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Market Reaction to Environmental Controversies: The role of perceived behaviour

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Abstract

The rising importance of ESG related issues has been witnessed both by recent literature and surveys. In this paper, we first analyse whether environmental controversies have a significant impact on the involved companies' stock returns. Secondly, we investigate whether companies' perceived environmental behaviour influences the market's reaction. We contribute to the literature by using the environmental pillar score from the year prior to the controversy (lagged E score) as a proxy for perceived environmental behaviour. Our sample consists of 86 controversies involving U.S. public companies in the years 2017-2021. We apply an event study methodology to analyse the cumulative average abnormal returns (CAAR) in an event window spanning from three days before the event date to three days after. The result, although not statistically significant, suggests that there has been a negative reaction following the controversial events visible especially between day 0 and day 2. Subsequently, we compute cumulative abnormal returns (CAR) for each controversy over this period (i.e., between day 0 and day 2), and regress it on the lagged E score. The results shows a positive significant relationship between the lagged E score and CAR suggesting that perceived firm environmental behaviour may function as an anchor from which subsequent events are judged.

Keywords: ESG, environmental controversies, market reaction, perceived behaviour, anchoring

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1 Introduction

This paper examines the market reaction to environmental controversies and whether the reaction can be explained by investors' previous perception regarding firms' environmental behaviour. While some studies have historically argued that the focus on environmental behaviour brings more costs than benefits for firms (Palmer, Oates & Portney, 1995), others have contended that economic and environmental performance can be complements (Porter & van der Linde, 1995). More recent research indicates that there is an increasing environmental pressure and accountability on firms from both the public and investors (Flammer, 2013; Al-Tuwaijri, Christensen, & Hughes, 2004). The growing importance of environmental, social, and governance (ESG) related issues to investors (Deloitte, 2021; EY, 2020) and other stakeholders (Maignan & Ferrell, 2004) has been further highlighted by surveys and research.

Furthermore, the academic literature shows that corporate misconduct, controversies, and illegal behaviour result in negative reactions from the stock market (Guntorpe, 1997; Reichert, Lockett, & Rao, 1996; Paruchuri & Misangyi, 2015; Perry & de Fontnouvelle, 2005). Nevertheless, not all misconducts spark the same reaction, not even comparable acts from comparable firms. In September of 2015, it was announced by the Environmental Protection Agency in the US that Volkswagen had cheated on emission tests using fraudulent software and violated the Clean Air Act. The controversial event, also known as "dieselgate", affected over 11 million vehicles worldwide and more than 500.000 vehicles in the US (Cremer, 2015). Volkswagen's share price dropped by 30% in the week following the announcement and led to the resignation of their CEO Martin Winterkorn (La Monica, 2015). A year and a half earlier, General Motors were sued by the US Department of Justice for defective and faulty ignition switches which were linked with over 100 deaths (Kessler, 2015). A week after the lawsuit, General Motors' stock price dropped by 1.8% (Fukushima, 2014). This inconsistency in the reaction from the market can be further exemplified with Exxon and Whole Foods which were both found to overcharge customers; the former saw a drop in the stock price of 3% after the news was published while the latter saw a 1% increase (Baker, Derfier-Rozin, Pitesa, & Johnson, 2019).

Studies on the underlying factors behind the market's reaction have shown varied results. Some studies suggest that markets react negatively to ESG controversies only for high-visibility firms (Aouadi & Marsat, 2018); oth-

ers suggest that controversies fueled by a sense of hypocrisy exarcebates the response from the market (Janney & Gove, 2011). Some also discuss the relevance of media attention and portrayal of culpability (Carberry, Engelen, & Van Essen, 2018), while others suggest that ESG sector reputation plays an important role in determining the reaction from the market (Capelle-Blancard & Petit, 2019). Godfrey (2005) argues that firms which have previously behaved in a socially responsible way can face more lenient responses from stakeholders. Furthermore, the importance of firm perception and expectations has also been discussed by different authors. Creyer and Ross (1996) argue that a company perceived to be ethical may suffer more after a controversial or unethical event due to the reference point from which it is judged; on the other hand, Lange and Washburn (2012), argue that a firm perceived to behave ethically may be judged more leniently due to people anchoring the firm with a certain behaviour. Even though the market's reaction to misconduct has been widely investigated, the literature has been relatively limited concerning the heterogeneity in investors' reaction and the factors responsible for either mitigating or exacerbating this response. The advantage of ESG related behaviour for alleviating the market's reaction after controversies can be ambivalent and we intend to contribute to that discussion.

Given the rising importance of environmental concerns for investors, we investigate if companies' perceived prior environmental behaviour contributes in explaining the heterogeneity in investors' reactions. By perception we mean the notion and impression that investors have of how environmentally responsible the firms is and has been. This perception can serve as a bias for future judgements of firm's behaviour (Tversky & Kahneman, 1974; Lange & Washburn, 2012). The role of perceptions and expectations in people's decision-making processes has been found to be significant (Creyer, 1997). Additionally, the evaluation and judgement of current firm behaviour by individuals can be influenced by the firm's previous engagement in socially responsible behaviour (Lange & Washburn, 2012; Jones & Davies, 1965). We proxy perceived behaviour by the environmental pillar score obtained from Refinitiv's ESG database. Our sample consists of 86 controversies in the United States spanning from 2017-2021. Through an event study we show that in our sample the cumulative average abnormal returns (CAAR) following environmental controversies are negative but not statistically significant. Moreover, we conduct a regression analysis showing that investors' prior perceptions are significant in explaining the market reaction even when

controlling for other variables. Furthermore, the coefficients are positive implying that better perceived environmental behaviour leads to more lenient responses from the market.

The remainder of this paper is structured as follows. The next chapter discusses relevant literature and presents our research hypotheses. Chapter 3 follows with a description of the data used in this study. Chapter 4 presents our event study and regression analysis methodology, while chapter 5 discusses our results. Finally, chapter 6 concludes this thesis.

2 Literature Review and Hypotheses

This chapter discusses relevant literature to our study and presents our research hypotheses accordingly. We firstly discuss the rising environmental pressure that firms face from investors and other stakeholders. We then review literature discussing how the market reacts to controversies and studies researching the underlying dynamics behind the reactions. The final part of the literature review shows the importance of how firms' behaviour is perceived by others and how it can affect judgements.

2.1 Environmental pressure

While some literature argues against the relevance of being environmentally responsible for financial performance (Friedman, 2002; Lee, Faff, & Rekker, 2013; Palmer, Oates & Portney, 1995), other studies indicate that there is and has been an increasing trend in investor sensitivity to environmental issues (Aouadi & Marsat, 2018; Flammer, 2013). This can be seen by investors' preferences in firms which are environmentally responsible and avoid controversies in this area (Flammer, 2013; Al-Tuwaijri, Christensen, & Hughes, 2004). Recent surveys similarly support the importance of ESG related issues for investors and the significant increase in pressure from them (Bell, 2021). Additionally, there is also increasing external pressure from society, the media, and regulators (Flammer, 2013). EY's global institutional investor survey in 2020 suggests that this pressure also comes from institutional investors. Out of the investors surveyed, 73% answered that they perform a rigorous evaluation of companies' non-financial disclosures and further that is a pivotal part of their investment decisions (EY, 2020). Other surveys suggest that a majority of institutional investors make ESG assessments regularly (Deloitte, 2021).

Additionally, several studies indicate that environmentally responsible behaviour has a positive impact on firms' market return. Statman and Glushkov (2009) find significant abnormal returns using a high-low portfolio strategy for social responsibility scores from KLD with a sample between 1992-2007. Specifically, a portfolio built on this strategy using the environmental score shows annual excess returns of 2.69% using the Fama and French (1992) three-factor model. Moreover, using a sample between 1993-2010, Eccles, Ioannou, and Serafeim (2014) classify 180 U.S. firms on their environmental sustainability level. They find that a high-low portfolio strategy, built using

the Carhart (1997) four-factor model, can report excess annual returns of up to 4.8%. Derwall, Guenster, Bauer, and Koedijk (2005) also find that a high-low portfolio strategy using the Carhart (1997) four-factor model reveals an outperformance of the higher rated firms in terms of ecologically responsible behaviour compared to lower rated firms. Their sample includes U.S. firms in the period between 1995-2003.

Given this, we argue that the importance of the environmental dimensions for firms is not to be easily disregarded. With what can be interpreted as ubiquitous environmental pressure, failing to adhere to the changing market landscape can be costly for firms.

2.2 Market reaction to misconduct and controversy

The majority of the literature across disciplines has come to a consensus that firm misconduct and illegal acts lead to negative reactions from investors (Gunthorpe, 1997; Reichert, Lockett, & Rao, 1996; Paruchuri & Misangyi, 2015; Perry & de Fontnouvelle, 2005). Frooman (1997) finds significant abnormal negative returns due to firm misconducts and suggests that socially responsible behaviour is necessary for shareholder wealth to increase. In other areas such as accounting and finance, Karpoff, Lee, and Martin (2008) observe much larger penalties imposed by the market compared to the penalties from the Securities and Exchange Commission (SEC) following financial fraud. They argue that the reputational penalty is over 7.5 times larger than that imposed by legal and regulatory entities. This reputational penalty has been studied before in the context of federal crimes and has come to similar conclusions (see e.g. Alexander, 1999). Studies showing similar results of significant negative abnormal return following firm misconduct and unethical behaviour can also be found in the area of business ethics (Capelle-Blancard & Petit, 2019; Gunthorpe, 1997).

Furthermore, the nature of conduct matters, that is, good behaviour and bad behaviour are not treated symmetrically (Arora & Dharwadkar, 2011). Skinner (1994) argues that firms' disclosure of bad news lead to stronger reactions by the market compared to the reaction following the disclosure of good news. However, a more recent study by Capelle-Blancard and Petit (2019) also finds that ESG news from the media have a larger impact on the market value of firms relative to when the news are disclosed by NGOs or firms themselves. As mentioned, the literature mostly agrees that firm misconduct leads to negative reactions from the stock market. Hence, the

first part of the study can be summed up by Hypothesis 1.

Hypothesis 1: Environmental controversies lead to a significant negative reaction from the market.

2.2.1 Dynamics behind investor reaction

Though it might seem arbitrary, the process of the market reacting to firm misconduct is a complex one and the literature trying to explain the underlying dynamics of the inconsistency in investor reaction is relatively limited. Barnett (2014) addresses this inconsistency from a cognitive perspective. He argues that stakeholders take on a complex cognitive task which involves the assessment of several factors to decide on how to react to firm misconduct and deciding on the potential punishment. He proposes a three-step filtering process of stakeholder punishment of misconducts which consists of noticing, assessing, and acting. The stakeholders we bear in mind for this study are investors.

Firstly, he recognises that people have limited attention and diverse stimuli constantly competing for it. He criticises the studies stemming from the stakeholder theory, proposed by Freeman (1984), which argue that stakeholders' power to punish and reward firms conditions them to behave well. That would require stakeholders to constantly police and monitor firm behaviour. Given that investors rarely invest in a single company and the limited attention span of people, some misconducts will have lower or higher probability of being noticed. Additionally, he contends that this probability of noticing misconducts varies with, for example, personal interests and media source preferences. Barnett (2014) therefore argues that part of the inconsistency simply stems from the fact that some occurrences of misconduct will go unnoticed while others will not.

Secondly, another layer of complexity is added since stakeholders assess not only the nature of the misconduct itself (given that it has been noticed) but also the nature of the firm committing the act. An example of the complexity of the process can be drawn from Godfrey (2005, p.788) who states that firms can accrue "positive moral capital" which can alleviate potential punishments from stakeholders. This could protect firms by giving them the benefit of the doubt in times of controversy. Additionally, Barnett (2007) contends that stakeholders also consider the historical socially (ir)responsible behaviour of firms when deciding how to react to misconducts.

Wood (1991, p.693) states that in order to assess a firm's corporate social performance and behaviour, one must inspect deeper into its "principles, processes, and outcomes" to understand the policies and motivations underlying its decisions. Nevertheless, discrepancies in the assessment of the misconduct are partly due to factors such as confirmation bias; moreover, the assessment can also vary with the mood of the stakeholder, according to Barnett (2014). He contends that it is unreasonable to assume that stakeholders consistently are able to police firms in such a complex manner and ties his argument to the concept of bounded rationality, which restricts stakeholders' ability to consistently punish firm misconduct. The inconsistency in punishment can therefore be partly attributed to the complexity of the stakeholder making sense of the event and judging it based on both the nature of the misconduct and of the firm.

Thirdly, Barnett (2014) argues that even if the event is noticed and it is regarded as a misconduct, the stakeholder might still not decide to punish the firm. The stakeholders decide on whether or not to punish depending on their limited time and resources, and might deem punishment to require too much effort and thus refrain from doing so. When it comes to consumers, for instance, Vogel (2005) argues that they are generally not willing to go out of their way to be ethical in their purchasing decisions. Given that the event has been noticed and deemed to be a misconduct, he states that the probability of stakeholders' deciding to actually punish depends on factors such as their morality, the opportunity cost they perceive, and the impact they expect that the punishment will have on the firm. In contrast, Karpoff (2012) argues that investors need not be constantly and thoughtfully policing and disciplining firm behaviour, but rather that investors in protecting their own interest against future misconducts can indirectly punish the firm.

Other literature has studied the role of information, media, and media coverage in explaining investor reactions to firm misconduct (Carberry, Engelen, & Van Essen, 2018). Using a sample of 345 firm misconducts across five European countries, Carberry, Engelen, and Van Essen (2018) conclude that when the media is able to provide clear information which reduces the ambiguity of the misconduct, there are significant negative abnormal returns. This negative reaction is further enhanced if the whole firm itself is portrayed as culpable in the media, compared to specific individuals within the firm. Moreover, Capelle-Blancard and Petit (2019) find that ESG sector reputation has a significant effect on the abnormal returns. Aouadi and Marsat (2018) contend that controversies can have an impact on firm value but that

it has no significant effect when interacted with a score for corporate social performance. They further argue that this holds true only for high-visibility firms which receive considerable attention from the media.

Some studies also focus on how countries' legal regimes shape the reaction of the stock market following firm misconduct (Erragragui, Peillex, Benlemlih, & Bitar, 2023). Others investigate the perceived morality and attribution of motives of unethical acts at the firm- and event-level (Baker et al., 2019).

2.3 The role of perceived behaviour

Prior perceptions and expectations have been found to have an important role in people's decision making (Creyer, 1997). Creyer (1997) and Creyer and Ross (1996) use prospect theory to argue that consumers react more harshly to unethical behaviour by firms if they previously perceive and expect them to be ethical, and less harshly if the firm is not perceived as such. If an individual has exceedingly high expectations of firm behaviour, violating these expectations can spark negative reactions (Rhee & Haunschild, 2006). Hence, consumers asymmetrically judge firm behaviour from their reference point of perception.

On the other hand, perceived behaviour and expectations may work the other way too. That is, firms with a previous bad perception will face harsher reactions while firms perceived as good will face more lenient reactions. Klein and Dawar (2004) argue that the prior perception produces a spillover effect which biases people's judgement of firm behaviour. They find that firms with a prior negative perception are blamed more for controversies. Indeed, prior perception of socially responsible behaviour can play an important role in how individuals judge and assess current firm behaviour (Lange & Washburn, 2012; Jones & Davies, 1965). In line with Tversky and Kahneman (1974), Lange and Washburn (2012) argue that firm's perceived behaviour forms the anchor from which new behaviour is judged. Individuals then make adjustments from that anchor, but adjust insufficiently which creates a bias towards the prior perception (Tversky & Kahneman, 1974). Hence, a firm perceived to be good may be forgiven more easily and its responsibility in a controversial event may be minimised. Moreover, Janney and Gove (2011) find that firms' corporate social responsibility (CSR) reputation can have a significant effect in determining the reaction from the market after a corporate scandal. They argue that CSR initiatives can serve as a cushion from investors' negative reaction. However, they state that investors can also react

more harshly if the firm is involved in a scandal related to their CSR initiatives, thus leading to a sense of hypocrisy. Overall, the literature suggests that good firm behaviour in terms of ESG and CSR can be interpreted as a two-edged sword.

With rising environmental pressure, the perception of firm's environmental behaviour can be assumed to influence investors. Based on the previous discussion, we argue that prior perceptions could function as an anchor from which investors insufficiently adjust their response. We proxy this perception via the environmental pillar score from Refinitiv; the scores are lagged one year relative to the year of the environmental controversy itself to reflect prior perceptions from investors. Hence, if a company is perceived to behave in an environmentally responsible way, thus having a higher lagged E score, the negative reaction stemming from a controversial event may be mitigated. With this in mind, our hypotheses are as follow:

Hypothesis 2a: Prior perceptions of environmental behaviour are significantly related to CAR following environmental controversies.

Hypothesis 2b: The better the perception, the more lenient the reaction from the market following a controversial event.

3 Data

In this chapter we present the data we have used in our study. Firstly, we discuss our sample of environmental controversies and how they have been categorised; subsequently, we present the variables relevant for both the event study and the regression analysis.

3.1 Environmental controversies

We have focused on environmental controversies for US public companies in the period 2017-2021. The data has been accessed through the Refinitiv database, where environmental controversies are defined as significant events "related to the environmental impact of the company's operations on natural resources or local communities" (Refinitiv, 2022, p.26). We have focused on the companies included in the list "Refinitiv ESG USA" for which ESG scores are available, since this is needed in the second phase of our study.

We have selected a maximum of one controversy per company per year, and we have selected the controversy taking place the earliest in the year of interest. The reason for this is that the perception may be altered during the year if multiple environmental controversies happen. When focusing only on the earliest controversy, prior perceptions are more likely to be captured and represented by the lagged E score rather than being confounded by other events happening during the year. Nevertheless, it could still be possible that controversies other than environmental ones have happened before the selected events, and they may have an impact on the company overall. Finally, in order to mitigate confounding events, we have also checked that there were no other controversies of any nature in a range going from ten days prior to ten days after the event date of the controversy selected.

Subsequently, we have removed thirteen controversies which did not appear to be of an environmental nature to us (e.g., patent infringements or other litigations), one controversy for which we have not been able to find the news online, and three controversies for which the news are arguably hard to define as controversial. Eventually, the sample consists of 86 controversies. Moreover, we have also changed the event dates for some of the controversies, given the presence of news articles published earlier than the event date on Refinitiv.

The environmental controversies in our sample are different from each other with respect to the event taking place. It is arguable that the news of

a settlement may not have the same impact as a breaking news of a current damage to the environment. It might be that the market will react less to the former since settlements refer to events the market is already aware of and for which the market has probably already adjusted its expectations. Hence, they are already to some extent reflected in the stock price. In order to investigate whether the reaction changes depending on the content of the news, we have read each news article and subsequently created five categories. The categories are different from each other but they are not mutually exclusive: hence, a controversy could end up in multiple categories. The categories are the following:

- Restrictions on operation: whether the company is restricted (or there is a threat of being restricted) from operating, perhaps because some permits have been revoked due to environmental reasons;
- Lawsuits/Accusations: whether a company has been accused or has been sued for causing a certain event;
- Settlements/Rulings: whether the company has settled for something it has allegedly done or whether it has been convicted;
- Protests/open criticism: whether there are protests against the company, or whether it is openly criticised;
- Current damage: whether the controversy is current, meaning that the news reports something that has just happened (e.g., oil spill).

3.2 Stock prices

In order to conduct the event study and obtain the cumulative abnormal returns (CAR), we need the companies' returns. We have downloaded from Refinitiv prices for all the companies in the sample from 2016 to 2021, from which we have computed returns. We have also downloaded from Yahoo Finance the prices of the market indexes the companies are part of, namely NYSE Composite and NASDAQ Composite. We have removed some observations in the prices obtained from Refinitiv since the markets seemed to be closed during those days, suggested both by the fact that the price had not changed but also by their absence on Yahoo Finance. Hence, we have made sure that the dates are consistent between Yahoo Finance and Refinitiv.

3.3 Lagged E scores

Historical environmental scores have also been obtained through Refinitiv. Each of the ESG pillars is composed of different categories. The E score is composed of resource use, emissions, and innovation. These categories are then further divided in subcategories, capturing more specific aspects of the environmental impact of a company (Refinitiv, 2022). We argue that the E score could then be a good proxy for perceptions, since it looks at the operations and the impact of companies. It could be argued that consumers and investors perceive the company in the same way or deduce from the E score the environmental impact of a company.

It is important to note that categories are weighted differently depending on the industry group a company belongs to. Moreover, the score is obtained by comparing the performance of a company with its peers, i.e., other companies belonging to the same industry group (Refinitiv, 2022). Hence, it could be that a more environmentally friendly company obtains a lower E score compared to a less environmentally friendly company because the performance of the companies is compared relative to their respective industry. From Table 1 we can see the descriptive statistics for the lagged E score and its correlations with the control variables used. The average value is 63.725 and there is variability around the mean. The correlation with other variables is relatively low.

3.4 Control variables

We have included as control variables other features that may explain CAR, namely age, book-to-market ratio, and leverage. These are defined as "standard predictors of stock market value" (Carberry, Engelen, & Van Essen, 2018, p.135). Age has been computed as the year of the event minus the foundation year of the company involved in the controversy. Book-to-market ratio has been computed as the ratio between the book value of the company and its market value. Leverage has been computed as the ratio between long-term debt and total assets. For both book-to-market and leverage, the values refer to the end of the year prior to the controversy.

Moreover, we have included two additional control variables: size and previous controversies. Size is represented as the market capitalization of the company the year prior to the controversy. According to Aouadi and Marsat (2018), size affects the visibility of firms since smaller firms may

Table 1: Descriptive statistics and correlation matrix for the lagged E score and the control variables.

Statistic	Lagged E Score	Age	Leverage	Size	BTM	Prior Controversies
N	86	86	86	86	86	86
Mean	63.725	96.605	0.294	72,526	0.606	3.058
St. Dev.	23.134	53.004	0.153	116,066	0.426	4.885
Min	1.130	2	0	49.339	−0.684	0
Median	70	112	0.284	37,320	0.585	1
Max	91.280	219	0.874	677,443	2.645	25
Lagged E Score	1					
Age	0.112	1				
Leverage	−0.217	−0.236	1			
Size	0.263	−0.015	−0.255	1		
BTM	−0.015	0.086	−0.295	−0.168	1	
Prior Controversies	0.383	0.283	−0.298	0.335	0.102	1

This table shows at the top the number of observations denoted as N, followed by the mean, standard deviation, minimum, median, and maximum values for the lagged E score and the control variables. At the bottom, the table shows the correlation matrix. All the tables in this paper have been formatted with the assistance of the stargazer package in R (Hlavac, 2022).

attract less attention from the public. At the same time, we argue that smaller companies may be less prepared to deal with the consequences of a controversy thus being exposed to more risk. Hence, we believe size to be of relevance. Furthermore, as previously mentioned, the public considers past behaviour when reacting to current behaviour (Barnett, 2007; Lange & Washburn, 2012). Hence, we have included previous controversies as a control variable since it may be influencing perceptions on a company, thus influencing CAR. This variable has been computed as the number of controversies a company has been involved in five years prior to the year of interest. All the data has been retrieved from Refinitiv.

As visible from Table 1 all the variables show considerable variability around the mean. The correlations between the variables are relatively low, all being below 0.4.

4 Methodology

In this chapter we introduce the methods used in our study. We first discuss the event study, how we have applied it to our paper, and the output resulting from it. Subsequently, we present the regression analysis and the models we intend to investigate.

4.1 Event study

The purpose of an event study is to investigate whether a certain event has had an impact on the stock price. In order to do that, it compares the actual returns of a company with its expected returns usually computed by using the market model. The difference between the two is the abnormal returns (AR); when abnormal returns are significant, the event of interest can be interpreted as having an impact on the stock price (Benninga, 2014).

The abnormal returns are obtained for all the days within an event window. The event window comprises a certain number of days prior to the event, the day of the event, and a certain number of days after the event. Days before the event are included in order to account for potential leak of news, while days after the event are included in order to account for delays in the reaction of the market. Summing up the ARs from the event window, cumulative abnormal return (CAR) is obtained, which allows us to investigate the impact of an event over a certain period in the event window (Benninga, 2014). In this paper, we have used the event window (-3,0,3) comprising three days prior to the event, the day of the event, and three days after the event. We use this event window in order to identify which days are affected by the controversy since we do not know how many days in advance there may be a leak nor how long it takes for the market to adjust.

The parameters used in computing expected returns are estimated with OLS in the estimation window, which is meant to capture the normal behaviour of the stock. We follow Benninga (2014) and use 252 trading days in the estimation window. For 2 controversies we have less than 252 trading days since the company has been trading for fewer days than that. Nevertheless, these controversies have more than 126 trading days in the estimation window, suggested by Benninga (2014) in order to obtain robust results.

We define the first day of the estimation window as $T0$ and the last day as $T1$; the event window has as first day $T1 + 1$ and as last day $T2$. We estimate the parameters in the estimation window with the market model:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \epsilon_{it} \tag{1}$$

where R_{it} and R_{mt} are the stock return for controversy i and the market return respectively on day t in the estimation window, and where α_i and β_i represent the parameters to estimate, i.e., the intercept and the slope respectively. ϵ_{it} represents an error term with zero mean (Campbell, Lo, & MacKinlay, 1997). For the market returns a market index is used, which in our sample is either the NYSE Composite or NASDAQ Composite, depending on where the stock is being traded. Subsequently, we obtain abnormal returns for controversy i, which we define as $\hat{\epsilon}_i^*$. This is a vector containing abnormal returns for each day in the event window, from $T1 + 1$ to $T2$

$$\hat{\epsilon}_i^* = \mathbf{R}^*{}_i - \hat{\alpha}_i \iota - \hat{\beta}_i \mathbf{R}^*{}_m \tag{2}$$

where $\mathbf{R}^*{}_i$ represents a vector of actual daily returns in the event window, $\hat{\alpha}_i$ and $\hat{\beta}_i$ are estimates of the parameters in Equation 1, $\mathbf{R}^*{}_m$ is a vector of market returns for each day in the event window, and ι is a vector of ones (Campbell, Lo, & MacKinlay, 1997). Once we have the abnormal returns we can aggregate them to obtain the cumulative abnormal returns (CAR). We can compute CAR for a time period of interest starting at s_1 and ending at s_2. The time period selected does not have to coincide with the event window, but it should be included in the event window like this $T_1 < s_1 \leq s_2 \leq T_2$ (Campbell, Lo, & MacKinlay, 1997). CAR for a controversy i is then:

$$C\hat{A}R_i(s_1, s_2) \equiv \gamma' \hat{\epsilon}_i^* \tag{3}$$

where γ' is a vector of ones in the positions $s_1 - T1$ to $s_2 - T1$ and of zeroes in the other positions, and where $\hat{\epsilon}_i^*$ is a vector of abnormal returns for controversy i (Campbell, Lo, & MacKinlay, 1997).

Averaging the CARs over all the events we obtain the cumulative average abnormal returns (CAAR) from s_1 to s_2:

$$CAAR(s_1, s_2) = \frac{1}{N} \sum_{i=1}^{N} C\hat{A}R_i(s_1, s_2) \tag{4}$$

Subsequently, we compute the confidence intervals in order to investigate the significance of CAAR in the days of the event window. We obtain the t values:

$$t = \frac{CAAR(s_1, s_2)}{\sqrt{Var[CAAR(s_1, s_2)]}} \tag{5}$$

where $Var[CAAR(s_1, s_2)]$ is estimated cross-sectionally over all CAR_i.

$$Var[CAAR(s_1, s_2)] = \frac{1}{N(N-1)} \sum_{i=1}^{N} (CAR_i(s_1, s_2) - CAAR(s_1, s_2))^2 \tag{6}$$

Thus, CAAR, in order to be significant at the 95% level, should have a t value larger than 1.96 in magnitude, while in order to be significant at the 90% level, it should have a t value larger than 1.645 in magnitude.

4.2 Regression analysis

The regression analysis allows us to investigate the relationship between the one year lagged E score (used as a proxy for perceptions) and the companies' stock performance. The former is our independent variable, while the latter is our dependent variable and it is the CAR computed in the period (s_1, s_2) where the controversy has had an effect on the market's reaction. This period is suggested by the event study conducted in the first phase of this paper. Three models have been explored in order to test the hypotheses presented at the beginning of this paper. In two of the models we include control variables suggested by previous literature. All the models have been estimated using OLS.

In **model (1)** we regress CAR only on the lagged E score (E).

$$CAR_i = \beta_0 + \beta_1 E_i + \epsilon_i \tag{7}$$

In **model (2)** we regress CAR on the lagged E score (E) while controlling for age, book-to-market ratio (BTM) and leverage.

$$CAR_i = \beta_0 + \beta_1 E_i + \beta_2 Age_i + \beta_3 BTM_i + \beta_4 Leverage_i + \epsilon_i \tag{8}$$

In **model (3)** we regress CAR on the lagged E score (E) while controlling for two additional variables compared to the previous model, namely, market capitalization (Size) and prior controversies (Prior).

$$CAR_i = \beta_0 + \beta_1 E_i + \beta_2 Age_i + \beta_3 BTM_i + \beta_4 Leverage_i + \beta_5 Size_i + \beta_6 Prior_i + \epsilon_i \tag{9}$$

5 Results and Discussion

In this chapter we first present the results from the event study. We discuss where the effect of the controversy is more visible, and hence decide which time period in the event window we focus on. We then compute CAR in this time period, and use it as the dependent variable in the regression analysis. We conclude the chapter, by discussing the results for all the models in the regression analysis.

5.1 Event study results

As previously mentioned, we have obtained the cumulative average abnormal returns (CAAR) for each day in the event window and computed the t-values in order to check if they are significant. Hence, s_1 is always the first day in the event window (i.e., -3), while s_2 changes each day until the end of the event window (i.e., 3).

Figure 1 shows the CAAR for the event window (-3,0,3). Overall, it seems like the market reacted to the controversy at the event date. CAAR is positive before the event date while it becomes negative at the event date and remains negative after the event date. As suggested by the confidence intervals, in none of the days in the event window is CAAR statistically significant.

Hence, it is arguable that there are no information leaks prior to the event day. Moreover, the considerable increase in CAAR at day 3 may be a correction to a previous overreaction from the market. It could also be that other confounding events have taken place, thus overshadowing the controversy. Regardless the reason for this correction, we argue that the effect of the controversy is mainly visible between day 0 and day 2 in the event window.

Given the results of the event study conducted, it is possible to note that CAAR following an environmental controversy is negative. Nevertheless, controversies have not had a significant impact on returns, as suggested by the t-values in the analysis. Therefore, this is in contrast with our first hypothesis, where we expect environmental controversies to spark a significant reaction from the market. A potential reason for this may be that some of the controversies reported in the news are not perceived to be so severe, thus not affecting the market response significantly.

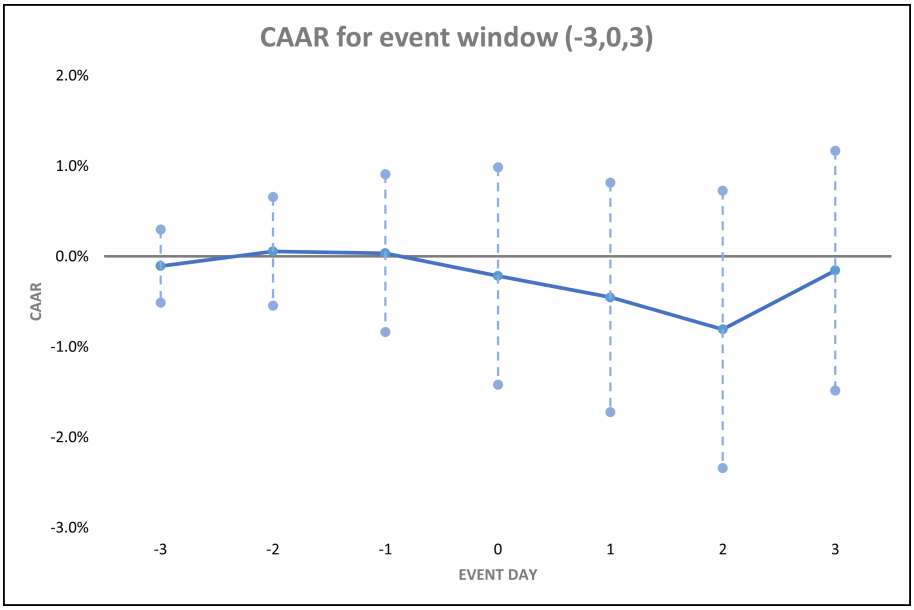

Figure 1: CAAR for the event window (-3,0,3) with confidence intervals.

5.1.1 CAAR for the categories

In order to mitigate the issue related to the severity of the news, we have investigated whether CAAR is significant for the different categories constructed considering the nature of the controversy. It is arguable that some of the categories may be perceived as more severe than others. The period we have considered when computing CAAR for the categories is the one in which we see more clearly the reaction from the market following the controversies. As seen in Figure 1, the reaction is mainly between day 0 and day 2. Hence, the CAAR considered is $CAAR(s_1, s_2)$ where $s_1 = 0$ and $s_2 = 2$.

As visible in Figure 2, the lowest CAAR is witnessed by controversies regarding lawsuits, despite having the widest confidence intervals of all. Surprisingly, settlements have a similar negative CAAR as restrictions and current damages to the environment. Finally, the CAAR for protest is close to zero. The categories do not seem to differ much between each other and none of them is statistically significant. The result may also depend on the categorisation that we have made.

Overall, the results obtained are contrasting our first hypothesis. The event study conducted suggests that the environmental controversies in our

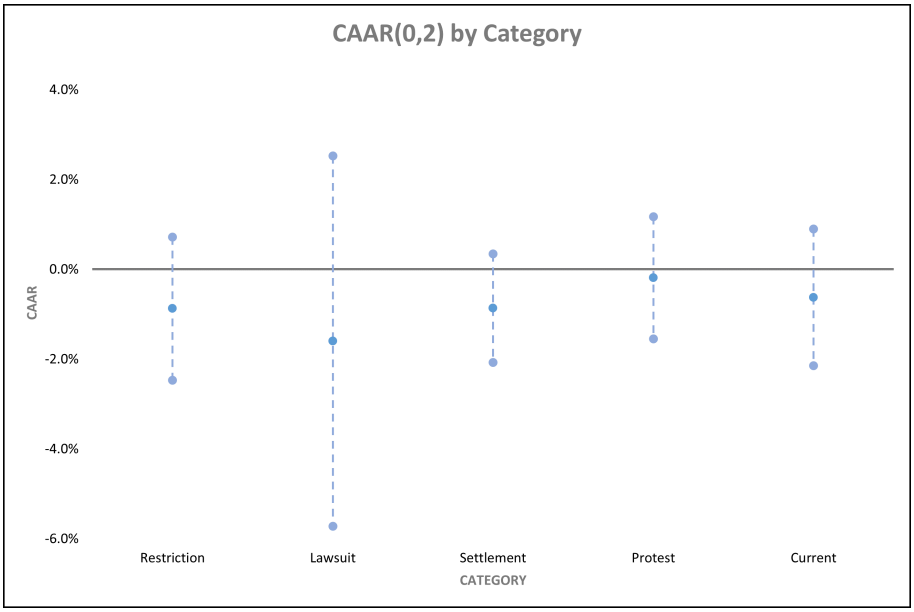

Figure 2: CAAR(0,2) by category with confidence intervals.

sample, despite being negative, have not had a statistically significant impact on CAAR, neither when taken as a whole, nor when analysed into categories.

5.2 Regression analysis

We now present the results of the regression analysis. According to our hypotheses we would expect the lagged E pillar score to have a significant impact and to be positive, meaning that a higher E pillar score the year before should positively affect returns in the event of a controversy. This is in line with the argument that prior environmental perceptions function as an anchor point influencing investors' judgement of a controversial event.

5.2.1 Dependent variable

The output of the event study is used in the regression analysis. For this purpose, we are interested in the individual CARs computed where the market has reacted to the controversy. As previously discussed, the reaction from the market is mainly visible between day 0 and day 2. Hence, the CARs used as dependent variable are $CAR(0, 2)$ where $s_1 = 0$ and $s_2 = 2$. The

Table 2: Descriptive statistics for CAR(0,2).

Statistic	N	Mean	St. Dev.	Min	Median	Max
CAR (0,2)	86	−0.008	0.068	−0.561	−0.002	0.101

This table shows at the top the number of observations denoted as N, followed by the mean, standard deviation, minimum, median, and maximum values for CAR(0,2), which is the dependent variable.

descriptive statistics for the $CAR(0, 2)$ is provided in Table 2 and the list of the individual CARs can be seen in Table A1 in the appendix.

As visible, the average CAR is negative and there is a relatively high dispersion around the mean. The minimum value is quite distant from the mean and probably contributing to the negative average. The median is negative but lower in magnitude compared to the mean. This is supported by a visual inspection of the distribution of the CARs, visible in Figure A1 in the appendix. The boxplot suggests that there are several outliers in the CARs. It is possible to notice how extreme the minimum value is in comparison to other outliers. We argue that it is important to keep the outliers as they represent events that have actually taken place and are not due to measurement errors. Nevertheless, some of the models in the analysis have experienced issues with heteroskedasticity due to the presence of such extreme outliers. Hence, we have corrected this by winsorizing the data at the 2^{nd} and 98^{th} percentiles. In this way, we have mitigated the impact of extreme values without discarding any data.

5.2.2 Results

Table 3 shows the results for all three models. In model (1) the lagged E score is significant ($p < 0.05$) with a coefficient of 0.00031. The lagged E score is significant also for model (2) and model (3) ($p < 0.1$) with a positive coefficient of 0.00029 and 0.00032 respectively. This means that a 1 unit increase in the lagged E score leads to an average increase in CAR of 0.031% in model (1), of 0.029% in model (2), and of 0.032% in model (3). R^2 and adjusted R^2 are low for all the models meaning that the lagged E score and the other variables do not explain much of the variability in CAR. Carberry, Engelen, van Essen (2018) find the book-to-market ratio to be of significance

in their regression with CAR following misconduct. Nevertheless, our regression suggests neither size, leverage, or book-to-market ratio to be significant. Moreover, Aouadi and Marsat (2018) suggest size to be an important factor for the market reaction but our regression does not find it to be significant for the CAR following environmental controversies. Barnett (2007) argues for the importance of historical socially responsible behaviour, nevertheless, we have not been able to find a significant effect from the number of prior controversies in our study.

When it comes to hypothesis 2A, there is a significant relationship between the lagged E score and the CAR following a controversial event. The relationship holds even when controlling for the other variables. Given that we consider the lagged E score as a proxy for perceived environmental behaviour, our results suggest that such perception could influence the market response following an environmental controversy.

Moreover, the coefficient for the lagged E score is positive in all the models. As seen previously, the results are statistically significant for model (1) ($p < 0.05$) and for model (2) and model (3) ($p < 0.1$). Hence, the results suggest that companies with better perceived behaviour the year prior to the controversy, witness, on average, more lenient responses from the market. This supports hypothesis 2B. The lagged E score seems to work as an anchor from which companies' behaviour is judged. If a company has a high E score, it is perceived to be environmentally responsible. In the event of a controversy, it may be hard for investors to adjust their perceptions from the reference point, and hence end up being more lenient in their response. In other words, a company perceived to have a good environmental behaviour is forgiven more easily by investors, as discussed by Lange and Washburn (2012). Hence, we do not see a harsher punishment sparked by a sense of hypocrisy (Janney & Goove, 2011) or by broken expectations as discussed by Creyer and Ross (1996).

Table 3: Regression results.

	Dependent variable:		
	CAR(0,2)		
	(1)	(2)	(3)
Lagged E score	0.00031**	0.00029*	0.00032*
	(0.00015)	(0.00015)	(0.00016)
Age		−0.00004	−0.00004
		(0.00007)	(0.00007)
BTM		0.01313	0.01115
		(0.00829)	(0.00868)
Leverage		−0.01877	−0.02516
		(0.02411)	(0.02551)
Size			−0.00000
			(0.00000)
Prior Controversies			0.00006
			(0.00082)
Constant	−0.02259**	−0.02051	−0.01649
	(0.00991)	(0.01685)	(0.01773)
Observations	86	86	86
R^2	0.04985	0.09753	0.10641
Adjusted R^2	0.03854	0.05296	0.03854
Residual Std. Error	0.03120 (df = 84)	0.03096 (df = 81)	0.03120 (df = 79)
F Statistic	4.40719** (df = 1; 84)	2.18834* (df = 4; 81)	1.56785 (df = 6; 79)

This table shows the results of the regression analysis. In model (1) we regress CAR(0,2) on the lagged E score. In model (2) we regress CAR(0,2) on the lagged E score while controlling for age, BTM, and leverage. In model (3) we regress CAR(0,2) on the lagged E score while controlling for size and prior controversies in addition to the control variables in model (2). Note: *p<0.1; **p<0.05; ***p<0.01.

6 Conclusion

Given the rise in environmental pressure from investors in recent years, this paper sets out to examine the market reaction to environmental controversies and the role played by investors' previous perception of firm behaviour.

The main findings of this thesis are that the markets on average react negatively to environmental controversies and that previous perception of firms environmental behaviour may play an important role as an anchor to mitigate this response. These results concur with the results of studies showing the relationship between environmental and financial performance and that prior perceptions of good behaviour can shield firms from negative market reactions (Janney & Gove, 2011; Klein & Dawar, 2004; Lange & Washburn, 2012). In contrast to some reports in the literature (Creyer & Ross, 1996; Rhee & Haunschild, 2006), we do not find that being involved in a controversy after perceptions of good behaviour lead to a more negative reaction. Additionally, Carberry, Engelen, and van Essen (2018) find the book-to-market ratio to be significant in their regression while we do not find any significance of any of the financial predictors that they propose. In contrast to Aouadi and Marsat (2018) and Barnett (2007), we do not find any significant relationship with CAR for neither size nor prior controversies. We thus contribute to the literature providing a potential explanation to the heterogeneity that can be observed in investors' reaction to controversial events, since previous studies have found varied results in this area. This study also reinforces the importance of firms' environmental responsibility for investors, which can also be found in recent literature streams.

Although negative, CAAR is unexpectedly shown not to be significant following controversial events. Potential reasons may be that the controversies in our sample have not been severe enough or that the controversies may have already been reflected in the stock price.

A possible limitation of this study is the lagged E score's ability to reflect investors' perception of environmental behaviour. Future research could introduce other approaches to proxy these perceptions which might yield different results. Another limitation is that there can be other confounding events we have not accounted for. A suggestion for future studies is then to consider also the confounding effect of other types of events such as the disclosure of important financial news. Furthermore, our proxy for prior perceptions depends on the environmental pillar score from a single data provider: Refinitiv. Forthcoming studies could consider an approach simi-

lar to that of Halbritter and Dorfleitner (2015), i.e., taking into account the difference in scores from several ESG rating agencies.

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Appendix

Table A1: CAR(0,2).

CONTROVERSY ID[1]	CAR (0,2)
MMM18	−0.013
MMM19	−0.033
ALB18	0.017
AIG21	−0.019
AMPY21	−0.561
AR19	0.013
ADM19	−0.005
T21	−0.022
ATI17	−0.043
GOLD18	0.007
GOLD20	0.019
BDX19	0.026
BRKa21	−0.001
BLK19	0.002
CCL17	0.009
CCL19	−0.030
CC17	0.010
CVX18	0.016
CVX19	0.005
CNX18	−0.035
COP18	0.005
CEIX18	−0.059
DVN21	−0.067
D17	−0.009
D19	−0.013
D20	0.001
DUK18	−0.037
DD18	−0.002
DD19	−0.003
Continued on next page	

[1]The ID is a combination of the ticker of the company involved and the year of the event. For example, "MMM18" refers to a controversy involving the company 3M in 2018.

Table A1: CAR(0,2) (continued).

CONTROVERSY ID	CAR (0,2)
DD20	0.011
DD21	−0.011
EIX21	−0.009
EOG21	−0.010
ETRN20	0.029
XOM17	0.014
XOM18	0.003
XOM19	−0.004
XOM20	−0.028
F17	0.005
F18	−0.004
F19	0.101
GM17	0.046
GM19	0.015
HOG20	−0.084
HES18	−0.009
HD18	−0.012
HD20	0.005
KALU17	−0.026
KMI17	0.015
KMI18	0.008
KGC18	0.037
MRO18	0.009
MPC18	0.030
MPC20	−0.051
MCD18	−0.031
NEM21	0.035
NI20	−0.029
OXY20	−0.024
PDCE20	−0.038
PCG17	−0.009
PCG18	−0.008
PCG19	0.019
PCG20	0.079
PCG21	−0.007

Continued on next page

Table A1: CAR(0,2) (continued).

CONTROVERSY ID	CAR (0,2)
PSX17	−0.003
PSX18	0.044
PSX19	−0.003
PSX20	−0.112
PSX21	0.011
RRC20	0.012
SRE17	0.001
SO19	0.010
SO20	0.021
SWX17	−0.008
SUN21	−0.026
TSLA19	0.025
TSLA21	−0.034
TSN17	0.084
UGI19	0.015
X17	0.026
X18	−0.008
X19	−0.014
VLO20	0.032
WMB20	0.008
WWW21	−0.021
ZTO21	−0.032

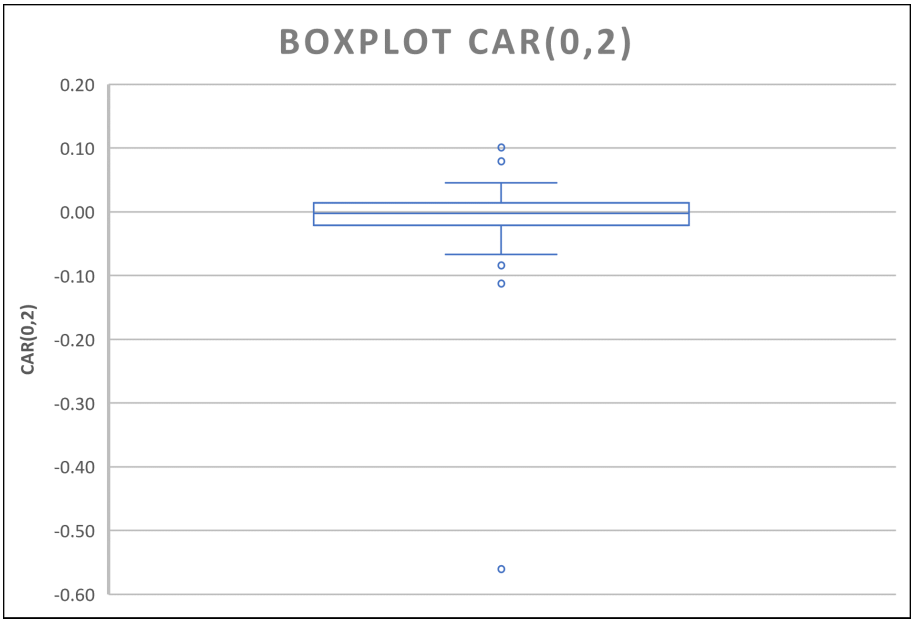

Figure A1: Boxplot showing the distribution of CAR(0,2).