization	0.330***	2.48	0.787***	3.99
Book-to-Market Ratio	0.414	0.85	1.421**	1.98
Social Index	-0.401	-0.86	-0.663	-0.97
Solvency	0.009	0.29	-0.039	-0.81
Shareholder Equity Ratio	-1.346*	-1.60	0.911	0.73
Return-on-Assets	1.591***	2.64	3.617***	4.05
Leverage	-0.095*	-1.36	0.030	0.29
Industry Fixed Effects	Yes		Yes	
R2	0.009		0.042	
Adjusted R2	0.006		0.038	
Observations	4,487		4,487	

OLS regressions are performed with CAAR as the dependent variable. This test is one-sided. Significance levels are 1.28 for 10%, 1.65 for 5% and 2.33 for 1%. ***, **, * denote significance at the 1%, 5%, and 10% level, respectively.

5.2.7. Event 6: April 22, 2016

Table 13 shows the results of the cross-sectional test of the sixth event, and the results only show one significant coefficient for the first window. The sixth event is the emergence of the successor of the Kyoto Protocol in the form of the Paris Agreement on April 22, 2016. The Paris Agreement contains even more stringent rules to prevent climate change. Surprisingly, the Return-on-Assets has a negative coefficient of -0.795, meaning an increase in the Return-on-Assets results in a decrease in the stock market reaction. However, in the second event window, the Return-on-Assets has a significant positive coefficient of 2.057, leading to a higher stock market reaction of 2.057% when the Return-on-Assets increases by 1. The coefficient of the Shareholder Equity Ratio is also surprising as it shows almost the same result as in event 3. An increase in the Shareholder Equity Ratio of '1' results in a decrease of the CAAR of 2.894%. The similarities between the two events are that both involve the signing of a new Agreement. The third event involves the signing of the Kyoto protocol, while the sixth event is the signing of the Paris Agreement. Lastly, the Book-to-Market Ratio is positively significant and implies that when this ratio increases by 1%, the stock market reaction increases by 0.619%.

Table 13

Cross-sectional results event 6

Event 6: April 22, 2016				
Variable	[+1, -1] Coefficient	t-statistic	[+3, -3] Coefficient	t-statistic
Intercept	0.192	0.55	1.306**	2.22
Total Assets	0.032	0.29	-0.025	-0.14
Market Capitalization	-0.101	-1.00	0.144	0.85
Book-to-Market Ratio	-0.047	-0.24	0.619**	1.90
Social Index	-0.002	-0.01	-0.379	-1.12
Solvency	-0.019	-0.70	-0.018	-0.40
Shareholder Equity Ratio	-0.137	-0.23	-2.894***	-2.90
Return-on-Assets	-0.795***	-2.65	2.057***	4.06
Leverage	-0.021	-0.54	0.009	0.14
Industry Fixed Effects	Yes		Yes	
R2	0.006		0.021	
Adjusted R2	0.002		0.017	
Observations	4,257		4,257	

OLS regressions are performed with CAAR as the dependent variable. This test is one-sided. Significance levels are 1.28 for 10%, 1.65 for 5% and 2.33 for 1%. ***, **, * denote significance at the 1%, 5%, and 10% level, respectively.

5.2.8. Event 7: November 4, 2016

Table 14 shows the regression results of the last event. The last event is the Paris Agreement entering into force on November 4, 2016. The Agreement aims for countries to strengthen their ability to deal with climate change. For both windows, the Book-to-Market Ratio is significantly negative. A 1% increase in the Book-to-Market Ratio implies a decrease in the stock market reaction of 0.718% for the first window and 1.566% for the second window. These results are opposite to those of the fourth event, where both coefficients are positive. Looking at Table 6, we see that the fourth event has a negative and only a slightly positive CAAR for the first and second event window, respectively. The last event shows a positive CAAR for both event windows. I can conclude that for the more positive CAAR, an increase in the Book-to-Market Ratio implies a negative stock market reaction. However, when the CAAR is negative or only slightly positive, an increase in the Book-to-Market Ratio results in a positive stock market reaction. The first event window also shows that an increase in the Leverage implies a positive stock market reaction of 0.149%.

Table 14
Cross-sectional results event 7

Event 7: November 4, 2016				
Variable	[+1, -1] Coefficient	t-statistic	[+3, -3] Coefficient	t-statistic
Intercept	0.231	0.58	2.243***	3.32
Total Assets	0.083	0.66	-0.103	-0.48
Market Capitalization	0.152*	1.33	0.330**	1.69
Book-to-Market Ratio	-0.718***	-3.33	-1.566***	-4.26
Social Index	0.365*	1.58	0.786**	1.99
Solvency	0.007	0.25	0.158***	3.12
Shareholder Equity Ratio	0.663	0.99	-1.540*	-1.34
Return-on-Assets	0.519*	1.51	1.022**	1.74
Leverage	0.149***	3.26	0.074	0.95
Industry Fixed Effects	Yes		Yes	
R2	0.027		0.019	
Adjusted R2	0.023		0.015	
Observations	4,341		4,341	

OLS regressions are performed with CAAR as the dependent variable. This test is one-sided. Significance levels are 1.28 for 10%, 1.65 for 5% and 2.33 for 1%. ***, **, * denote significance at the 1%, 5%, and 10% level, respectively.

Most noticeably, the last event is the first event that has a significant value for the Social Index. If the company is ranked as being social, this increases the CAAR by 0.786%. This implies that being present in the Social Index improves the stock market reaction. This also shows the relation with SRI as was evident in the event study for the seventh event. Investors show more interest in the ESG factors and react likewise to companies that are socially aware.

Moreover, the second event window shows positively significant coefficients for the Market Capitalization, Solvency, and the Return-on-Assets. If the Market Capitalization increases by one decile, this increases the stock market reaction by 0.330%. When the Solvency and the Return-on-Assets increase by 1%, this implies an increase in the CAAR of 0.158% and 1.022%, respectively.

5.2.9. Summary

To summarize, this section presents the regression results of the different events with their corresponding event windows. This study primarily focuses on companies in the Social Index and if their stock return is higher than companies in the Compustat Universe. Unfortunately, only one event had a significant result regarding the inclusion in the Social Index. Inclusion in the Social Index has a positive effect on the CAAR in event seven. This result is according to what this study predicts, so environmentally aware companies show higher CAARs than non-aware companies for the seventh event.

Additionally, as a proxy for the companies' size, the Total Assets show a positive effect on the stock market reaction. Market Capitalization is neutral in its effect. In some events, it shows positive effects, while in other events, it shows negative effects on the stock market reaction. The Book-to-Market Ratio has a positive coefficient in four out of five significant events, implying that investors positively prize a higher ratio. The coefficient of Solvency is, in general, positive across the events. However, the coefficients are only slightly positive in most event windows, so being more solvent has a positive stock market reaction and increases the CAAR. The Shareholder Equity Ratio is the characteristic that has the most impact on the CAAR throughout the events. However, due to only being significant throughout three event windows, no accurate conclusion is made on what is the effect on the CAAR.

The Return-on-Assets has a highly positive effect on the CAAR across the events, which is also expected as it shows how profitable a company is. An increase in the Return-on-Assets is thus positively perceived by investors. Leverage does not show a real direction in its stock

market reaction. It is only significant in two events and is positive for the first and negative for the second event, so no conclusion is made based on this firm characteristic.

6. Conclusion

6.1. Conclusion

Over the last years, investors are not only looking at the financial performance of companies. Investors have a broader view and look at the impact the company they invest in has on the world itself. This study examines the stock market reaction of North American companies to different events that involve negative environmental reports and regulations regarding climate change. The research focuses on a self-developed Social Index based on the MSCI ESG KLD Index and involves North American companies. The Social Index is based on multiple indicators regarding the ESG performance that ranks a company on their awareness of the environment. The study compares firms in this Social Index to firms in the North American Compustat Universe. My work is the first study that looks at companies' reaction to the announcements of climate change reports and environmental regulations throughout multiple years.

This study answers the following research question: *“How do investors react to climate change reports and regulations”*. The hypothesis used to answer the research question is that firms in the Social Index have less negative stock market reactions to the environmental reports and regulations than firms in the Compustat Universe. Using the event study methodology with the market-adjusted model and a cross-sectional test, the hypothesis is tested, and the research question is answered. The event study calculates the CAAR to different events. The cross-sectional test looks at how the different firm characteristics influence the CAAR for the different events.

This research considers seven key events and a cross-sectional test to measure the reactions. The first and second events are adopting the UNFCCC on May 9, 1992, and the UNFCCC entering into force on March 21, 1994. The third and fourth events are the signing of the Kyoto Protocol and the Kyoto Protocol becoming effective on December 11, 1997, and February 16, 2005, respectively. The fifth event is the approval of the ACES on June 26, 2009.

The sixth and last event is the signing and becoming effective of the Paris Agreement on April 22 and November 4, 2016, respectively.

The results of the event study suggest that the CAAR of the firms in the Social Index is significantly higher in five of the seven events. The other events show higher CAARs for the firms in the Compustat Universe. For these two events, investors react more positively to the companies in the Compustat Universe. Overall, the event study analysis makes me accept the alternative hypothesis that the effect on the stock price of companies in the Social Index is less negative than the reaction of the firms in the Compustat Universe to the negative environmental reports and regulations. Furthermore, the effects of the announcements on the stock price are, in general, even positive as the CAARs are positive in most of the events.

The cross-sectional test analyses the reaction of the CAAR to different firm characteristics. The effect of the size of the company is investigated based on Total Assets and Market Capitalization. Total Assets show that the size of the company has a positive effect on the stock market reaction. The Market Capitalization does not show a specific direction and is neutral in its effect on the CAAR. The Book-to-Market Ratio shows a positive coefficient for most event windows, implying that the ratio is positively prized by investors and thus increases the stock price. As expected, the Return-on-Assets shows a positive effect on the stock market reaction. An increase in the Return-on-Assets explains how profitable a company is, and thus investors react likewise to this increase. The Social Index coefficient is only significant for the last event in which it implies a positive relationship with the CAAR. Investors react positively to the inclusion in the Social Index for this last event. The cross-sectional test makes me reject the alternative hypothesis, as no real conclusion is made based on one event. There is no evidence that the effect on the stock price of companies in the Social Index is less negative than the reaction of the firms in the Compustat Universe to the negative environmental reports and regulations.

Overall, the event study and the cross-sectional test show different results. The event study shows that investors value the climate change reports and regulations more positively for the companies in the Social Index than for companies in the Compustat Universe. The cross-sectional test only shows that investors value the inclusion in the Social Index more positively during the last event. These different results make me answer the research question that is fundamental in this study. Investors value the climate change reports and regulations more positively for the companies in the Social Index than for companies in the Compustat

Universe during the event study. The cross-sectional test does not show that investors value the companies in the Social Index more than companies in the Compustat Universe. The results suggest that investors react positively to climate change reports and regulations.

To conclude, this research contributes to the existing literature because it is the first study to look at the effect of different environmental reports and regulations on the stock prices of socially aware companies and compare this with 'normal' companies. Previous works mostly focused on CSR practices and socially aware companies' financial performance and why they are more or less profitable than 'normal' companies. This study looks at how investors react differently to these social companies in contrast to other companies when it comes to environmental reports and regulations. This study also contributes to the existing literature that focuses on the effect of outside information on the company. These studies mostly focused on one group of firms and made no distinction between social companies and 'normal' companies (Shane & Spicer, 1983; Hughes K. E., 2000; Lorraine, Collison, & Power, 2004).

6.2. Limitations and recommendations for future research

This research is subjected to the following limitations that also serve as recommendations for future research. Firstly, my study uses a self-developed index of social companies based on the MSCI ESG KLD Index. This is due to the non-existence of the more specific MSCI KLD 400 Social Index in the WRDS Database. The WRDS database may contain the MSCI KLD 400 Social Index in the future for other researchers to use this database. Secondly, investors react quickly to new information, which is also immediately reflected in the stock prices. However, this research uses daily stock prices, and therefore it is interesting for future research to see what happens to the stock prices in the hours or even minutes after the announcements.

Thirdly, even though I expect the low R^2 because stock returns are difficult to explain, it is a limitation. The low R^2 means there is no strong relationship between the model and the dependent variable. This is due to omitted variables that have a strong relationship with the dependent variable. Lastly, this research focuses on North American companies and their stock market returns. Future research's primary recommendation is to look at European firms and their stock market reaction to global environmental regulations and reports. This research

primarily focuses on global regulations and reports. Future research can also study local environmental regulations and see if investors in other countries also react to these regulations.

7. References

- Aureli, S., Gigli, S., Medei, R., & Supino, E. (2020). The value relevance of environmental, social, and governance disclosure: Evidence from Dow Jones Sustainability World Index listed companies. *Corporate Social - Responsibility and Environmental Management*, 27(1), 43–52.
- Ball, R., & Brown, P. (1968). An Empirical Evaluation of Accounting Income Numbers. *Journal of Accounting Research*, 6(2), 159–178.
- Banz, R. W. (1981). The relationship between return and market value of common stocks. *Journal of Financial Economics*, 9(1), 3–18.
- Becchetti, L., Ciciretti, R., & Hasan, I. (2009). Corporate social responsibility and shareholder's value: an empirical analysis.
- Berry, T. C., & Junkus, J. C. (2013). Socially Responsible Investing: An Investor Perspective. *Journal of Business Ethics*, 112(4), 707–720.
- Blacconiere, W. G., & Patten, D. M. (1994). Environmental disclosures, regulatory costs, and changes in firm value. *Journal of Accounting & Economics*, 18(3), 357.
- Bloomberg. (2019). Carbon emissions hit a record high.
- Bowen, R. M., Castanias, R. P., & Daley, L. A. (1983). Intra-Industry Effects of the Accident at Three Mile Island. *Journal of Financial and Quantitative Analysis*, 18(1), 87.
- Brown, S. J., & Warner, J. B. (1985). Using daily stock returns: The case of event studies. *Journal of Financial Economics*, 14(1), 3–31.
- Chan, C. C. C., & Milne, M. J. (1999). Investor reactions to corporate environmental saints and sinners: An experimental analysis. *Accounting and Business Research*, 29(4), 265–279.
- Chen, M. Y. (2014). "I Just Did 400 Million Event Studies" – A Study of Market Model Robustness and Deterioration in Times of Crisis. *University of Cambridge; London School of Economics & Political Science (LSE)*.
- Cho, C. H., Guidry, R. P., Hageman, A. M., & Patten, D. M. (2012). Do actions speak louder than words? An empirical investigation of corporate environmental reputation. *Accounting, Organizations and Society*, 37(1), 14.
- Dowdell, T. D., Govindaraj, S., & Jain, P. C. (1992). The Tylenol Incident, Ensuing Regulation, and Stock Prices. *Journal of Financial and Quantitative Analysis*, 27(2), 283.

- Drempetic, S., Klein, C., & Zwergel, B. (2019). The Influence of Firm Size on the ESG Score: Corporate Sustainability Ratings Under Review. *Journal of Business Ethics*.
- Fama, E. F. (1970). Efficient Capital Markets: A Review of Theory and Empirical Work. *The Journal of Finance*, 25(2), 383–417.
- Fama, E. F., Fisher, L., Jensen, M. C., & Roll, R. (1969). The Adjustment of Stock Prices to New Information. *International Economic Review*, 10(1), 1–21.
- Fama, E. F., & French, K. R. (1992). The Cross-Section of Expected Stock Returns. *The Journal of Finance*, 47(2), 427–465.
- Flammer, C. (2013). Corporate Social Responsibility and shareholder reaction: the environmental awareness of investors. *Academy of Management Journal*, 56(3), 758.
- Friede, G., Busch, T., & Bassen, A. (2015). ESG and financial performance: aggregated evidence from more than 2000 empirical studies. *Journal of Sustainable Finance & Investment*, 5(4), 210–233.
- Godfrey, P. C., Merrill, C. B., & Hansen, J. M. (2009). The Relationship between Corporate Social Responsibility and Shareholder Value: An Empirical Test of the Risk Management Hypothesis. *Strategic Management Journal*, 30(4), 425–445.
- Guo, M., Kuai, Y., & Liu, X. (2020). Stock market response to environmental policies: Evidence from heavily polluting firms in China. *Economic Modelling*, 86, 306–316.
- Hill, J., & Schneeweis, T. (1983). The Effect of Three Mile Island on Electric Utility Stock Prices: A Note. *The Journal of Finance*, 38(4), 1285.
- Hughes K. E. (2000). The Value Relevance of Nonfinancial Measures of Air Pollution in the Electric Utility Industry. *The Accounting Review*, 75(2), 209–228.
- Jacobs, B. W., Singhal, V. R., & Subramanian, R. (2010). An empirical investigation of environmental performance and the market value of the firm. *Journal of Operations Management*, 28(5), 430.
- Lorraine, N. H. J., Collison, D. J., & Power, D. M. (2004). An analysis of the stock market impact of environmental performance information. *Accounting Forum*, 28(1), 7–26.
- Mackinlay, A. C. (1997). Event Studies in Economics and Finance. *Journal of Economic Literature*, 35(1), 13–39.
- McWilliams, A., & Siegel, D. (2000). Corporate social responsibility and financial performance: Correlation or misspecification? *Strategic Management Journal*, 21(5), 603–609.

- MSCI Inc. (2020). *MSCI KLD 400 Social Index*. Retrieved from <https://www.msci.com/documents/10199/904492e6-527e-4d64-9904-c710bf1533c6>
- Porter, M. E., & Linde, C. van der. (1995). "Toward a New Conception of the Environment-Competitiveness Relationship." *The Journal of Economic Perspectives : A Journal of the American Economic Association.*, 9(4), 97.
- Renneboog, L., Horst, J. Ter, & Zhang, C. (2008). Socially responsible investments: Institutional aspects, performance, and investor behavior. *Journal of Banking & Finance*, 32(9), 1723.
- Robeco. (n.d.). ESG Definition.
- Sariannidis, N., Zafeiriou, E., Giannarakis, G., & Arabatzis, G. (2013). CO2 Emissions and Financial Performance of Socially Responsible Firms: An Empirical Survey. *Business Strategy and the Environment*, 22(2), 109–120.
- Sauer, D. A. (1997). The impact of social-responsibility screens on investment performance: Evidence from the Domini 400 Social Index and Domini Equity Mutual Fund. *Review of Financial Economics*, 6(2), 137–149.
- Schueth, S. (2003). Socially responsible investing in the United States. *Journal of Business Ethics*, 43(3), 189.
- Shane, P. B., & Spicer, B. H. (1983). Market Response to Environmental Information Produced outside the Firm. *The Accounting Review*, 58(3), 521–538.
- Sparkes, R., & Cowton, C. J. (2004). The Maturing of Socially Responsible Investment: A Review of the Developing Link with Corporate Social Responsibility. *Journal of Business Ethics*, 52(1), 45–57.
- Statman, M. (2006). Socially Responsible Indexes. *Journal of Portfolio Management*, 32(3), 100–109.
- TheGuardian. (2019). Revealed: the 20 firms behind a third of all carbon emissions.
- van Beurden, P., & Gössling, T. (2008). The Worth of Values - A Literature Review on the Relation Between Corporate Social and Financial Performance. *Journal of Business Ethics*, 82(2), 407–424.

8. Appendix

Table 15

Indicators used for the Social Index with description and classification as Strength or Concern

Indicator	Description	Strength or Concern
Environmental Opportunities	How companies take advantage of opportunities in the market for environmental technologies	Strength
Toxic Emissions and Waste	How companies manage their risk of incurring liabilities associated with pollution and waste	Strength
Packaging Materials & Waste	How companies manage their risk of incurring liabilities associated with packaging and waste	Strength
Carbon Emissions	How companies manage their risk of increased costs linked to carbon pricing or regulatory caps	Strength
Water Stress	How companies manage their water and possible shortage thereof	Strength
Biodiversity & Land Use	How companies manage their risk of incurring liabilities related to their operations damaging fragile ecosystems	Strength
Raw Material Sourcing	How companies are affected by using raw materials that have a high environmental impact	Strength
Other Strengths	Assessment of a firm's environmental management policies, programs, and initiatives that are not covered by other metrics	Strength
Toxic Emissions and Waste	Controversies related to toxic emissions and waste	Concern
Supply Chain Management	Controversies related to raw materials that hurt the environment	Concern

Water Stress	Controversies related to water management practices	Concern
Other Concerns	Environmental issues that fall outside of the other metrics	Concern
Impact on Community	Controversies related to a firm's interactions with communities it does business in.	Concern
Union Relations	High union density	Strength
Employee Involvement	Encouragement of worker involvement	Strength
Collective Bargaining and Unions	Controversies related to union relations practices	Concern
Health and Safety	Controversies related to health and safety of employees, temps and contractors, and franchisee employees	Concern
Corruption & Political Instability	The risk of liabilities related to corruption scandals or political and social instability	Strength
Financial System Instability	The risk of enhanced regulatory scrutiny because of contributions to systematic risk in financial markets	Strength
Bribery & Fraud	The risk of controversies related to business ethics practices	Concern

Table 16
 Predictive Validity Framework used for the event study

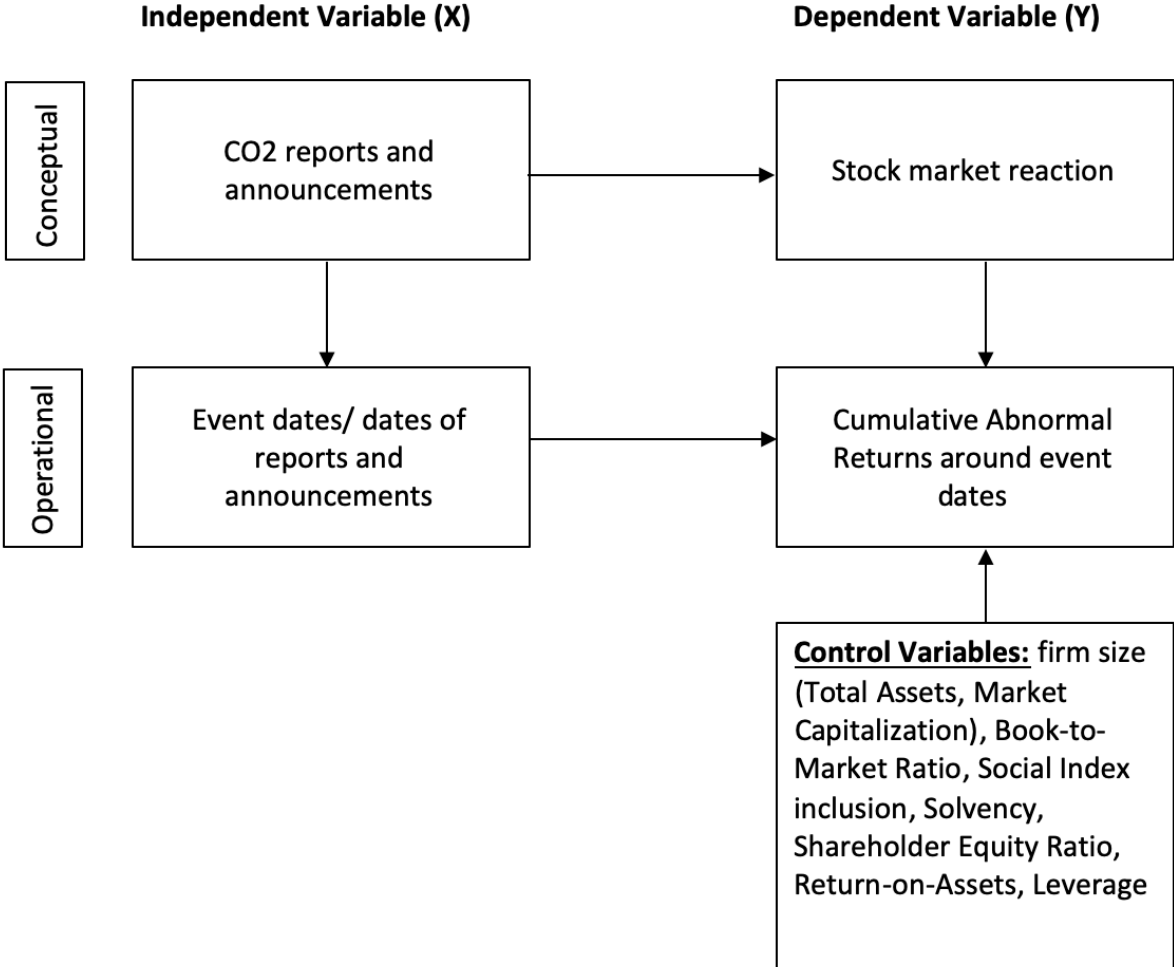


Table 17

Deciles of Total Assets and Market Capitalization of Descriptive Statistics Cross-Sectional Test

Panel A: Compustat Universe						
	Total Assets in Millions			Market Capitalization in Millions		
Decile	Nr. of Firms	Min	Max	Nr. of Firms	Min	Max
1	3347	1.731	14.450	3347	0.380	6.501
2	3346	14.456	34.839	3346	6.502	17.081
3	3346	34.854	68.980	3346	17.086	33.513
4	3346	68.982	135.720	3346	33.516	58.573
5	3346	135.732	261.931	3346	58.576	101.261
6	3346	262.053	490.593	3346	101.275	178.495
7	3347	491.151	965.844	3347	178.527	325.288
8	3346	966.265	2,076.018	3345	325.514	676.935
9	3345	2,077.317	6,230.600	3346	677.055	1,866.326
10	3346	6,233.818	330,314.000	3346	1,866.768	60,730.990

Panel B: Social Index						
	Total Assets in Millions			Market Capitalization in Millions		
Decile	Nr. of Firms	Min	Max	Nr. of Firms	Min	Max
1	189	31.006	470.037	189	3.955	222.414
2	189	479.336	1,132.614	188	222.702	446.389
3	188	1,136.603	2,028.100	189	446.583	713.441
4	187	2,031.200	3,349.890	187	715.424	1,056.516
5	188	3,354.200	5,091.383	188	1,072.346	1,626.594
6	189	5,097.600	8,252.000	189	1,630.393	2,506.008
7	188	8,270.000	14,114.180	188	2,507.627	4,177.004
8	188	14,218.000	23,259.000	188	4,201.992	6,875.004
9	188	23,286.000	48,671.000	188	6,891.208	12,644.010
10	188	48,926.560	330,314.000	188	12,770.020	60,730.990

The T-test in means between Panel A and Panel B		
	Total Assets	Market Capitalization
T-statistic	-30.98***	-37.56***

This test is one-sided. Significance levels are 1.28 for 10%, 1.65 for 5% and 2.33 for 1%. ***, **, * denote significance at the 1%, 5%, and 10% level, respectively.

Table 18

Overview of variables used in this research

Variable	Description	Unit	Data Source
Total Assets	The total value of assets reported on the Balance Sheet	Millions/ Decile Ranks	Compustat
Total Liabilities	The current liabilities plus long-term debt plus other noncurrent liabilities, including deferred taxes and investment tax credit.	Millions	Compustat
Net Income	The income or loss reported by a company	Millions	Compustat
Revenue	The gross income of the company	Millions	Compustat
Market Capitalization	Common shares outstanding multiplied by share price	Millions/ Decile Ranks	Compustat/CRSP
Employees	The number of company workers	Individuals	Compustat
Cumulative Average Abnormal Return	The difference between the actual return and the market return	%	CRSP
Book-to-Market Ratio	The difference between total assets and liabilities divided by the market capitalization	Ratio	Compustat/CRSP
Solvency	The total assets divided by the total liabilities	Ratio	Compustat
Shareholder Equity Ratio	The difference between total assets and liabilities divided by the total assets	Ratio	Compustat
Return-on-Assets	The earnings before interest divided by the total assets	Ratio	Compustat
Leverage	The total debt divided by total equity	Ratio	Compustat