The Short-Term Impact of Sustainability on Firm Value

Evidence Around the Announcements of Newsweek's Green Ranking and Influences on Corporate Fundamentals

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Master Thesis

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Date: November 26, 2019

Abstract

Regarding the effect of corporate sustainable performance (CSP) on firm value, a lot is known on the long-term effect, which is mostly positive (Sharples, Fulton, & Kahn, 2012). However, on the short term, literature on this effect is less clear, also containing insignificant and negative results. This thesis continues on the subject.

Using the Newsweek Green Ranking (NGR) as a proxy for CSP, it is possible to calculate the effect of the announcement of the rankings from 2014 until 2017 on abnormal stock returns by executing an event study. For the largest part, these results tended to be insignificant, where the significant models showed a negative influence of a higher Green score on abnormal returns. Large differences, however, were discovered between the various industry groups, and especially years. A significant difference was present between the rankings of 2014 and 2015 versus the rankings of 2016 and 2017, occurring before and after the signing of the 2015 Paris Climate Agreement.

Because Newsweek uses two-year old data to calculate a company's CSP, also the anticipating effect has been calculated, applying the regressions on monthly excess returns during the year leading up to the announcement. Here, results were more significant, and still negative.

In order to come from a correlational approach used by previous scholars to a more causal relationship, the effect of the Green score has also been investigated on corporate fundamentals, which should in their turn have an effect on firm value. Significant, negative results were found on revenue increases for more sustainable companies, whereas their operational efficiency, in the form of a higher EBITDA margin, was only increased by a much smaller number, possibly explaining the negative, direct effect of CSP on firm value.

Acknowledgments

After months of hard work, I hereby present my master thesis. Because it could not have been possible without the help of some other people, I would like to thank everyone that helped and supported me during the process.

First of all, I would like to thank my supervisor, Stefano Cassella, for your patience and valuable feedback. I really appreciated the meetings we had together and the time and effort you put in reviewing my work. Furthermore, I would like to thank Christoph Schneider, who acted as a second reader on this thesis, for his time evaluating my work.

Secondly, I would like to express my gratitude to my family, for their endless support during the writing process and from the start on when I announced to pursue a double degree and started at Tilburg University.

Lastly, I would like to thank my friends, for their support and guidance during the process, and especially their willingness to review parts of my work.

Sebastiaan Keijsers
Tilburg, November 2019

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Abbreviations Used

CAAR: Cumulative Average Abnormal Return

CAR: Cumulative Abnormal Return

CSP: Corporate Sustainable Performance

DCF: Discounted Cash Flow

DJSI: Dow Jones Sustainability Index

ESG: Environmental, Social, and Governance

GICS: Global Industry Classification Standard

NGR: Newsweek's Green Ranking

OLS: Ordinary Least Squares

1. Introduction

1.1 Background

Corporate social responsibility (CSR), defined as taking responsibility for a firm's social and environmental impact (Martin Curran & Moran, 2007), has become mainstream inside companies the past decade. Today's executives understand more than ever that becoming sustainable not only limits the unwanted side-effects of doing business, but also has an enormous long-term economic value, and are applying it throughout all functions of the enterprises. From an enquiry by magazine *The Economist*, distributed among 200 senior executives, came key findings that 87% of the respondents agree that sustainability will become more important in the upcoming decade, linking it to a higher profitability in the long term and the creation of new strategies. However, on the short term this link between profitability and sustainability seems to be absent, also being pointed out that immediate financial goals are a more pressing priority than sustainability (Watts & Freudmann, 2010).

Moreover, the attention on sustainable investing, also called socially responsible investing and defined as incorporating environmental, social and governance (ESG) factors into investment decisions (Ernst & Young, 2017), is growing rapidly. Whereas private, especially younger investors tend to value socially responsible behavior by itself (Ernst & Young, 2017), fund managers in investment institutions are more affected by beliefs of long-term returns of socially responsible investments and efforts to reduce financial risk (Jansson & Biel, 2011). This indicates both groups do value sustainable investing, albeit for different reasons.

While it is commonly agreed that sustainability leads to higher financial performance on the long term, as was the conclusion from an extensive literature review executed by Deutsche Bank in 2012, examining 56 research papers and four meta-studies (Sharples et al., 2012), the evidence is not as indecisive on the short term, in the form of direct wealth effects after announcement. Considering the large required investments, leaking free cash flows from the firm in the form of capital expenditures, and doubts about future earnings in the form of revenue increases or improved profitability, it can raise questions whether corporate investments in sustainable performance are value-adding on the short term, even if such projects are being presented to have a positive net present value.

The largest-scale assessment of corporate sustainable performance (CSP), which regards the environmental part of CSR, is the Newsweek's Green Ranking (NGR), which has been published since 2009 and ranks the 500 largest US firms by market capitalization. This ranking, although receiving criticism about its accuracy, has become one of the leading proxies regarding CSP. Whereas previous work

regarding this ranking solely explored correlations between sustainable performance and financial performance, and generally found positive results (Amato & Amato, 2012; Anderson-Weir, 2010; Cordeiro & Tewari, 2015; Lyon & Shimshack, 2015), Yadav, Han & Rho (2016) tried to work towards a causal relationship, including possible effects of sustainable behavior in their research such as revenue gains, cost reductions and intangible benefits. This research continues on their work, analyzing the effects over multiple years of rankings, and trying to find causal explanations for a possible short-term wealth effect.

1.2 Research Questions

The main research question in this thesis is formulated as follows:

> *Does being sustainable as a company, as proxied by the NGR, result in increased firm value on the short term*?

This main question is supported by the following sub questions:

(1) *Do significant differences exist between the different metrics of the NGR?*
(2) *What is the difference regarding the influence of CSP on firm value over the past years?*
(3) *Do significant differences exist between the various industries, both on average and in the coefficients?*
(4) *Is the influence of CSP on firm value being explained by increase in company fundamentals?*

1.3 Methodology

To test these research questions, first of all, an event study has been executed around the publication of this annual list concerning the 500 largest firms in terms of market capitalization, which are both public and headquartered in the United States. Using the event study methodology, the dependent variable of the research has been calculated, which is the cumulative abnormal return (CAR) in the event window. Subsequently, these CARs have been regressed on different aspects of the Green Ranking, e.g. score, rank, or position in the top ten. The second step is to look whether significant differences exist between industries, especially concerning heavy industries such as energy or manufacturing versus light industries as the financial sector, and between years. For the latter, an interesting effect to investigate is the difference before and after the 2015 Paris Climate Agreement.

As the NGR uses two-year-old data, which is publicly available, it can be expected that the information was already incorporated in the share price by the time Newsweek announced the rankings, either by attentive investors expecting future results, or by the presence of corporate announcements regarding sustainability before publication of the ranking. Therefore, inspired by Levi & Newton (2016), another

regression analysis has been executed as a side-step, regressing a company's green score on monthly stock returns the year prior to the announcement. For example, the scores for 2014's ranking, which used data over 2012, have been used to explain the variance in monthly stock returns in 2013.

Finally, it has been researched if CSP influences company fundamentals on the short term, in order to build a causal relation between CSP and firm value. In this research it was chosen to include the fundamentals suggested by Yadav et al. (2016) and Wilcox, Wilcox & Jares (2014), which are revenue increase as a proxy for growth rate, EBITDA margin increase as a proxy for increased operational efficiency, increase in capital expenditures as a proxy for increased required investments and intangible assets increase as a proxy for intangible benefits.

1.4 Academic and Business Relevance of the Research

This research aims to contribute to the knowledge of how sustainability affects short-term firm value. Concretely, it continues on the studies executed by Yadav et al. (2016), Levi & Newton (2016), and Wilcox et al. (2014), combining their approaches in order to find more concrete evidence for this relationship. Moreover, contrary to the previous studies regarding the NGR (as listed in Subsection 2.1.1), this study includes data of multiple years, trying to achieve more robust results. Furthermore, during the years treated in this thesis wealth and asset managers have seen a large increase in the demand for sustainable investments, increasing over 100% annually since 2012 (Ernst & Young, 2017), suggesting a larger demand for sustainable assets results in a larger effect when redoing the analyses. Additionally, the Paris Climate Agreement was signed in 2015, occurring right in the middle of the dataset. Therefore, the direct impact of this large-scale agreement can also be deduced from the research.

Secondly, by including corporate fundamentals, this study could function as a bridge from the mere focus on the correlation between sustainability and firm value, towards a more causal explanation for how firm value is affected by sustainable behavior. This has been done by the inclusion of variables affecting firm value in the method of discounted cash flow (DCF).

For practitioners, this research hopes to provide concrete evidence of the attitude from investors towards sustainability. Previous results proved to be generally positive but not conclusive, not showing decisive evidence investors react positively immediately to often costly measures companies take in order to be more sustainable. Moreover, by including the various corporate fundamentals, managers and entrepreneurs can find out where to focus on when implementing new measures and policies.

1.5 Main Findings

When looking at the abnormal stock returns around the publication of the rankings, the majority of results shows that CSP has an insignificant influence on firm value. Regarding the few models where CSP does have a significant effect, this effect is in all but one regression models negative. However, major differences exist between the different years and industries. Especially regarding the two most recent years, the results on average are less negative and significantly different from the first two years in the sample.

When extending the time window to the year prior to publication, the negative influence of a higher Green score tends to hold, as CSP has a significant, negative influence on monthly stock returns after controlling for the factors of the Carhart asset pricing model and industry and year effects.

It is expected that this negative effect can partly be explained by the four selected fundamentals. More sustainable firms are experiencing a significantly slower sales growth, whereas the positive effect on operational efficiency is significant as well, but only relatively small. Furthermore, firms with a higher CSP require to spend less on investments, and experience a slower growth in intangible assets. To what extent these fundamentals are specifically related to the decrease in firm value has not been investigated, but could be interesting for further research.

1.6 Outline of the Research

The rest of this thesis is outlined as follows. In Chapter 2, previous research concerning the impact of sustainability on short-term firm value is summarized in order to sketch the theoretical framework of the research. Based on theory, the hypotheses have been drawn and formulated in the same chapter. In Chapter 3 the methodology of the empirical analyses is being described, as are the data sources. Afterwards, in Chapter 4 the results of these empirical analyses are shown. Finally, in Chapter 5 the results are being discussed and conclusions are being drawn.

2. Literature Review and Hypothesis Development

In this chapter the theoretical background is given, on which the hypotheses are based. First of all, previous studies concerning the impact of sustainability on short-term firm value are summarized, which are grouped in three sections along the three most often used proxies for CSP. Secondly, possible mechanisms in which way sustainability can influence firm value are illustrated, in order to come to a causal relationship between CSP and firm value. The hypotheses are elaborated throughout the chapter.

2.1 Earlier Studies on Impact of Sustainability on Firm Value

When investigating what the impact of sustainability is on firm value, three major proxies are to be found in literature on how to calculate CSP: the NGR, inclusion in a sustainable index such as the Dow Jones Sustainability Index (DJSI) or the FTSE4Good Index (Shah, 2016), and individual firm initiatives. In this section the results of previous studies are listed, which tend to be generally positive, but still including insignificant or negative evidence, after which the first hypotheses are formulated.

2.1.1 Earlier Studies Using Newsweek's Green Ranking

By investigating 2009's ranking, Lyon & Shimshack (2015) found significant, positive results concerning the ranking position on abnormal returns. A position which is 100 places more favorable, i.e. being ranked as 50 rather than 150, resulted in a 0.2% higher CAR over an event-window of four days. Even after controlling for firm and industry fixed-effects, firms placed in the top 100 experienced a 0.73% higher CAR than the CAR averaged over the remaining 400 firms. Furthermore, Cordeiro & Tewari (2015) found similar results by analyzing the same ranking. When looking at the long term (6-12 months), these positive results tend to remain positive. However, the results overall are significantly influenced by a firm's size, indicating larger, more visible firms benefit to a larger extend (Cordeiro & Tewari, 2015). This visibility effect, moreover, has been confirmed in another study by Amato & Amato (2012), using the same ranking. When controlling on a firm's beta and revenue, only firms ranked in the top quartile had a significant, positive effect on stock values, while not having a significant effect for lower ranked firms (Amato & Amato, 2012), which could indicate the top 100 receives more attention from investors than the remainder of the ranking and is able to profit from this.

Research around later publications of the ranking show results which are consistent with the general image as described above. When looking at the global top 100 ranking in 2010, significant, positive wealth effects are to be found. Climbing one position closer to the first spot, results in an average wealth effect of 11 million dollars. Besides, firms in non-heavy industries show more robust results than firms in heavy industries (Murguia & Lence, 2015). Furthermore, by applying event study methodology around the

publication of 2012's ranking, significantly positive standardized CARs (SCARs) are to be found after controlling for firm and industry fixed-effects. Also firms which have are being ranked as sustainable repeatedly experience significantly higher SCARs than firms with a reduced or unchanged environmental performance (Yadav, Han, & Rho, 2016). Two other studies, however, focusing on the rankings of 2011 and 2012, found no significant effects of sustainable performance on firm value (Prober, Meric, & Meric, 2015; Wilcox, Wilcox, & Jares, 2014).

Regarding the insignificance of abnormal stock returns during a particularly short event window, Levi & Newton (2016) found similar results when only taking into account the announcement of the rankings of 2009 and 2010. However, when extending the time window by calculating monthly stock returns, they found that the most sustainable stocks outperform the least sustainable stocks by 3.7% annually, on a risk-adjusted basis. This indicates that being sustainable indeed does result in increased firm value, although the effect is not captured by investors so rapidly (Levi & Newton, 2016).

Nevertheless, still a minority of studies found a negative relationship between the NGR and firm value. By investigating the ranking of 2009, the CAR averaged over all firms was found to be negative and significantly non-zero, being minus 2.2%. The score itself had no significant influence on the CAR as coefficient in the applied regression analysis. It has to be noted, however, that the R^2 of the regression was only 0.000607, meaning the study did not have a very large explanatory power. As well, the regressions did not include any control variables regarding firm or industry characteristics, making the research rather limited (Anderson-Weir, 2010). Another study, which used the ranking of 2010, found contrary results. The intercept was found to be positive and significant at the 1% level, but the coefficient for a firm's score negative and significant at the 1% level (Meric, Watson, & Meric, 2012). Finally, research spanning the rankings of 2009 until 2012 found evidence that a favorable ranking resulted in negative stock returns for manufacturing firms specifically, whereas the opposite is the case for service firms. Firms being ranked "in the middle", i.e. in between positions 101 and 400 generally were the ones with the highest abnormal returns (McMillan, Dunne, Aaron, & Cline, 2017).

2.1.2 Sustainable Index Inclusion

Another proxy for a high (low) CSP is inclusion (deletion) in a sustainable stock index. The most prominent example of such an index is the DJSI, which was launched in 1999 by SAM (RobecoSAM currently) in collaboration with Dow Jones Indices. Every year, its assessment committee selects the top 10% of the leading sustainability companies in each industry, in order to build up indices worldwide and on geographical level with the most sustainable firms (Kong Cheung, 2011). Being included in this selection,

either as a new company or being allowed to remain, is considered having a high level of corporate sustainability. Being removed, of course, indicates bad sustainable behavior. Another prominent example of such an index is the UK-based FTSE4Good, launched in 2001 and especially aimed at European companies (Martin Curran & Moran, 2007).

A study focusing on US stocks that were included or deleted from the DJSI between 2002 and 2008 found a significant, but temporary increase in stock price after being included in the index, which was corrected in the days after on average (Kong Cheung, 2011). Another study, which focused on large US non-financial firms between 1999 and 2002 found a significant positive relation between inclusion in the index and Tobin's *q* (S.-F. Lo & Sheu, 2007). A study that examined firms worldwide between 1999 and 2016, found similar results. After including relevant control variables, the events only had a limited significance. However, results tended to be more positive in the later years, indicating investors are starting to value sustainability increasingly (Hawn, Chatterji, & Mitchell, 2018). A specific case study for German firms actually showed negative results, indicating German investors penalize inclusion in a sustainable stock index (Oberndorfer, Wagner, & Ziegler, 2013).

Martin Curran & Moran (2007) first tested the impact of inclusion and deletion from the FTSE4Good UK Index, and found results that show a trend towards positive results for the inclusion of a firm, and negative results for the deletion of a firm. However, these results were insignificant. Other studies, focusing on either only the UK or Europe as a whole, found similar, insignificant evidence (Clacher & Hagendorff, 2012; Siegmund & Witt, 2012).

2.1.3 Studies on Individual Firm Announcements

The final proxy for CSP often used in literature is the announcement of corporate sustainable initiatives, environmental awards and certifications or participation in environmental programs, i.e. announcements that target individual companies only.

The effect of environmental initiatives was first tested by Klassen & Mclaughlin (1996), herein using the proxy of the announcement of winning an environmental award. They found significantly positive returns around the announcement of an award and, reversely, significantly negative returns around the announcement of environmental crises. A later research, which tested between 2004 and 2006 both the primary announcement of such an initiative by the firm and the following announcement of a certification by a third party, found only significant reactions for certain initiatives, such as ISO 14001 certifications, and philanthropic gifts to environmental causes, in order to conclude that the market only reacts selectively to environmental initiatives (Jacobs, Singhal, & Subramanian, 2010).

Two studies are to be found for participation in voluntary environmental programs in corporation with the US Environmental Protection Agency. The first study found an significantly positive effect of participating in the Green Lights program, by testing the differences in return on assets between participants and non-participants (Moon, Bae, & Jeong, 2014). However, another study found that participation in the Climate Leaders program led to statistically significant negative returns in the event window, despite showing a non-significant positive return of 0.56% on the day of announcement (Keele & Dehart, 2011).

Finally, some specific case-studies have been executed in countries outside of the US. A study focused on fines for environmental pollution imposed on UK companies found significantly negative returns. The opposite reaction, i.e. positive returns for environmental performance announcements, were not to be found (Lorraine, Collison, & Power, 2004). A study on the implementation of ESG and environmental initiatives in Hong Kong found significantly positive returns, although the ESG initiatives were found to lead to higher returns versus the environmental initiatives (K. Y. Lo & Kwan, 2017).

2.1.4 Hypotheses

Because of the predominantly positive results from previous studies presented in this section (Cordeiro & Tewari, 2015; Lyon & Shimshack, 2015; Murguia & Lence, 2015; Yadav et al., 2016), it is expected that sustainability will lead to an increase in share price after announcements on this subject. Therefore, the first, and primary hypothesis of this thesis is formulated as follow:

> H_1: A high CSP will have a significant, positive effect on firm value.

Since the data of a firm's individual performance is already known to investors in contrast to its performance compared to its peer-group (as was argued by Lyon & Shimshack (2015)), it is predicted that the variable *score* has a lower impact regarding the expected wealth effect than the variable *rank*, as this variable is presenting the most new information. Hence, the second hypothesis is formulated as:

> H_2: The magnitude of a low rank will be larger than a high score when regarding the relationship between CSP and firm value.

Furthermore, given the greater market share of sustainable investment funds in later years (Ernst & Young, 2017), and the presence of such an effect in previous studies (Hawn et al., 2018), it can be expected that the announcement of sustainable news will be received more positively in later years. Therefore, the third, dual hypothesis is formulated as:

H_{3a}: On average, wealth effects in more recent years will be more positive than the ones in previous years.

H_{3b}: The influence of CSP on stock returns will be larger in more recent years than in previous years.

Since studies showed more robust results for lighter, less polluting industries than for heavier, more polluting industries (Klassen & McLaughlin, 1996; McMillan et al., 2017; Murguia & Lence, 2015), it can be expected that the announcement of sustainable news will be received more positively in lighter industries. Therefore, the fourth, dual hypothesis is formulated as:

H_{4a}: On average, wealth effects in lighter industries will be more positive than the ones in heavier, more polluting industries.

H_{4b}: The influence of CSP on stock returns will be larger in lighter, less polluting industries, than in heavier, more polluting industries.

2.2 Sustainability Influencing Company Fundamentals

As mentioned in the introduction, this research tries to work towards a causal relationship between CSP and firm value. The way it will be done, is by exploring the influence of CSP directly on company fundamentals, conceptualized by Yadav et al. (2016), as shown in Figure 1, and Wilcox et al. (2014). In this section more evidence for these relationships is being elaborated, and hypotheses are formulated.

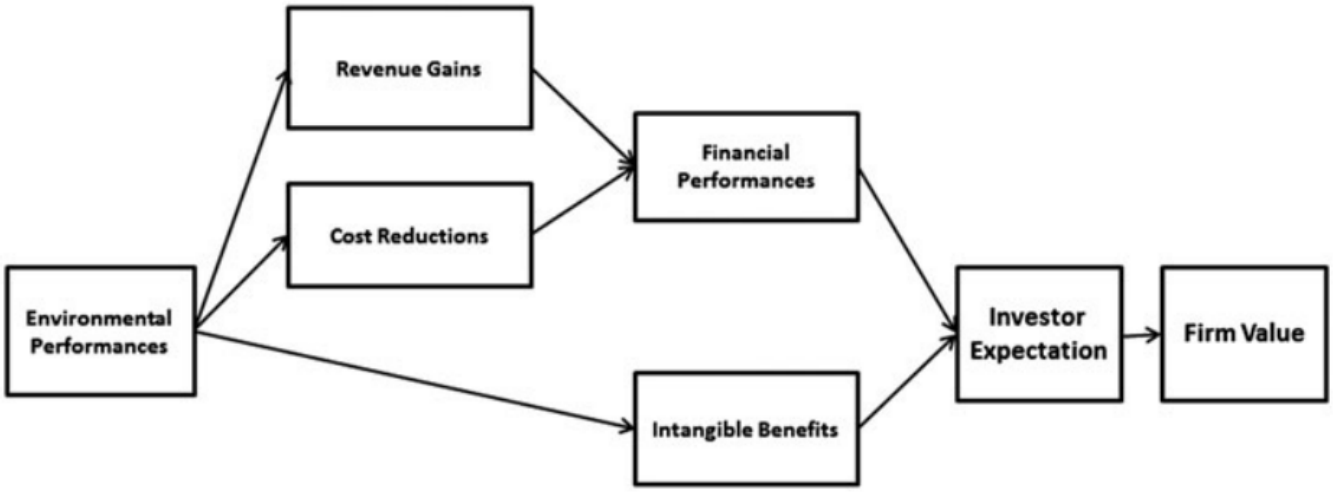

Figure 1: Conceptual model for linkage between environmental performance and firm value (Yadav et al., 2016)

2.2.1 Revenue Growth

Often mentioned in studies listed in Section 2.1 (Amato & Amato, 2012; Cordeiro & Tewari, 2015; Jacobs et al., 2010; Keele & Dehart, 2011; Klassen & McLaughlin, 1996; McMillan et al., 2017; Wilcox et al., 2014;

Yadav et al., 2016), revenue growth is a major possible reason why CSP would lead to higher future cash flows, and thus firm value.

The main way in which sustainability leads to revenue growth is the so-called sustainability price premium. Customers have a preference for products of environmentally oriented companies and therefore manufacturers can differentiate their markets by promoting their environmentally friendly products (Klassen & McLaughlin, 1996; Yadav et al., 2016). According to a survey by McKinsey, 70% of customers in Europe and the US would accept to pay a premium of 5% for a sustainable product (Miremadi, Musso, & Weihe, 2012). Moreover, Americans in general are willing to pay a part of their income in order to become more sustainable (Rosewicz, 1990), but a recent survey showed that this amount is low. Only 39% were in favor of handing in up to $10 (The Associated Press, 2016).

Furthermore, sustainability could lead to gained market share due to a better image of the product (Klassen & McLaughlin, 1996), the entry of a firm to a new market (Jacobs et al., 2010; Yadav et al., 2016) or even the development of a new business model (Nidumolu, Prahalad, & Rangaswami, 2009). Examples of the latter mentioned by Jacobs et al. (2010) range from clothing made from organic materials, hybrid vehicles and low energy-consuming data centers. Finally, it could be possible to generate additional revenue by finding markets for by-products produced in the regular processes or new technologies developed for environmental reasons (Wang & Sarkis, 2013).

This mechanism has been tested empirically. Lo & Sheu (2007) used the one-year sales growth as an interaction variable in their study regarding the influence of being included in the DJSI on *Tobin's q*, and found that this relationship was positively reinforced, meaning sales growth is a meaningful moderator. In a study which compared the level of sales growth of the 100 most sustainable global companies in 2008 over a control group found significantly higher mean sales growth during the time period of 2006 until 2010 (Ameer & Othman, 2012). In another study sales growth was found to have a positive correlation of 0.15 with CSR (Mcguire, 1988), and in a study aimed at Japanese corporations revenue increase also had positive, significant correlation coefficients as an interaction variable between CSP and both earnings per share and Tobin's *q* (Nakao, Amano, Matsumura, Genba, & Nakano, 2007). However, Wilcox et al. (2014) found contrary evidence, finding that firms ranked higher on the NGR actually experienced a lower revenue growth.

Because of the presence of various mechanisms to positively influence revenue growth and the majority of evidence confirming this relationship, the fifth hypothesis is formulated as:

H_5: Firms with a higher CSP experience a larger revenue growth than firms with a lower CSP.

2.2.2 Cost Reductions

The most commonly mentioned method in which CSP could aid firm value, is by the means of cost reductions. First of all, a more sustainable company generally consumes less energy and raw materials, improving its operational efficiency. Secondly, an improved environmental performance reduces the probability of major industrial accidents, reducing the negative effects in the aftermath, such as clean-up and possible lawsuits (Jacobs et al., 2010; Klassen & McLaughlin, 1996). Other possible savings on a smaller scale, as mentioned by Yadav et al. (2016), include lower transport cost due to reduced packaging weights, and avoided government tariffs for pollution.

Contrary to this theory, is Friedman's shareholder theory, which indicates that a company's sole responsibility is to maximize its profits. By investing in social responsibility, a company's executive is spending the money of his shareholders to things not in the best interest of the corporation (Friedman, 1970). Anderson-Weir (2010) also used this idea for building the model that restrictions which come at the cost of sustainability could also lead to higher operating cost, thus reducing efficiency.

Wilcox et al. (2014) also included a test on operating expenses in their research, and found that for the firms in the top tertile of the NGR experienced the lowest growth of operating expenses, indicating that these firms were able to profit from their sustainable performance by increasing operating efficiency.

Again, because of the presence of various mechanisms to positively influence operational efficiency and the existence of evidence confirming this relationship, the sixth hypothesis is formulated as:

H_6: Firms with a higher CSP experience a larger increase in EBITDA margin than firms with a lower CSP.

2.2.3 Capital Expenditures Increase

The major negative consequence of becoming more sustainable, is that these initiatives come at a large cost up front, as is mentioned in the studies listed in Section 2.1 (Wilcox et al., 2014; Yadav et al., 2016). The treat to investors is that these costs, consisting of investments in infrastructure, technology or intellectual property (Wilcox et al., 2014), cannot be recouped in the future in the form of operational efficiency (leading to a higher profit margin) (Yadav et al., 2016). Furthermore, using the conventional methods of evaluating investment decisions (i.e. DCF or net present value), concerns exist that these methods do not favor sustainable projects, as they require longer payback terms and qualitative benefits are hard to quantify in such calculations (Kimbro, 2013).

A qualitative research, consisting of 400 interviews and 1,100 questionnaires aimed at sustainability experts and business managers, confirmed this image. Interviewees unanimously complained at the capital market's ignorance to CSP, keeping their focus at short-term results. In the food and beverage industry shareholders are afraid that CSP will lead to sacrificing their competitive position, having the consequence that sustainability projects remain in the pilot phase only (Steger, Ionescu-Somers, & Salzmann, 2007). An empirical research, however, rejected the hypothesis that sustainable companies experience a larger growth in investments. Companies ranked in the top tertile of the NGR experienced the slowest growth of depreciation and amortization expenses compared to the middle and lowest group (Wilcox et al., 2014).

Despite the evidence provided by Wilcox et al. (2014), it is argued that more sustainable companies need a larger amount of investments to fund their plans, which is why the seventh hypothesis is formulated as:

> H_7: Firms with a higher CSP experience a larger increase in capital expenditures than firms with a lower CSP.

2.2.4 Intangible Resources Increase

Besides the tangible benefits or liabilities mentioned above, firms are expected to achieve intangible benefits by increasing its CSP, as was argued by Yadav et al. (2016) and Cordeiro & Tewari (2015) and included in its theoretical background. Examples of such intangible measures include innovative power, retaining human capital, reputation, and organizational culture (Surroca, Tribo, & Waddock, 2010).

The intangible asset to be influenced by CSP mentioned most in literature, is a firm's corporate reputation. Sketched by Surroca et al. (2010), an improved reputation should lead to improved customer loyalty, and consequently improved revenues, attract better employees and negotiate better terms with lenders. Furthermore, the outcome of the research of the latter scholars was that no direct result exists between sustainability and corporate financial performance, only an effect mediated by such intangible resources.

Nevertheless, it is rather hard to quantify the construct of a firm's reputation objectively for a large group of firms, requiring subjective surveys, such as Fortune's Most Admired Companies ranking, only including a total of 330 US-based firms. However, one possible source of intangible benefits, knowledge gained by innovating, is captured in the form of patents, which are assigned a value and retained on a company's balance sheet. Using this data it is possible to formulate and test the eighth hypothesis:

> H_8: Firms with a higher CSP experience a larger increase in intangible assets than firms with a lower CSP.

3. Methodology

In this chapter the methodology of the analyses to test the hypotheses stated in Chapter 2 is elaborated. First of all, in Section 3.1 some background information is given on the NGR, this thesis' proxy for CSP. Consequently, in Section 3.2, the data sources of the other variables are listed and the data cleaning process is explained. Afterwards, in Section 3.3 the way of calculating stock returns, the dependent variable in two parts of the empirical analysis is explained. Finally, in Section 3.4 the regression models and other statistical techniques used to test the various hypotheses are listed.

3.1 Background Information Newsweek's Green Ranking

3.1.1 History

Newsweek launched its inaugural ranking in the printed issue of September 21, 2009. Together with research partners *Trucost, KLD Research & Analytics* and *CorporateRegister.com* the magazine ranked the 500 largest US companies by revenue, market capitalization and number of employees, on environmental performance. This score was based on three separate factors: environmental impact, green policies, and reputation score (Lyon & Shimshack, 2015).

The ranking returned in 2010, having a similar methodology but replacing *KLD Research* with *MSCI ESG Research* as one of the research partners. A new feature that year was the publication of a global top 100 ranking, also ranking firms outside of the US (Newsweek, 2010). Partnering with *Trucost* and *Sustainalitics*, Newsweek issued the ranking again in 2011. This time the ranking consisted of two lists of 500 companies, US only and global, scoring the companies on environmental impact, environmental management and a newly assigned environmental disclosure score, rather than the reputation score used in previous rankings (Newsweek, 2011). In 2012, the magazine used the same exact methodology, making it possible to compare firms meaningfully year-over-year for the first time (Newsweek, 2012).

After years of financial troubles and a spin-off to IBT Media (IBTimes, 2013), Newsweek relaunched the Green Ranking again on June 5, 2014, this time cooperating with *Corporate Knights Capital*. The magazine ranked the 500 largest public US and global firms by just market capitalization, using an new, improved, and rule-based methodology, utilizing publicly available data only (Newsweek, 2014). This methodology is described in more detail below. For the publications in the three years afterwards, Newsweek and *Corporate Knights* used almost the same methodology, only replacing the reputation score by a green revenue score in 2015. This makes it again possible to make meaningful year-over-year comparisons of firms, and include change in position in the research (Heaps & Yow, 2015; Newsweek, 2016, 2017).

3.1.2 Methodology of the Ranking

The companies are all scored using the following eight criteria, of which the eighth changed after 2014:

1. Combined energy productivity score (weighing 15% and normalized by sales)
2. Combined greenhouse gas productivity score (weighing 15% and normalized by sales)
3. Combined water productivity score (weighing 15% and normalized by sales)
4. Combined waste productivity score (weighing 15% and normalized by sales)
5. Sustainability pay link (weighing 10%)
6. Sustainability board committee (weighing 5%)
7. Audited environmental metric (weighing 5%)
8. Green revenue percentage range (reputation score in 2014's rankings) (weighing 20%)

These criteria are added up, and normalized to form a value between zero (least sustainable) and one (most sustainably possible). Newsweek designed the methodology to be compliant with some principles, such as transparency, publishing the full methodology, objectivity, only using quantifiable data, and availability, making use of publicly available data only (via *Bloomberg, FactSet* and *Thomson Reuters*). Moreover, companies cannot choose to opt out of the research, but will be approached by Corporate Knights to verify the obtained data (Newsweek, 2016, 2017).

Firms are classified using the Global Industry Classification Standard (GICS) (S&P Global & MSCI, 2018), being able to point out industry leaders, and making peer-to-peer comparisons.

3.1.3 Academic and Business Impact

The first announcement of the ranking in 2009 reached a considerably large audience. During the week the ranking was published in Newsweek magazine and its webpage, Google searches for the magazine increased 122 times the average weekly volume, also experiencing abnormal larger searches during the two weeks after publication (Lyon & Shimshack, 2015). This high coverage can be explained due to the fact it was the first time the topic of sustainability was treated on such a large scale, scoring nearly the entire S&P 500 index. The only major proxy for CSP existing at the time was the DJSI, containing the highest scoring 20% of a certain industry, significantly less than Newsweek included (Prestel, 2017).

Besides the recognition Newsweek received, highly ranked companies paid quite some attention to a positive review. Many posted an article on their corporate website after being included in the top ten (Neumayr, 2016), or ranked as industry leader (Hilker, 2017; Toyota, 2017). Finally, the ranking became a relevant proxy for CSP in academia, as is being elaborated in Subsection 2.1.1.

However, from an academic perspective the ranking, and its reported studies, also received some criticism. First of all, Lyon and Shimshack (2015) suggested that all data underlying the ranking was already available to investors, meaning that the publication of the ranking should not have a particularly large effect on stock prices. Indeed, they also found that the rank of a company had a larger effect on share price than a company's score, which should already be incorporated in the share price. Secondly, scholars argue whether the list captures the concept of sustainability in a correct way, therefore not being a correct proxy for CSP. Evidence has been found, for example, that the ranking has no significant correlation with pollution measures as based on the Toxics Release Inventory (Cong, Freedman, & Park, 2014).

3.2 Data Sources and Cleaning

The data used to proxy CSP is extracted from the website of Newsweek magazine, from the four respective webpages containing the rankings for US firms for the years 2014 until 2017. Each ranking contains the full name of the company, its ranking during the year, and the standardized score. Besides this information, the variables *Quintile*, and the dummy variables *Top 10 qualification* and *Best in industry* have been created. Furthermore, the industry classification used by Newsweek (GICS), has also been used in this study. One change is applied to this study regarding industry classification. In the ranking of 2017, a separate class was created for firms in the real estate industry, whereas these firms were placed in the financial industry in the years before. To avoid irregularities, the firms grouped in the real estate industry have been replaced in the financial industry.

Subsequently, to standardize the firms' identification, the full company names were matched with trading symbols (tickers), and afterwards with a PERMNO number, which is the standard security identification number used by the CRSP database. Of the total of 2,000 records for the four years of rankings, only three records had to be removed. Regarding the ranking of 2015, a duplicate record was to be found for Williams Companies, which has been removed. Regarding the ranking of 2017, the record for iHeartsmedia has been removed, as the company is not public any more by the time the ranking was published. Also regarding the ranking of 2017, the record for Publix Supermarkets has been removed, since the company has never been publicly held.

For the remaining 1,997 records, the abnormal returns have been calculated for the four time periods in which the NGR was published online. For each time period, six different, symmetrical event windows were considered. For calculating the CAR of each record, the event study application from WRDS (which uses stock data from CRSP) has been applied, and the process is explained in further detail in Subsection 3.3.1.

The control variables, which have been derived from the similar study by Yadav et al. (2016), were calculated using data from the CRSP/Compustat Merged database. These are:

- The natural logarithm of a firm's total assets
- The debt ratio, calculated by dividing a firm's long-term debt by a firm's total assets
- The return on assets, calculated by dividing a firm's net income by a firm's total assets

Considering the data for the second part of the analysis, the monthly stock returns (the dependent variable) are retrieved from the CRSP database. How these are calculated, and what the rationale behind this analysis is, has been elaborated in Subsection 3.3.2. The independent variables used to explain variance in monthly stock return, i.e. the monthly factors for risk-free rate, equity risk premium, small-minus-big, high-minus-low, and momentum, are all retrieved from the Fama-French Portfolios database.

The dependent variables for the third and last part of the analysis, which are the fundamentals, are all retrieved from the CRSP/Compustat Merged database. First of all, the revenue percentage increase has been calculated by dividing the difference in revenue from year t-2 to year t-1 by the revenue in year t-2, where t indicates the year of the respective ranking. Secondly, the EBITDA margin increase, used as a proxy for increased operational efficiency, is calculated by subtracting the EBITDA over sales ratio in year t-2 from the EBITDA over sales ratio in year t-1. The CAPEX percentage increase is calculated by dividing the difference in CAPEX from year t-2 to year t-1 by the CAPEX in year t-2. The intangible assets percentage increase is calculated by dividing the difference in total intangible assets from year t-2 to year t-1 by the total intangible assets in year t-2. If the latter two variables are found to be highly correlated to the revenue increase, they will be normalized by dividing them over the revenue percentage increase during year t-1.

3.3 Stock Return Calculation and Approach

This study uses two, different approaches and time windows to quantify the effect on firm (market) value. In the first part of the analysis, the increase in firm value is captured using an event study, which calculated the difference in stock price before and after each ranking was published, which is explained in detail in Subsection 3.3.1. In the second part of the analysis, the increase in firm value is captured using monthly stock returns, which is explained in detail in Subsection 3.3.2.

3.3.1 Short-Term Returns

This thesis uses the event study methodology outlined by McKinlay (1997), in particular the so-called market model. This methodology consists of two major parts, and is displayed schematically on a timeline in Figure 2.

Figure 2: Timeline of event study (McKinlay, 1997)

First of all, for each stock the dependence to the market index is calculated during the estimation window consisting of 150 trading days. Regarding the timeline displayed in Figure 2, T_0 would correspond to 170 trading days before the event, and T_1 would correspond to 20 trading days before the event. A gap of 20 trading days has been created, to avoid any interference with the stock returns during the different event windows. The stock returns of a certain company during the 150 trading days are subsequently regressed on the return of a market index most applicable to the company during the same trading days. Since this study comprises the 500 largest, US firms by market capitalization, the S&P 500 index has been used as a proxy for market return. This regression is formulated as follows (McKinlay, 1997):

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

In the second part, using the estimates α_i and β_i for a firm's dependence to a market index, the abnormal returns are calculated during the event window in which the rankings were published online, in order to find what part of a company's stock return during this time cannot be explained by movement in the market index price. These abnormal returns are calculated as follows (McKinlay, 1997):

$$AR_{i.t} = R_{i,t} - R_{riskfree,t} - (\alpha_i + \beta_i * (R_{m,t} - R_{riskfree,t}))$$

Since the previous studies applying the event study methodology around the NGR announcement all used different event windows, this study used six different, symmetrical event windows, ranging from [0], i.e. only the day the ranking was published, to [-5,+5], which is an event window of 11 trading days. The abnormal returns are being added up to form the CAR, which is calculated as follows (McKinlay, 1997):

$$CAR_{i,\tau} = \sum_{t=-\tau}^{+\tau} AR_{i,t}$$

These calculations resulted in 1,952 complete records for short-term stock returns on a total of 1,997 records for CSP.

3.3.2 Medium-Term Returns

As was stated in Subsection 3.1.2, Newsweek uses publicly available, two-year-old data to calculate its CSP. Therefore, attentive investors should already know how sustainable a company is by the time Newsweek publishes it ranking, and the announcement should not have a significant effect on stock price under the efficient market hypothesis. As a side-step, therefore, in this thesis the monthly stock returns during the year directly after the data collection period are examined whether the effect of corporate sustainability is already present. For illustrative purposes, the timeline of this analysis regarding 2014's ranking is shown in Figure 3.

Figure 3: Timeline of medium-term analysis, example for 2014's ranking

The medium-term stock returns are calculated by comparing the stock price at the last trading day of a month to the price at the last trading day of the previous month and adding back the received dividend during that month. The following equation has been used:

$$R_{i,t} = \frac{P_{i,t} - P_{i,t-1} + D_{i,t}}{P_{i,t-1}}$$

Using the approach of Levi & Newton (2016), the monthly risk-free, for which the Fama-French Portfolios database uses the one-month US treasury yield, is subtracted from a firm's monthly stock return to form the monthly, excess returns. These calculations resulted in 23,571 monthly excess returns, on a possible total of 23,964 (12 months for 1,997 records of CSP).

3.4 Regression Analysis

In this thesis the ordinary least squares (OLS) regressions method has been utilized. In this section the various models are elaborated which will help to confirm or reject the hypotheses, as stated in Subsection 2.1.4 and throughout Section 2.2, and find answers to the research questions posed in Section 1.2.

3.4.1 Short-term Stock Return Analysis

In order to test both the first and second hypotheses, the first regression model tests the univariate influence of the CSP, herein proxied by different aspects of the NGR, on short-term firm value, proxied by

two different time windows of the event study executed around the announcement of the NGR. This model is formulated as follows:

$$CAR_{i,t} = \alpha + \beta * CSP_{i,t} + \varepsilon$$

where CSP either is the score, rank, quintile, or dummy variable if a company is ranked in the top 10 or best of its respective industry.

Because it is likely the dataset is contaminated by concurring events, having an impact on abnormal stock returns but having no link with CSP, it has been tried to clean the dataset. Unfortunately, the elaborate approach set by Yadav et al. (2016), utilizing the LexisNexis Academic database to filter out any major notifications that might influence stock returns, was not possible. It was possible, however, to filter out records that would happen during the announcement of annual or quarterly financial statements by cross-referencing to a firms fiscal year end in the CRSP/Compustat merged database. All firms having a fiscal year end in February, May, August, and November, which publish earnings statements in June or December (the months in which the NGR was published from 2014 until 2017), have been removed. Furthermore, by cross-referencing to the SDC database, it is possible to filter out firms involved in mergers and acquisitions during the longest event windows of 11 days around the publication of the ranking. Firms for which notifications existed about being taken over, or for executing an acquisition with a value over 100 million USD were flagged and deleted from the sample. After deleting the records contaminated with earnings announcements or acquisition involvement, the regression analysis has been executed again.

To test the dual third hypotheses, the dataset has been split in the four years. For each year, the CAAR has been calculated and compared visually to find evidence to reject or confirm H_{3a}. Moreover, a Welch t-test (or unequal variances t-test) has been executed to find out whether the average abnormal return is equal before and after the 2015 Paris Climate Agreement. Subsequently, the regression equation stated at the beginning of this Subsection, only using the variable *score* as regressor, has been executed in each of the four years and the β is compared to test H_{3b}.

Afterwards, to test the dual fourth hypotheses, the dataset has been split over the ten GICS industries. For each industry group the CAAR has been calculated again and compared visually to find evidence to reject or confirm H_{4a}. Next, the regression equation stated at the beginning of this Subsection, only using the variable *score* as regressor, has been executed in each of the ten industry groups and the β is compared to test H_{4b}.

Finally, in order to come up with more robust evidence confirming or rejecting H_1, control variables (of the year before) will be included in the regression equation, which is as follows:

$$CAR_{i,t} = \alpha + \beta_1 * Green\ score_{i,t} + \beta_2 * \ln(TA)_{i,t-1} + \beta_3 * Leverage_{i,t-1} + \beta_4 * \mathrm{ROA}_{i,t-1} + \varepsilon$$

It is chosen to only include the Green score as a measure for CSP since this variable is most consistent over the years and applicable to all firms.

Because the dataset covers the ranking over multiple years, creating multiple records of the same firm, it is also possible to employ panel data techniques. Therefore, industry and year dummies are also added in a later stage to include their respective fixed effects. Finally, firm fixed effects are added, in order to grasp relevant firm characteristics not caught in the control variables.

3.4.2 Medium-term Stock Return Analysis

As a side-step to come up with more evidence supporting or rejecting H_1, the time window has been shifted to a full year, rather than 11 trading days at most. In the first regression in this part, the excess monthly stock returns, during the year before a ranking was published, are only regressed on the Green score, which has the following equation:

$$R_{i,t-1} - R_{risk-free,t-1} = \alpha + \beta_1 * Green\ score_{i,t} + \varepsilon$$

In the subsequent regressions, more monthly factors are added to form more accurate asset pricing models. First of all, the equity risk premium is added to form the CAPM model. Subsequently, the high-minus-low and small-minus-big factors are added to form the Fama-French three-factor model. Finally, the momentum factor is added to form the Carhart four-factor model, which was also used by Levi & Newton (2016), and results in the following regression equation:

$$R_{i,t-1} - R_{risk-free,t-1} = \alpha + \beta_1 * Green\ score_{i,t} + \beta_2 * ERP_{t-1} + \beta_3 * SMB_{t-1} + \beta_4 * HML_{t-1} + \beta_5 * MOM_{t-1} + \varepsilon$$

Afterwards, panel data techniques are employed in this part as well, and industry and year dummies are added in a later stage to include their respective fixed effects. Finally, firm fixed effects are added, in order to grasp relevant firm characteristics not caught in asset pricing model.

3.4.3 Short-term Fundamentals Analysis

In the third and last part of the analysis, the four selected company fundamentals are the dependent variables. Their increase has been analyzed during the year happening before the announcement of their respective ranking, thus happening in the same time period during which the monthly stock returns were

analyzed as explained in Subsection 3.4.2 and visualized in Figure 3. This resulted in the following regression equation:

$$Fundamental_{i,t-1} = \alpha + \beta_1 * Green\ score_{i,t} + \varepsilon$$

where the fundamental is either the revenue percentage increase (H_5), EBITDA margin increase (H_6), capital expenditures percentage increase (H_7), or intangible assets percentage increase (H_8).

Afterwards, panel data techniques are employed in this part as well, and industry and year dummies are added in a later stage to include their respective fixed effects. Finally, firm fixed effects are added, in order to grasp relevant firm characteristics not caught in the variables.

4. Results

In this chapter the results of the various regression analyses and statistical tests are elaborated. First of all, in Section 4.1 the dataset is explored and descriptive statistics are calculated to form a general image of the dataset. Subsequently, in Section 4.2 by building correlation matrices the mutual relations between variables are explored. Next up, in Section 4.3 the various statistical analyses testing the short-term impact of CSP on firm value are presented, after which a side-step has been made in Section 4.4 extending the time window of stock returns. In Section 4.5 a company's CSP is regressed on corporate fundamentals, trying to form a causal relationship between CSP and firm value rather than solely correlations. Finally, in Section 4.6 the economic significance of the various analyses has been calculated and commented on.

4.1 Descriptive Statistics

Table 1: Descriptive statistics of variables used in empirical analyses

Variable	Obs.	Mean	Std. dev.	Min.	Max.
CSP					
Green score	1,997	0.3004	0.2066	0	0.892
Green rank	1,997	248.7311	142.2174	1	500
Quintile	1,997	2.9975	1.4137	1	5
Top 10 qualification (Dummy)	1,997	0.02003	0.1401	0	1
Best in industry (Dummy)	1,997	0.02003	0.1401	0	1
Short-term stock returns					
CAR [0]	1,952	0.0006	0.0109	-0.0742	0.0859
CAR [-1,+1]	1,952	-0.0008	0.0211	-0.1126	0.1108
CAR [-2,+2]	1,952	-0.0015	0.0287	-0.2305	0.1793
CAR [-3,+3]	1,952	-0.0004	0.0343	-0.2154	0.2333
CAR [-4,+4]	1,952	-0.0012	0.0378	-0.1958	0.2460
CAR [-5,+5]	1,952	-0.0027	0.0408	-0.1717	0.2116
Control variables					
Ln(Total assets)	1,948	9.9457	1.3104	6.0803	14.7606
Debt ratio	1,948	0.2659	0.1795	0.0000	1.6541
Return on assets	1,948	0.0569	0.0714	-1.2270	0.3493
Medium-term stock analysis					
Monthly stock returns	23,571	0.0145	0.0826	-0.9094	1.8323
Monthly risk-free rate	23,571	0.0000	0.0001	0.0000	0.0003
Monthly equity risk premium	23,571	0.0117	0.0311	-0.0604	0.0775
Monthly small-minus-big factor	23,571	0.0003	0.0240	-0.0437	0.0549
Monthly high-minus-low factor	23,571	0.0018	0.0231	-0.0412	0.0827
Monthly momentum factor	23,571	0.0021	0.0324	-0.0737	0.1028
Fundamentals					
Revenue percentage increase	1,899	0.0577	0.2446	-0.8143	4.3164
EBITDA margin increase	1,833	-0.0010	0.1862	-3.7883	3.8903
CAPEX percentage increase	1,786	0.1243	0.5795	-0.8798	16.0839
Intangible assets percentage increase	1,745	0.4082	4.1504	-0.9554	148.4757

The descriptive statistics of all variables used in the various empirical analyses are shown in Table 1. These variables are displayed in the order in which there are being used throughout this chapter. A note has to be placed that for the medium-term stock analysis, one record in the NGR corresponds to twelve, monthly stock returns.

From Table 1 it can be concluded that the stock returns during the different event windows have a rather large coefficient of variation, ranging from 15 to 85, and exceptionally high (low) maximum (minimum) abnormal returns during the short event windows. Therefore it can be argued that other, concurrent events played a major role during the window besides the announcement of the NGR, which will be corrected for in the statistical analyses.

4.2 Correlations Between Variables

In Table 2 the mutual correlations are shown of all variables used in the analyses of Section 4.3, of which the meaningful, non-obvious, significant correlations are shown in bold.

First of all, it can be seen that the CARs during event windows [0] (only taking account the day of announcement) and [-3,+3] have the highest correlations with the various metrics of the NGR. Regarding the shortest event window, a very significant, negative correlation is to be found when a company is ranked in the top 10 or being best in its respective industry. Such a correlation is also to be found between abnormal returns in the [-1,+1] window and being ranked best in industry, albeit with a much lower significance (p=0.058 versus p=0.007).

When looking at the longer event windows, the window [-3,+3] shows mostly significant correlations with the different measures of the NGR, having significant correlations with a company's NGR score, rank and top 10 qualification. All of these three, adding to the correlations between the [0] window and CSP variables, show a trend of a negative influence of being sustainable as a company and the firm value on the short-term, which goes against the majority of previous research. Because these windows show most significant correlations, they are chosen to be the dependent variable in the regressions in Section 4.3.

Moreover, also the control variables show quite some significant correlations with both CSP and the abnormal stock returns. Showing a significant, positive correlation between total assets and score and a negative correlation with rank, indicates that mostly larger companies put effort in being sustainable. The same can be said for firms having a lower debt ratio and higher profitability (return on assets). When looking at the stock returns, larger firms experience a positive correlation with abnormal returns, as do firms with a larger debt ratio and lower profitability.

Table 2: Correlation (Pearson's) matrix CSP, Short-term stock returns, and Control variables (used in Section 4.3). Meaningful, significant correlations, i.e. not being in between NGR metrics or CARs, are shown in bold.

	Score	Rank	Quintile	Top 10	Best in industry	[0]	[-1,+1]	[-2,+2]	[-3,+3]	[-4,+4]	[-5,+5]	Ln(TA)	Debt ratio
Green rank	-0.957***												
	(0.000)												
Quintile	-0.933***	0.979***											
	(0.000)	(0.000)											
Top 10 qualification	0.329***	-0.240***	-0.198***										
	(0.000)	(0.000)	(0.000)										
Best in industry	0.301***	-0.234***	-0.203***	0.555***									
	(0.000)	(0.000)	(0.000)	(0.000)									
CAR [0]	-0.028	0.028	0.025	**-0.054****	**-0.061*****								
	(0.210)	(0.224)	(0.274)	(0.017)	(0.007)								
CAR [-1,+1]	-0.011	0.002	0.001	-0.031	**-0.043***	0.555***							
	(0.635)	(0.934)	(0.958)	(0.176)	(0.058)	(0.000)							
CAR [-2,+2]	-0.017	0.027	0.025	-0.021	-0.030	0.460***	0.798***						
	(0.459)	(0.231)	(0.278)	(0.349)	(0.184)	(0.000)	(0.000)						
CAR [-3,+3]	**-0.052****	**0.039***	0.036	**-0.042***	-0.025	0.357***	0.664***	0.805***					
	(0.023)	(0.084)	(0.112)	(0.066)	(0.273)	(0.000)	(0.000)	(0.000)					
CAR [-4,+4]	-0.035	0.018	0.014	-0.029	-0.015	0.319***	0.597***	0.714***	0.890***				
	(0.121)	(0.438)	(0.538)	(0.204)	(0.497)	(0.000)	(0.000)	(0.000)	(0.000)				
CAR [-5,+5]	0.013	-0.025	-0.028	-0.034	-0.010	0.311***	0.551***	0.659***	0.801***	0.908***			
	(0.565)	(0.274)	(0.210)	(0.132)	(0.652)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)			
Ln(Total assets)	**0.242*****	**-0.255*****	**-0.257*****	-0.023	0.027	**-0.054****	-0.002	**0.051****	**0.063*****	**0.054****	**0.086*****		
	(0.000)	(0.000)	(0.000)	(0.305)	(0.233)	(0.017)	(0.918)	(0.024)	(0.005)	(0.016)	(0.000)		
Debt ratio	**-0.080*****	**0.075*****	**0.070****	-0.034	-0.016	**0.098*****	**0.044***	0.028	0.019	**0.038***	**0.051****	-0.155***	
	(0.000)	(0.001)	(0.002)	(0.135)	(0.469)	(0.000)	(0.051)	(0.222)	(0.411)	(0.098)	(0.025)	(0.000)	
Return on assets	**0.118*****	**-0.109*****	**-0.098*****	**0.065*****	0.013	**-0.053****	-0.017	**-0.054****	**-0.049****	**-0.043***	-0.028	-0.224***	-0.090***
	(0.000)	(0.000)	(0.000)	(0.004)	(0.570)	(0.020)	(0.463)	(0.018)	(0.032)	(0.056)	(0.220)	(0.000)	(0.000)

N=1,948, * p<0.10, ** p<0.05, *** p<0.01, significance between parentheses

Table 3: Correlation (Pearson's) matrix Green score and Medium-term stock analysis (used in Section 4.4)

	Adjusted stock return	Green score	ERP	SMB	HML
Green score	**-0.019*****				
	(0.003)				
Monthly equity risk premium	**0.391*****	-0.026***			
	(0.000)	(0.000)			
Monthly small-minus-big factor	**0.137*****	-0.039***	0.295***		
	(0.000)	(0.000)	(0.000)		
Monthly high-minus-low factor	**0.036*****	-0.078***	0.051***	0.085***	
	(0.000)	(0.000)	(0.000)	(0.000)	
Monthly momentum factor	**-0.121*****	0.064***	-0.253***	-0.078***	-0.553***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

N=23,571, * p<0.10, ** p<0.05, *** p<0.01, significance between parentheses

In Table 3 the mutual correlations are shown of all variables used in the analyses of Section 4.4, of which the meaningful, non-obvious, significant correlations are shown in bold.

The first striking significant correlation is between the Green score and adjusted (risk-free rate subtracted) monthly stock return, having a p-value below 0.01 and being negative. This evidence adds to the trend set in Table 2, indicating a negative influence of CSP on firm value. Moreover, the adjusted stock return has highly significant correlations with the equity risk premium and other factor loadings, indicating robust asset pricing models are to be made.

Furthermore, although the variables are not meant to be related to each other, the Green score has significant correlations with all the other proposed independent variables for the various regressions, possibly causing the statistical problem of multicollinearity. Therefore, the VIF score has to be calculated for each independent variable to make sure each variable has its own independent impact on the adjusted stock returns (Hair, Black, Babin, & Anderson, 2014).

Table 4: Correlation (Pearson's) matrix Green score and Fundamentals (used in Section 5.5)

	Green score	Revenue increase	EBITDA margin increase	CAPEX increase
Revenue percentage increase	**-0.120*****			
	(0.000)			
EBITDA margin increase	0.031	**0.111*****		
	(0.212)	(0.000)		
CAPEX percentage increase	**-0.086*****	**0.257*****	-0.001	
	(0.000)	(0.000)	(0.952)	
Intangible assets percentage increase	**-0.052****	**0.208*****	-0.009	**0.088*****
	(0.034)	(0.000)	(0.712)	(0.000)

N=1,648, * p<0.10, ** p<0.05, *** p<0.01, significance between parentheses

In Table 4 the mutual correlations are shown of all variables used in the analyses of Section 4.5, of which the meaningful, non-obvious, significant correlations are shown in bold.

First of all, the Green score is significantly, negatively correlated with the revenue percentage increase, counterintuitively indicating that more sustainable firms experience a slower revenue growth. Furthermore, there exist significant, negative correlations between a company's Green score and the increase in capital expenditures and intangible assets. Nevertheless, it can be questioned whether these negative correlations exist by themselves, or are caused by the revenue increase, since both capital expenditures increase and intangible assets increase are also highly correlated to the revenue increase. Therefore, these two variables are subsequently normalized by dividing them by the revenue increase, in order to find the isolated correlations between them and CSP.

Table 5: Correlation (Pearson's) matrix Green score and normalized Fundamentals (used in Section 5.5)

	Green score	Revenue increase	EBITDA margin increase	CAPEX increase (normalized)
Revenue percentage increase	**-0.120*****			
	(0.000)			
EBITDA margin increase	0.031	**0.111*****		
	(0.212)	(0.000)		
CAPEX percentage increase	**-0.065*****	**0.127*****	0.019	
(normalized)	(0.008)	(0.000)	(0.435)	
Intangible assets percentage increase	**-0.054****	**0.142*****	-0.007	**0.056****
(normalized)	(0.028)	(0.000)	(0.777)	(0.023)

N=1,648, * p<0.10, ** p<0.05, *** p<0.01, significance between parentheses

After normalization, the correlations have been recalculated and shown in Table 5.

The capital expenditures and intangible assets increase are still significantly negatively correlated to a company's Green score, albeit to a somewhat lower extend for capital expenditures increase.

4.3 Short-term Stock Return Analysis

4.3.1 Univariate Analyses

As explained in Section 3.3, the first part of the analyses treats the univariate regressions of the different indicators of CSP, which are derived from the NGRs, on stock returns. As explained in Section 4.2, since these event windows showed the largest correlations with the different variables, the event windows [0] and [-3,+3] act as dependent variables. The results of these regressions are displayed in Table 6.

From Table 6, it can be deducted that not many regressions result in significant results. Regarding the shortest event window, only significant, negative results are to be found for the *top 10 qualification* and *best in industry* dummy variables, indicating that is does not pay off to be an outstandingly sustainable firm on the short term.

When looking at the longer event window, more significant results are to be found. The Green score has a significantly negative influence on abnormal stock returns during the event window, as is the case with the rank, albeit with a much lower coefficient. A *top 10 qualification* again negatively influences stock returns, and in the case of the longer event window also to a larger extend. When looking at all regressions in Table 6, it has to be noted that the explaining power is rather low, having an R-squared ranging from 0.05% to 0.37%.

As it was noticed in Section 4.1, a lot of noise exist in the stock data, which is not expected to be solely due to the announcement of the NGR. Following the approach of Yadav et al. (2016), events in which it is clear that a concurring event is happening, are being excluded from the dataset. However, unlike these researchers, for this thesis the author does not have access to the LexisNexis Academic database, making it impossible to look automatically for all notifications occurring during the event window. Nevertheless, two major types of events that can be flagged, annual or quarterly earning calls and acquisitions announcements, have been found. This resulted in the exclusion of 161 records in the dataset. The regressions of Table 6 have been executed one more time, and are displayed in Table 7.

From Table 7 it can be deducted that only two of the five significant coefficients from Table 6 are still significant after the exclusion of concurring events. When looking at the shortest event window, only a *best in industry qualification* still significantly influences abnormal returns in a negative way. When looking at the longest event window, the same is the case for the Green score, having a significantly negative coefficient. This provides evidence rejecting H_1.

When looking at the differences between the different NGR indicators, at the longest event window regression 6 shows the best fit, having the highest R-squared and the highest significance of the coefficient out of the five regressions. This indicates that H_2, that a company's rank would actually have a higher fit than a company's score, has been rejected. When considering the shortest event window, the *best in industry* metric has the highest R-squared and only significant coefficient, showing the best fit. However, for the sake of consistency over the years and applicability to all firms, not just the ten industry leaders, it has been chosen to only use the score metric in further analyses.

Nevertheless, the explaining power of the regressions has decreased to a lower level, now ranging from 0.03% to 0.32%, indicating this univariate model is far from accurate. For this reason, control variables, industry, year, and firm fixed-effects are to be added in further subsections to explain the variance of abnormal stock returns in a greater extent.

Table 6: Regression analyses influence of ranking metrics on stock returns, excluding control variables

	CAR [0]					CAR [-3,+3]				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Green score	-0.0014					-0.0082**				
	(0.241)					(0.029)				
Green rank		<0.0001					<0.0001*			
		(0.250)					(0.099)			
Quintile			0.0002					0.0008		
			(0.303)					(0.130)		
Top 10 qualification				-0.0043**					-0.0103*	
				(0.017)					(0.066)	
Best in industry					-0.0047***					-0.0060
					(0.007)					(0.275)
Constant	0.0010**	0.0001	<0.0001	0.0007***	0.0007***	0.0021	-0.0026*	-0.0029	-0.0002	-0.0003
	(0.023)	(0.874)	(0.950)	(0.008)	(0.007)	(0.128)	(0.092)	(0.112)	(0.802)	(0.726)
R-squared	0.0007	0.0007	0.0005	0.0029	0.0037	0.0025	0.0014	0.0012	0.0017	0.0006
Obs.	1,952	1,952	1,952	1,952	1,952	1,952	1,952	1,952	1,952	1,952

* p<0.10, ** p<0.05, *** p<0.01, significance between parentheses

Table 7: Regression analyses influence of ranking metrics on stock returns, concurrent events removed, excluding control variables

	CAR [0]					CAR [-3,+3]				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Green score	-0.0010					-0.0072*				
	(0.452)					(0.071)				
Green rank		<0.0001					<0.0001			
		(0.373)					(0.154)			
Quintile			0.0002					0.0007		
			(0.408)					(0.209)		
Top 10 qualification				-0.0025					-0.0081	
				(0.208)					(0.194)	
Best in industry					-0.0045**					-0.0071
					(0.016)					(0.221)
Constant	0.0010**	0.0003	0.0003	0.0008***	0.0008***	0.0021	-0.0021	-0.0022	0.0001	0.0001
	(0.031)	(0.562)	(0.678)	(0.004)	(0.002)	(0.148)	(0.201)	(0.242)	(0.928)	(0.926)
R-squared	0.0003	0.0004	0.0004	0.0009	0.0032	0.0018	0.0011	0.0009	0.0009	0.0008
Obs.	1,791	1,791	1,791	1,791	1,791	1,791	1,791	1,791	1,791	1,791

* p<0.10, ** p<0.05, *** p<0.01, significance between parentheses

4.3.2 Differences Between Years

Since this thesis is the first research to examine the NGR over multiple years, it is possible to compare the abnormal returns over the different years. The dataset has been split over the four years, and for each year the cumulative average abnormal return (CAAR) has been calculated for both event windows used in the previous subsection. This evidence is graphically shown in Figure 4, including a 95% confidence interval for every CAAR.

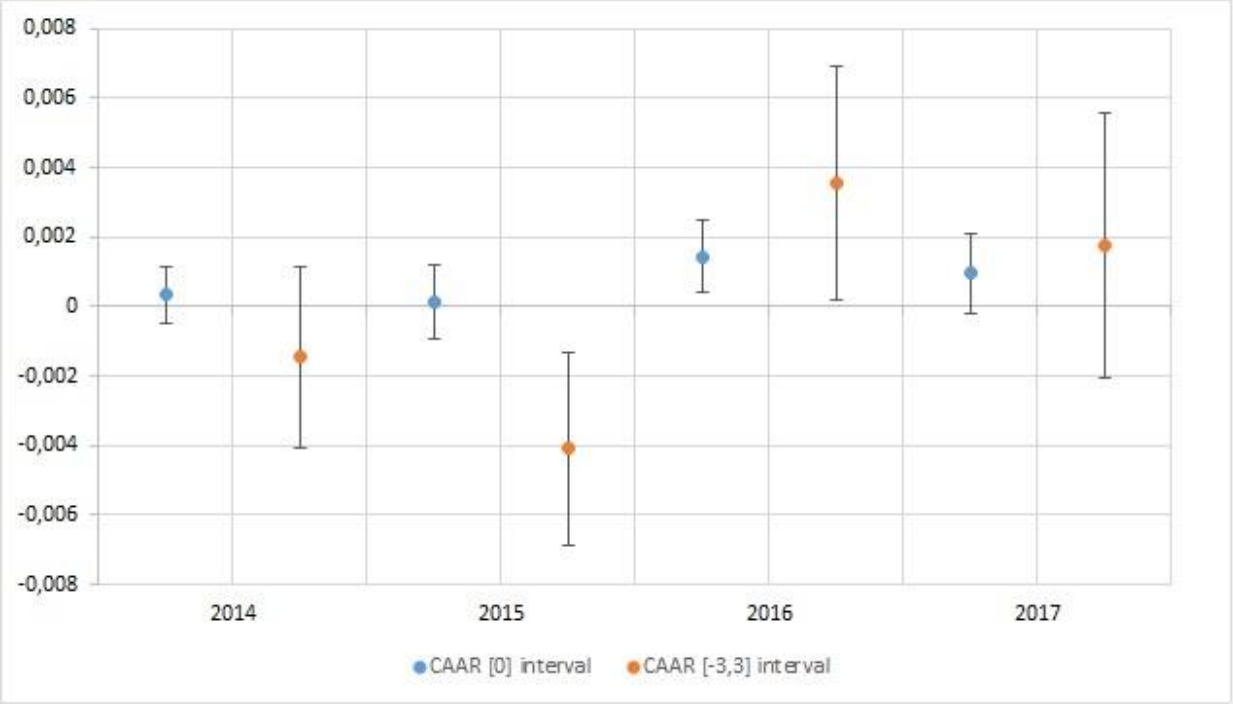

Figure 4: CAAR of all firms by year, including 95% confidence interval

From Figure 4 a clear split can be seen between 2014 and 2015 on one side, and 2016 and 2017 on the other side, which corresponds to the time window before and after the sealing of the Paris Climate Agreement on December 12, 2015. Furthermore, a Welch's one-tailed t-test statistically confirms this image, having a significance level of 0.033 for the [0] event window and 0.0004 for the [-3,+3] window, thus rejecting the null hypothesis of equal means. This evidence confirms H_{3a}.

A similar analysis has been executed only including the firms in the first quintile, i.e. firms being ranked among the 100 most sustainable companies. This evidence is displayed in Figure 5. This graph, however, does not show clear evidence of higher CAARs after 2015. When executing the same one-tailed Welch's t-test, the means are also not significantly different this time, having a p-value of 0.45 for the [0] window and 0.077 for the [-3,+3] window.

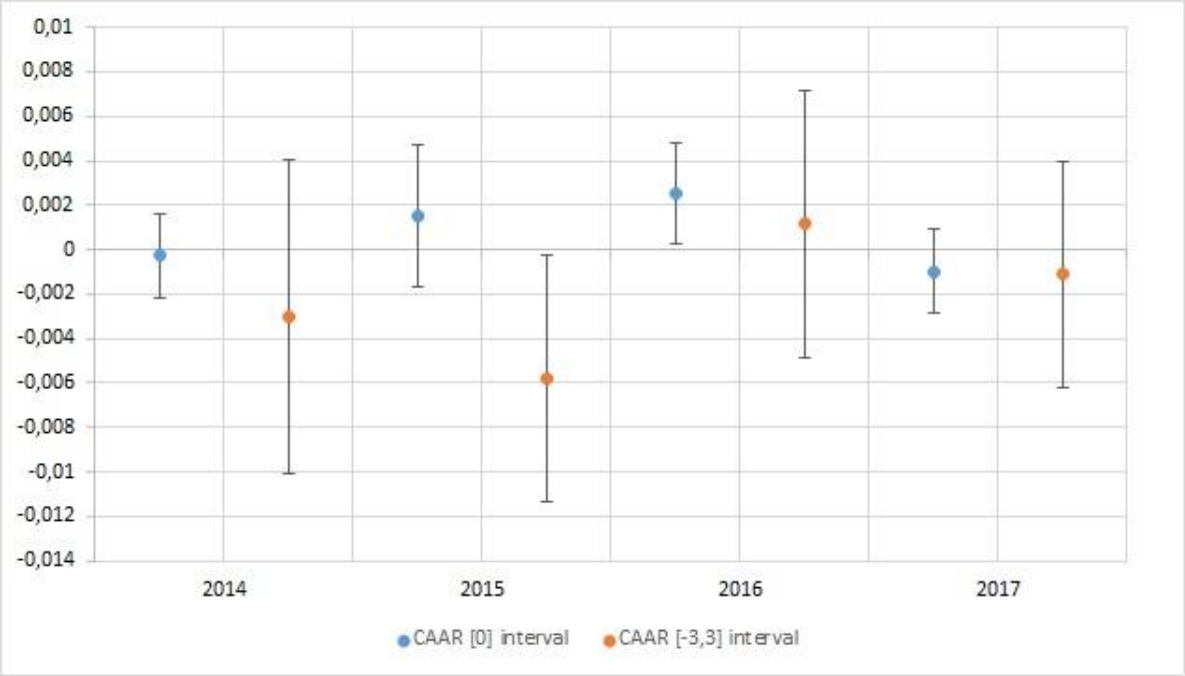

Figure 5: CAAR of top 100 firms by year, including 95% confidence interval

For a more in-depth exploration, the dataset has been split into the four different years, and regressions 1 and 6 from Table 7 have been executed again, now for each year separately. The results of this analysis is displayed in Table 8.

Table 8: Univariate regressions by year

	Year	β Green score	p-value β Green score	Constant	p-value constant	R-squared	Obs.
CAR [0]	2014	-0.0009	0.690	0.0006	0.434	0.0003	459
	2015	0.0047*	0.090	-0.0015	0.177	0.0065	442
	2016	0.0006	0.847	0.0013	0.262	0.0001	445
	2017	-0.0070***	0.009	0.0026***	0.002	0.0152	445
CAR [-3,+3]	2014	-0.0030	0.657	-0.0006	0.802	0.0004	459
	2015	-0.0105	0.142	-0.0005	0.854	0.0049	442
	2016	-0.0138	0.134	0.0083**	0.021	0.0050	445
	2017	-0.0020	0.821	0.0022	0.439	0.0001	445

* p<0.10, ** p<0.05, *** p<0.01

From Table 8 it can be concluded that, contrary to the evidence provided in Figure 4 and its respective t-tests, almost no significant differences exist over the different years regarding the influence of the Green score on abnormal returns during the event windows. Only in two regressions, which are during the shortest interval in 2015 and 2017, the coefficient for the Green score has a significant effect on abnormal returns. When looking at the longest event window, a difference in sign for the constant between 2014 and 2015 versus 2016 and 2017 has to be noted, but this constant is far from significant in three out of

four regressions. Table 8, along with Figure 5, shows no larger influence of CSP on firm value in more recent years, thus rejecting H_{3b}.

4.3.3 Differences Between Industries

Similarly to Figure 4, the CAARs have also been compared across the different industries, splitting the sample over the ten GICS industries in which Newsweek clusters the different companies. This evidence is displayed graphically in Figure 6, again including a 95% confidence interval.

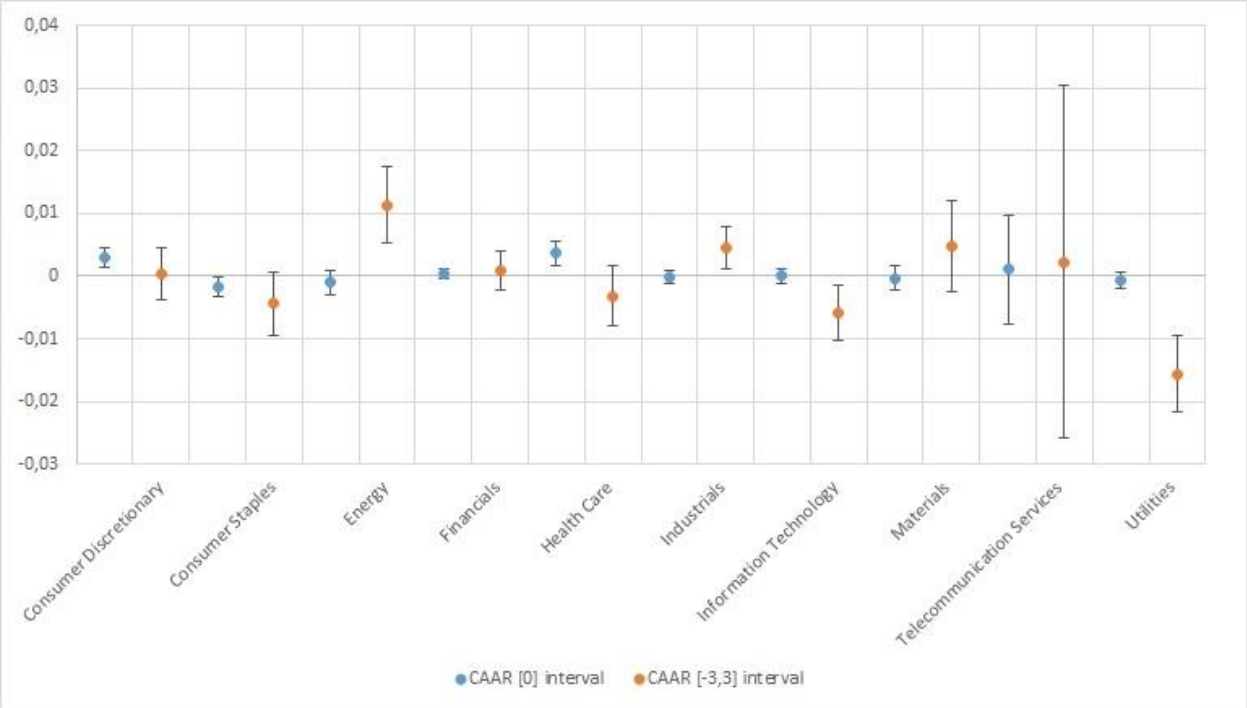

Figure 6: CAAR by industry, including 95% confidence interval

From Figure 6 it can be deducted that major differences exist between industries, although there is no clear contrast between light and heavy industries. Whereas the heavy Energy, Industrials and Materials industries on average have positive CAARs, the Utilities sector has the most negative average return. A note has to be made that the relatively large confidence interval of the Telecommunication Services industry is mainly due to the low number of observations.

For a more in-depth exploration, the dataset has been split into the ten different industries, and regressions 1 and 6 from Table 7 have been executed again, now for each industry group separately. The results of this analysis, similarly executed as the one displayed in Table 8, are shown in Table 9.

Table 9: Univariate regressions by industry

	Industry	β Green score	p-value β Green score	Constant	p-value constant	R-squared	Obs.
CAR [0]	Consumer Discretionary	0.0064	0.121	0.0014	0.273	0.0078	309
	Consumer Staples	-0.0029	0.461	-0.0006	0.727	0.0041	134
	Energy	-0.0046	0.437	-0.0002	0.920	0.0036	171
	Financials	-0.0002	0.933	0.0004	0.618	0.0002	314
	Health Care	-0.0035	0.438	0.0049***	0.007	0.0031	195
	Industrials	0.0012	0.657	-0.0005	0.628	0.0009	229
	Information Technology	0.0012	0.674	-0.0003	0.761	0.0008	217
	Materials	-0.0052	0.248	0.0016	0.414	0.0139	98
	Telecommunication	-0.0490**	0.027	0.0162**	0.044	0.1954	25
	Utilities	0.0032	0.428	-0.0019	0.249	0.0065	99
CAR [-3,+3]	Consumer Discretionary	0.0073	0.502	-0.0015	0.664	0.0015	309
	Consumer Staples	0.0026	0.843	-0.0054	0.337	0.0003	134
	Energy	-0.0164	0.385	0.0144***	0.003	0.0045	171
	Financials	0.0051	0.574	-0.0005	0.866	0.0010	314
	Health Care	-0.0192*	0.088	0.0032	0.473	0.0150	195
	Industrials	0.0103	0.218	0.0013	0.686	0.0067	229
	Information Technology	0.0023	0.826	-0.0066	0.115	0.0002	217
	Materials	-0.0182	0.275	0.0116	0.111	0.0124	98
	Telecommunication	-0.0292	0.703	0.0113	0.687	0.0065	25
	Utilities	-0.0109	0.554	-0.0115	0.129	0.0036	99

* p<0.10, ** p<0.05, *** p<0.01

From Table 9 it can be concluded that the effect of CSP on abnormal stock returns is far from significant in most industry groups. Only in two out of the twenty regressions, the Green score has a significant, negative effect on stock returns. Regarding the constants, the general image of Figure 6 has been repeated for the largest part, showing values far from zero for example at the energy, materials, and utilities sectors at the [-3,+3] event window. The latter makes it impossible to completely confirm H_{4a}, making it undecided, whereas the lack of significant correlations for the coefficient of the Green score rejects H_{4b}.

4.3.4 Addition of Control Variables and Fixed Effects

After the addition of control variables, for which the results are displayed in Table 10, the coefficient for the Green score remains highly insignificant regarding the shortest event window. However, regarding the longest event window, its effect remains negative, and becomes more significant. Moreover, its magnitude increases from a coefficient of -0.0072 in Table 7 to -0.0099 in Table 10. This adds to the evidence that rejects H_1.

Nevertheless, after adding industry and year dummies, the significance of CSP disappears in both event windows. When adding firm fixed effects, the Green score becomes significant regarding the shortest event window, and for the first time resulting in a positive effect.

Table 10: Regression analyses influence of Green score on stock returns, concurrent events removed, controls and industry, year, and firm dummies included

	CAR [0]					CAR [-3,+3]				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Green score	0.0004	0.0008	0.0008	0.0078**	0.0078**	-0.0099**	-0.0063	-0.0060	-0.0013	-0.0018
	(0.739)	(0.552)	(0.564)	(0.013)	(0.013)	(0.018)	(0.148)	(0.179)	(0.898)	(0.853)
Ln (Total assets)	-0.0005**	-0.0003	-0.0004		0.0010	0.0021***	0.0026***	0.0025***		0.0138***
	(0.033)	(0.144)	(0.140)		(0.496)	(0.002)	(0.001)	(0.001)		(0.004)
Debt ratio	0.0055***	0.0061***	0.0060***		0.0040	0.0050	0.0048	0.0040		0.0208
	(0.000)	(0.000)	(0.000)		(0.382)	(0.279)	(0.313)	(0.409)		(0.156)
Return on assets	-0.0084**	-0.0106***	-0.0101***		-0.0008	-0.0106	-0.0106	-0.0072		-0.0103
	(0.026)	(0.006)	(0.009)		(0.892)	(0.365)	(0.379)	(0.552)		(0.599)
Constant	0.0041*	0.0052**	0.0051**	-0.0083	-0.0211	-0.0186***	-0.0227***	-0.0235***	0.0005	-0.1670***
	(0.064)	(0.031)	(0.036)	(0.171)	(0.268)	(0.007)	(0.001)	(0.002)	(0.981)	(0.006)
Industry dummies	No	Yes	Yes	No	No	No	Yes	Yes	No	No
Year dummies	No	No	Yes	No	No	No	No	Yes	No	No
Firm dummies	No	No	No	Yes	Yes	No	No	No	Yes	Yes
R-squared	0.0146	0.0399	0.0413	0.4914	0.4920	0.0095	0.0390	0.0457	0.4637	0.4689
Adjusted R-squared	0.0124	0.0329	0.0326	0.1801	0.1789	0.0073	0.0319	0.0371	0.1355	0.1417
Obs.	1,787	1,787	1,787	1,787	1,787	1,787	1,787	1,787	1,787	1,787

* p<0.10, ** p<0.05, *** p<0.01, significance between parentheses

When considering the explaining power of the models, it has improved considerably. When looking at the adjusted R-squared, correcting for the fact that more variables were added to the model, it has improved to 0.73% and 1.24% by only adding control variables. When also adding industry and year dummies, the adjusted R-squared improved to 3.26% and 3.71%.

4.4 Medium-term Stock Return Analysis

When extending the time window, the first check that has to be made regards multicollinearity. As was stated in Section 4.2, the variable *Green score* correlates significantly with the other explaining factors, where the method of multivariate regression requires no relationships between explanatory variables. Therefore, the VIF scores are calculated for the independent variables in models 2, 3, and 4 and displayed in Table 11. Since no score is above 2, below the threshold of 10, this poses no problem for the further analyses (Hair et al., 2014).

Table 11: VIF scores for multicollinearity check regressions in Table 12

	VIF-score Model 2	VIF-score Model 3	VIF-score Model 4
Green score	1.001	1.007	1.008
Monthly equity risk premium	1.001	1.096	1.184
Monthly small-minus-big factor		1.1102	1.104
Monthly high-minus-low factor		1.014	1.474
Monthly momentum factor			1.559

In Table 12 the results of the regression analyses are displayed. At first, regarding model 1, the Green score has a significant, negative influence on monthly excess returns. However, when expanding the model with more explanatory variables, creating more reliable asset pricing models with a higher R-squared, this effect disappears and the coefficient becomes insignificant.

When adding industry and year dummies, the Green score becomes a significant regressor again, albeit with a lower coefficient. When adding the firm dummies, the significance disappears completely. Since the influence of CSP on stock returns was significantly negative, more, robust evidence has been added that rejects H_1.

Table 12: Regression analyses influence of Green score on medium-term stock returns, industry, year, and firm dummies included

	Monthly stock returns - Monthly risk-free rate						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Green score	-0.0077***	-0.0036	-0.0029	-0.0027	-0.0057**	-0.0054**	-0.0048
	(0.003)	(0.135)	(0.234)	(0.258)	(0.023)	(0.036)	(0.458)
Monthly equity risk premium		1.0374***	1.0180***	1.0047***	1.0051***	1.0029***	1.0097***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Monthly small-minus-big factor			0.0776***	0.0804***	0.0790***	0.0799	0.0783***
			(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Monthly high-minus-low factor			0.0515**	0.0099	0.0074	0.0013	0.0091
			(0.017)	(0.704)	(0.776)	(0.962)	(0.729)
Monthly momentum factor				-0.0544***	-0.0539***	-0.0476**	-0.0518***
				(0.004)	(0.005)	(0.015)	(0.007)
Constant	0.0168***	0.0034***	0.0033***	0.0036***	0.0027**	0.0026	-0.0040
	(0.000)	(0.000)	(0.000)	(0.000)	(0.047)	(0.125)	(0.725)
Industry dummies	No	No	No	No	Yes	Yes	No
Year dummies	No	No	No	No	No	Yes	No
Firm dummies	No	No	No	No	No	No	Yes
R-squared	0.0004	0.1530	0.1537	0.1540	0.1555	0.1556	0.1862
Adjusted R-squared	0.0003	0.1529	0.1536	0.1538	0.1550	0.1550	0.1606
Obs.	27,571	27,571	27,571	27,571	27,571	27,571	27,571

* p<0.10, ** p<0.05, *** p<0.01, significance between parentheses

4.5 Short-term Fundamentals Analysis

In order to find out in which ways CSP influences short-term firm value, the changes in some key corporate fundamentals are regressed on the Green score. The time window when these changes are calculated is the same as the one during which the medium-term stock return was executed (in Section 4.4), in order to form a clear bridge between the results. The results of the regressions are displayed in Table 13 and Table 14.

The first, and most striking relationship to be found, is the negative, highly significant influence of the Green score on revenue increase. Taking into account the relatively large constant, 17.13% when industry- and year-dummies are included, a Green score of up to 0.91 would still result in a positive revenue increase. However, the results suggest that more sustainable firms are unable to profit from the large rises in revenue occurring between 2013 and 2017, completely rejecting H_5.

Regarding increased operational efficiency, the regression models are insignificant for the largest part. However, when industry- and year-dummies are included, a significant, positive effect is to be found, confirming H_6. When looking at an increase in required investments (normalized for revenue increases), the effect is curiously reverse. More sustainable companies do not require a higher amount of capital expenditures at all, completely rejecting H_7, and suggesting that by becoming more sustainable, the required infrastructure was already present. Finally, regarding intangible benefits, the models also suggest a reverse relationship between CSP and intangible assets than the one described in literature, rejecting H_8. However, it has to be noted that a lot of noise exists in the way the intangible assets have been calculated.

When looking at the adjusted R-squared of the various regression models, it has to be noted that the models concerning revenue increase explain the largest share of variance, coming to 6.09% when including firm- and year-dummies. Furthermore, the fact that for all four dependable variables the model turned insignificant after including firm fixed-effects, indicates that more variables have a role in explaining the yearly changes in company fundamentals.

Table 13: Regression analyses influence of Green score on sales growth and operational efficiency increase, industry, year, and firm dummies included

	Revenue percentage increase				EBITDA margin increase			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Green score	-0.1606***	-0.1746***	-0.1883***	-0.0556	0.0297	0.0227	0.0405*	0.0521
	(0.000)	(0.000)	(0.000)	(0.404)	(0.158)	(0.304)	(0.073)	(0.396)
Constant	0.1067***	0.1316***	0.1713***	0.0347	-0.0100	-0.0026	-0.0023	-0.0415
	(0.000)	(0.000)	(0.000)	(0.767)	(0.196)	(0.822)	(0.868)	(0.695)
Industry dummies	No	Yes	Yes	No	No	Yes	Yes	No
Year dummies	No	No	Yes	No	No	No	Yes	No
Firm dummies	No	No	No	Yes	No	No	No	Yes
R-squared	0.0183	0.0506	0.0673	0.4790	0.0011	0.0041	0.0133	0.2682
Adjusted R-squared	0.0177	0.0456	0.0609	0.1787	0.0005	-0.0013	0.0063	-0.1527
Obs.	1,899	1,899	1,899	1,899	1,833	1,833	1,833	1,833

* p<0.10, ** p<0.05, *** p<0.01, significance between parentheses

Table 14: Regression analyses influence of Green score on investments increase and intangible assets increase, industry, year, and firm dummies included

	CAPEX percentage increase (normalized)				Intangible assets percentage increase (normalized)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Green score	-0.1906***	-0.1970***	-0.2582***	0.0188	-0.7285**	-0.8439**	-1.0087***	-0.1416
	(0.005)	(0.006)	(0.000)	(0.919)	(0.024)	(0.013)	(0.004)	(0.859)
Constant	0.1536***	0.1478***	0.1853***	0.4478	0.5202***	0.5600***	0.4585**	0.1876
	(0.000)	(0.000)	(0.000)	(0.157)	(0.000)	(0.002)	(0.033)	(0.889)
Industry dummies	No	Yes	Yes	No	No	Yes	Yes	No
Year dummies	No	No	Yes	No	No	No	Yes	No
Firm dummies	No	No	No	Yes	No	No	No	Yes
R-squared	0.0044	0.0182	0.0291	0.3644	0.0029	0.0075	0.0104	0.4812
Adjusted R-squared	0.0038	0.0126	0.0220	-0.0058	0.0023	0.0018	0.0030	0.1782
Obs.	1,786	1,786	1,786	1,786	1,745	1,745	1,745	1,745

* p<0.10, ** p<0.05, *** p<0.01, significance between parentheses

4.6 Economic Significance of Results

For calculating the economic significance of the various regression results, besides only the statistical significance, the following equation was used:

$$Economic\ significance = \frac{\beta_{Green\ score} * \sigma_{Green\ score}}{\mu_{Dependant\ variable}}$$

where β is the coefficient of the Green score in the respective regression model, σ is the standard deviation of the Green score as shown in Table 1, and μ is the average of the dependent variable, also as shown in Table 1.

For each dependent variable used throughout the thesis, the coefficient for the Green score has been chosen for which the model achieved the highest adjusted R-squared, while the coefficient was still significant. These are model 4 from Table 10 (for CAR [0]), model 6 from Table 10 (for CAR [-3,+3], model 5 from Table 12 (monthly excess stock return), model 3 from Table 13 (for revenue percentage increase), model 7 from Table 13 (for EBITDA margin increase), model 3 from Table 14 (CAPEX percentage increase), and model 7 from Table 14 (intangible assets percentage increase). The results of the economic significance calculation are displayed in Table 15.

Table 15: Economic significance calculation

Dependent variable	β Green score	σ Green score	μ dependent variable	Percentage increase
CAR [0]	0.0078	0.2066	0.0006	+268.58%
CAR [-3,+3]	-0.0099	0.2066	-0.0004	-511.34%
Monthly excess stock return	-0.0057	0.2066	0.0145	-8.12%
Revenue percentage increase	-0.1883	0.2066	0.0577	-67.42%
EBITDA margin increase	0.0405	0.2066	-0.0010	+812.43%
CAPEX percentage increase (normalized)	-0.2582	0.2066	0.0956	-55.80%
Intangible assets percentage increase (normalized)	-1.0087	0.2066	0.2953	-70.57%

From Table 15 it can be deducted that the economic significance of all results is rather large. The smallest, regarding monthly excess stock returns, suggest that an increase of one standard deviation in the Green score results in a loss of 8.12% compared to a similar company.

For the largest percentage increases, it has to be noted that the relatively large increase is mainly due to the average of the dependent variable being close to zero.

5. Discussion

In this chapter the results of the empirical analyses are being discussed. First of all, in the conclusion, using the rejected or confirmed hypotheses, the research questions will be answered. Secondly, the implications of this research will be elaborated, both for an academic perspective and for practitioners. Afterwards, the limitations of the study are being discussed, and lastly, suggestions for further research are being stated.

5.1 Conclusion

After having tested the hypotheses in Chapter 4, it is possible to find answers to the research questions formulated in Section 1.2.

First of all, since the majority of the evidence regarding H_1 was negative, it is possible to say that being sustainable as a company has a negative influence on firm value on the short term, finding a concrete answer to the main research question. Both in the event window when the ranking was published as in the year previous to this announcement, more sustainable firms experience significantly lower stock returns. Regarding the difference between the characteristics of the ranking, no significant differences exist, finding no clear answer for sub-question 1.

Significant differences do exists between the average stock returns for different years and industries. The CAAR was significantly larger in the years 2016 and 2017 compared to 2014 and 2015, and also major contrasts exist between the industry groups. Regarding the coefficients, however, these results were nowhere to be found for both time and industry, finding similar answers to sub-questions 2 and 3.

This negative influence of CSP on firm value is partly explained by annual increase in company fundamentals. The most striking effect was a highly significant, large decrease in sales growth for companies with a higher CSP, whereas operational efficiency only increased by a minor amount, which answers sub-question 4.

5.2 Academic Implications of Research

This research manages to close two gaps in existing literature on the short-term impact of CSP on firm value. Firstly, the time analyses found concrete results that the overall thoughts on sustainability among investors has changed significantly in the past few years. Especially after the signing of the 2015 Paris Climate Agreement abnormal returns on average became larger, and positive compared to the years before this.

Secondly, this study was able to act as a bridge from finding correlations between CSP and short-term firm value towards a causal relationship between the two. The hypothetical model put by Yadav et al. (2016) stated meaningful mechanisms in which sustainability is able to influence the underlying value of a firm, of which revenue growth was both the most statistically significant and economically relevant fundamental.

5.3 Business Implications of Research

This research targets two main groups of professionals. First of all, it gives guidance to investors on how to invest in firms with a high CSP. As these firms experience a small loss of value on the short term, it is not advisory to invest in them if the investor is searching for quick gains. However, since the evidence is overwhelmingly positive on the long term (Sharples et al., 2012), the investment will pay off eventually.

Secondly, since the negative effect of CSP on firm value is partly being explained by a major decrease in revenue growth and only a minor increase in operational efficiency, firms should be able to present the value of a sustainable initiative very clearly, and even better be able to achieve concrete results immediately.

5.4 Limitations

The most limiting factor in the first part of the analysis, i.e. the event study treating the abnormal stock returns immediately after publishing the ranking, is the lack of a reliable method to filter out other concurring events than earnings announcements or acquisitions, e.g. fines, corporate scandals, CEO changes, or profit warnings. The lack of a structured database containing all relevant news made it impossible to cross-reference to other meaningful events and filter them out.

Moreover, regarding the fundamentals analyses, it was especially difficult to find a meaningful proxy for intangible benefits of sustainability. The *total intangible assets* variable treats a lot of effects which are not relevant to CSP, and, furthermore, includes the goodwill when a firm acquires another firm. Most strikingly, this variable misses the factor of corporate reputation, which is mentioned regularly in literature as a relevant asset regarding CSP (Surroca et al., 2010).

5.5 Further Research

First of all, since the geographical scope of this research is limited to US firms only, it would be interesting to see whether significant differences exist compared to other developed, industrial nations. Murguia & Lence (2015) already found significant differences between US and non-US firms when investigating the top 100 of 2010's ranking, and it would be interesting to see whether these results hold when extending the timeline and number of firms.

Moreover, since Newsweek only ranks the 500 largest firms by market capitalization, another interesting aspect would be to extend the research to also include smaller companies. Since the control variable *Total assets* significantly, positively moderated the short-term effect of CSP on firm value, it can be expected that more differences are to be found when smaller, public firms are added.

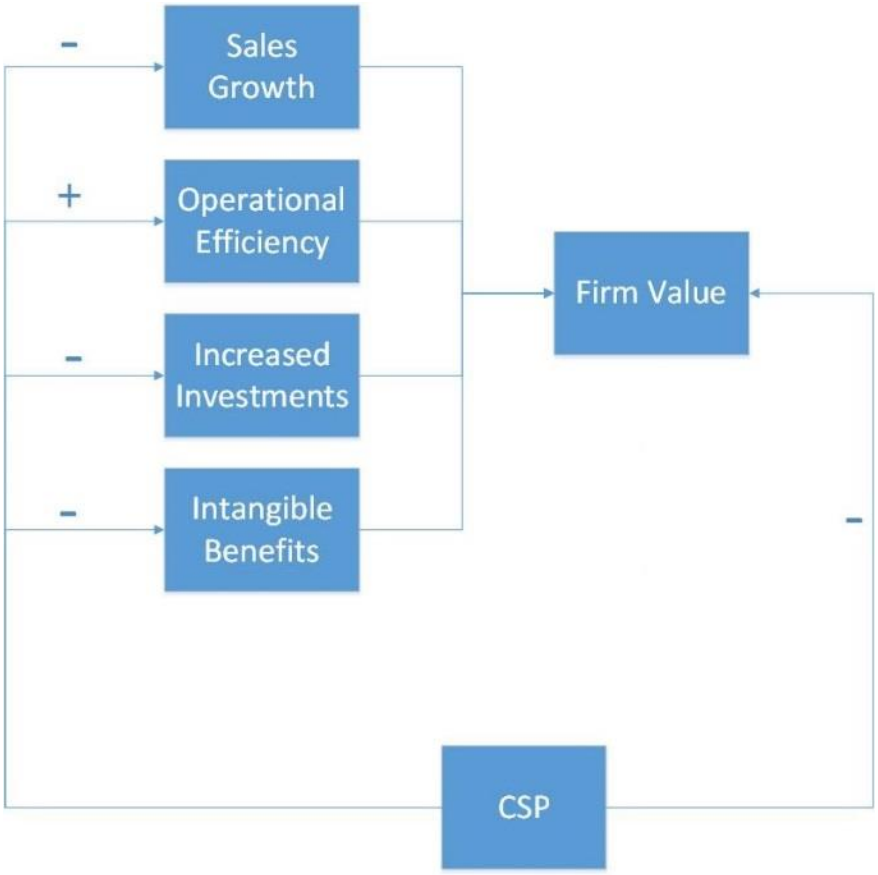

Figure 7: Model for further research

In this thesis, while applying the regressions during the same time period, a beginning has been made regarding the causal effect of CSP on firm value, as shown in Figure 7. However, to what extent each fundamental is related to firm value has not been investigated in this thesis, but could be interesting in further researches.

Finally, it would be interesting to investigate whether the overall stock climate significantly moderates the relationship between CSP and firm value. This research attributed stock returns from 2013 until 2017, during which the stock market experienced a major expansion. Furthermore, coming at an average of 5.77%, revenues grew rapidly. A suggestion for further research would be to re-execute the research during times of recession, to find out whether investors react differently in times of trouble.

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