

STOCKHOLM SCHOOL OF ECONOMICS

Department of Accounting

BE351 Degree Project in Accounting and Financial Management

Spring 2025

Do Environmental Leaders Perform Better During Disasters?

Evidence from the 2025 California Wildfires

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Abstract

On the 7th of January 2025, multiple wildfires broke out in the US state of California. Like other severe disasters, these fires affected society in many aspects. This study investigates one such effect: its impact on the American stock market. More specifically, we look at whether the environmental performance of S&P 500 firms played a deciding role in how the market treated firms' stocks in the time following the wildfires. The study conducted mean comparison tests and multiple linear regressions to identify whether a significant relationship existed between environmental performance and Cumulative Abnormal Returns (CARs). We investigated three separate time frames to account for differing reactions in different stages of the post-disaster period. We find no significant relationship in the short- or medium-term. Long-term results are mixed, with some models showing no effect and others showing a weak positive relationship. The long-term effect remains uncertain and requires further research to be fully understood.

Keywords: Event Study, Cumulative Abnormal Return, Natural Disasters, Environmental Performance, Stock Market Reaction

Supervisor: Irina Gazizova

Acknowledgements

We would like to express our sincerest gratitude to our supervisor, Irina Gazizova, who has supported us throughout the entire process and helped us tremendously with improving the quality of our thesis. We would also like to highlight our appreciativeness towards our course director, Katerina Hellström. The guidance she provided through lectures and seminars was very helpful.

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1. Introduction

1.1 Background

On January 7th, 2025, multiple wildfires broke out in southern California, the most notable being the Palisades and the Eaton fires. These fires, along with others that started on later dates, kept on burning and heavily affected people in southern California throughout January until they were finally contained towards the end of the month. Though wildfires are not uncommon in California, with multiple fires each year during the 10 years preceding 2025, even though these fires did not cover as many acres as some in previous years, they still received extensive media coverage. The media coverage was likely due to the fires largely affecting residential areas, whereas previous fires mainly affected less densely populated areas. Therefore, the January 2025 wildfires caused a disproportionate amount of destruction to structures compared to previous fires, which led to more people being directly affected than in many previous cases (California Department of Forestry and Fire Protection, 2025).

Impactful events such as these fires usually affect a broad range of societal areas in various ways, which makes it interesting to look beyond the direct impacts of the event. We have decided to look closer at the economy and how these fires affected the companies included in the Standard and Poor's 500 index (S&P 500). The S&P 500 includes the 500 biggest companies listed on American stock markets, encompassing about 80% of the available market capitalisation (S&P Global, 2025). The S&P 500 companies are listed on some of the most active markets on the planet. These include the New York Stock Exchange and the Nasdaq (US) which are the markets that average the highest monthly value of shares traded for 2024 (World Federation of Exchanges, 2025). As a result of the high activity in these markets, they also become highly reactive, taking all societal events into account. Thus, the assumption is that the markets will consider a significant event such as the January 2025 California wildfires. The question then becomes how the markets will react to this event, whether they will deem it relevant enough to influence investment decisions, and whether it will positively or negatively impact the market. In addition to the market as a whole being affected in a certain way, each company will also be affected in its own way, which might coincide with or differ from how the market is affected.

The performance of a company's stock, post a major event, is dependent on a countless number of factors. However, in most cases, certain factors can be pointed out as having a larger impact

than most others, depending on the event. In the specific case of the January 2025 California wildfires, as it is an environmental disaster, we believe that a factor which would be interesting to look closer at is the environmental performance of companies. Though the term environmental performance is used loosely, we believe that the definition provided by Mendes et al. (2011), which states that environmental performance is “*measurable results of the ability of an organization to handle environmental factors which can be, defined as those elements of an organization’s activities, products or services that can interact with the environment, and have an impact on it*”, is an accurate definition. It is the one that will be used in this paper. How strong a company's environmental performance is can vary vastly, and a strong performance is usually achieved through conscious decisions and initiatives to improve this specific performance. Considering this, it could be argued that strong environmental performance is a strategy that can be pursued for multiple reasons. With this in mind, it becomes interesting to see how this strategy affects stock market performance in the event of a wildfire.

1.2 Purpose & Research question

This study aims to investigate the effect of the California 2025 wildfires on the stock market performance of companies included in the S&P 500 index, which have strong environmental performance, and compare their performance to that of companies in the same index with weak environmental performance. Therefore, our research question is formulated as follows:

- *How did the California 2025 wildfires affect the stock market performance of S&P 500 companies with high versus low environmental performance?*

1.3 Relevance of the chosen subject

As section 2 previous literature will expand on, there already exists studies which cover similar areas to what we will investigate. Multiple studies have examined how natural disasters impact the markets, and many studies have examined how environmental performance can be connected to market performance. However, few studies have combined both, with the studies by Huynh et al. (2021) and by Malik et al. (2023) being part of the limited selection to actively discuss the connection between natural disasters, environmental performance, and stock market performance.

This thesis makes two main contributions. First, we isolate environmental performance specifically, rather than broad ESG or CSR scores, and compare firms with different performance, something earlier studies have not done. Second, we study a new and high-profile disaster (the 2025 California Wildfires), to test if previous findings still hold in a recent context.

1.4 Delimitations

We have made a couple of main delimitations in this study. First, we have chosen only to look at S&P 500 stocks. The reason why we choose not to look at all American stocks is mainly due to the data availability. The popularity of the S&P 500 means that data about it is readily available, while finding data about smaller US equities can be more challenging. Additionally, as the S&P 500 makes up the majority of the US market capitalisation, it becomes one of the most interesting indices to look at when trying to understand the dynamics of the American market (S&P Global, 2025).

The second delimitation for this study is that we are only using Refinitiv Eikon's environmental scores, even though many other well-renowned environmental score providers exist, such as MSCI, Bloomberg, and S&P. The main reason for only using one provider is that we wanted a clear and non-contradicting dataset. If we were to use environmental scores from multiple providers, then it is possible that the scores would differ, making the data hard to handle. The reason we chose Refinitiv Eikon specifically was its strong reputation and availability.

1.5 The study

To test our research question, we have conducted both mean comparison tests and multiple linear regressions to investigate whether a relationship between firms' environmental performance and their Cumulative Abnormal Returns (CAR) can be identified. In these tests, we have looked at three different time frames: short-term $([-1, +1]$ day), medium-term $([-5, +5]$ days), and long-term $([-30, +30]$ days). Our results indicate no significant relationship in the short- and medium-term. However, the long-term results are inconclusive, indicating further research is needed.

1.6 Disposition

This paper is divided into six sections, with this introduction being the first. Section 2 will cover previous literature that examines relevant subjects for our study. In section two, we will also develop a hypothesis based on the findings of the previous literature. Section 3 will outline the methodology used to test the hypothesis developed in section 2. Following up on that, section 4 will present the results of our study. After that, in section 5, we will discuss our results and other relevant matters. Finally, in section 6, we will conclude the most important findings of our study.

2. Previous Literature

2.1 Linking Wildfires and Environmental Sustainability

Wildfires often occur in arid areas that experience a lot of sunlight and heat; these circumstances can result from purely natural coincidence. However, previous literature points towards the fact that non-natural factors, such as anthropogenic climate change, can also increase the likelihood of these circumstances occurring and the severity of the resulting wildfires. A study by Diffenbaugh et al. (2014) investigates the effect of anthropogenic warming on California's drought risk. Using a combination of historical data analysis, climate model experiments, and statistical analyses, they found that anthropogenic warming does lead to an increase in the probability of drought in California. As an increase in drought also increases the risk of wildfires, this study indicates a relationship between increased anthropogenic warming and wildfires.

This relationship is more thoroughly explored in a study by Abatzoglou et al. (2016) that highlights this specific relationship. The study investigates to what extent anthropogenic climate change contributes to the rise of wildfires in the western US by using empirical data and combining it with statistical modelling and climate model simulations. Through these methods, the study finds that anthropogenic climate change has contributed to more than 50% of the increase in fuel aridity since the 1970s. Furthermore, in the last 30 years, this anthropogenic fuel aridity has approximately doubled the forest fire area beyond what was expected by natural climate variability. This further indicates a clear relationship between wildfires and anthropogenic climate change.

2.2 The Relationship Between Environmental and Market Performance

The environmental performance of companies is commonly captured under ESG or CSR measures. Therefore, most previous studies look at these as a whole, rather than focusing only on environmental performance. Both ESG and CSR include multiple factors, but are primarily made up of environmental performance. Therefore, they can reasonably be used as proxies for environmental performance. So, to ensure the highest quality of previous literature, studies related to ESG and CSR have also been included in this part of the review.

A study by Wang et al. (2024), which explores what effect ESG ratings can have on how the market responds to earning surprises, illustrates an apparent effect. The study finds that firms

with high ESG ratings see a stronger stock price reaction to positive earnings surprises and a more limited reaction to negative earnings surprises. This suggests that investors have greater trust in highly ESG-rated firms and, therefore, to a larger extent, believe positive earnings surprises are genuine and do not take negative earnings surprises as a sign of a poorly run company. Furthermore, the study finds that high ESG-rated firms are more prone to having a large portion of institutional ownership. This leads to less drastic market reactions, resulting in a more stable shareholder base and less volatility. These characteristics of firms with high ESG ratings make them more attractive to investors, thus positively affecting their market performance.

When investigating how positive and negative news about ESG factors affect stock performance during 2002-2010, Capelle-Blancard et al. (2017) found that while positive news will not result in a significant effect, negative news will lead to a decrease in stock price. This indicates that investors care more about companies not being bad regarding ESG than about them being especially good. Additionally, the study finds that investors only react to ESG-related news from media outlets, not from the firm's statements or NGOs. This points towards investors only trusting independent sources that have no apparent agenda. The study also found that stock price decreases from negative news can be mitigated by operating in an “ESG strong industry” or by using greenwashing.

Another study looking at the impact of ESG news, but focusing only on the environmental factor for the years 1980-2009, by Flammer (2013), had relatively similar results. However, there were some noteworthy differences and additions. One is that historically, there has been both a price increase for positive news and a decrease for negative news, but with time, the increases have diminished while the decreases have grown. This reflects changing expectations from investors, where strong environmental performance is expected today. At the same time, harmful environmental actions are seen as abnormal. Another observation from the study was that the stock price increases from environmentally friendly actions by companies were diminishing. This indicates that if a firm already has a reputation for being eco-friendly, from a purely stock price-focused perspective, it is not worth investing further in positive environmental actions. These findings further prove that ESG factors impact companies' market performance.

Serafeim et al. (2022) explore the role of ESG ratings in ESG news and the market reaction resulting from them. When looking at ESG ratings' predictive ability for future news, they

found that highly rated firms are more likely to receive positive ESG news in the future, setting market expectations. When looking at how the ratings affect the reaction to different news, what could be observed was that positive news had a larger effect on firms with lower ratings than on highly rated firms, likely due to the already existing expectations mentioned previously. However, when negative news occurred, the ratings did not have any effect as the study found that all firms were affected similarly by them, regardless of their rating. It could also be observed that different types of ESG news had differing effects. It was financially material ESG news that had the most significant impact on stock price movements, indicating that a company's ESG actions have the most impact on market performance when they in some way directly affect financial factors, which are traditionally important for investors to make their investment decisions. Finally, it is important to mention that all of the findings from this article about the effect of ESG ratings are only clearly visible when different rating agencies agree on the ratings of companies. When agencies provide differing ratings, the market becomes uncertain about interpreting ESG-related news, and therefore, the aforementioned effects become less pronounced.

It is widely accepted that firms' financial performance has a big impact on their stock market performance; it is thus interesting to look at how and if there is a connection between environmental and financial performance. This was done in an article by Margolis & Walsh (2003), where 127 previous studies investigating the relationship between firms' socially responsible conduct and financial performance were examined from 1972 to 2002. Though the article never formally defines "socially responsible conduct," it can reasonably be compared to modern equivalents such as ESG or CSR. As mentioned, both can be used as a proxy for environmental performance. Out of the 127 studies, the majority claim a positive relationship exists between the two, indicating that socially responsible conduct can be motivated from a purely financial perspective. However, when looking closer at the methodologies of these previous studies, the article finds many weaknesses and problems that question the legitimacy of the positive relationship. The questionable methodologies have also led to a certain degree of self-reinforcement, which puts further doubt into the findings.

To summarise, the majority of previous literature seems to suggest that there exists a relationship between environmental and market performance. Though most studies point to this relationship being positive, there still exists doubt regarding whether this is the case, with some studies also providing results that do not point towards a positive relationship.

2.3 The Impact of Disasters on Stock Markets

Disasters can come in many different forms, but what they all have in common is that they have a vast, overwhelmingly negative effect on many parts of society. However, when looking exclusively at the financial markets, do disasters have any notable effect? When Baker et al. (2020) studied the reaction of the market to the outbreak of the COVID-19 virus, they found that the pandemic had a significant effect on the market as it increased volatility drastically and led to an overall downturn. This makes the COVID-19 pandemic stand out from previous pandemics such as the Spanish flu or the 1968 influenza, which did not affect the markets nearly as much. The study provides numerous explanations for this observed difference, including that restrictions from COVID-19 strongly impacted the business environment, which today is way more service-focused than during previous pandemics, leading to less economic activity. Also, the faster modern-day information flow allowed the markets to react quickly. This indicates that pandemics can affect markets to a different extent and, significantly, that it is not the pandemics that directly impact the market but the consequences that might disrupt the market. What could also be observed from the COVID-19 pandemic is that, even though it initially only affected China, most major markets worldwide moved down in unison. Implying an increased interdependence in today's markets, likely due to globalisation (Liu et al., 2020). This indicates that disasters' economic impacts are not necessarily limited to the geographical areas they directly impact.

Regarding man-made disasters, Yousaf et al. (2022) examine the reaction to the Russia-Ukraine war of the G20 and additional selected markets. The study finds that though the initial shock of the invasion harmed most global markets, when looking at more long-term effects and the severity of the effects, it is observable that markets with stronger ties to the war were affected to a higher degree. This was since those countries' economic activities were more severely disrupted, which led to high uncertainty about future market performance. Additionally, the study finds that not all industries were negatively impacted by the event, as an increase in oil prices resulted in a positive effect on energy stocks, proving that the same disaster can have differing effects based on various factors. Differing impacts were also found in a study by Chesney et al. (2010), which investigated how terrorism has impacted the financial markets by looking at 77 different terrorist attacks. What most attacks had in common was that they led to an immediate overall negative reaction by the market, which it recovered from relatively quickly. However, many different effects are identified when looking at the reactions in detail. The study finds that while some industries, such as airlines and tourism, are especially negatively impacted, others, such as defence and pharmaceuticals, often experience a positive

impact. The study also found that markets in different countries react differently; for example, emerging markets tend to exhibit larger volatility.

Overall, previous literature indicates that disasters' effects on markets can vary greatly and are dependent on various factors. Also, the same disaster can affect separate industries differently.

2.4 The Impact of Natural Disasters on Stock Markets

As stated above, disasters can have vastly differing impacts on the markets, often depending on the type of disaster. Therefore, it becomes interesting to take a closer look at natural disasters and what impact previous studies have found them to have. A study by Sakariyahu et al. (2023) looks at the impact of the Türkiye-Syria earthquakes on different stock markets. A significant downturn immediately impacted the Turkish market and all other investigated markets. However, after a few days, the markets started to recover, indicating that the initial downturn was driven by emotional reactions to the shock rather than rational financial analyses. This is further supported by the fact that the study finds that the higher the investor attention was, the more severe the losses were, meaning that investor sentiment played a central role. As well as that panic selling was likely a major driver of the negative market reaction. An additional finding was that the severity of the downturn in foreign markets was influenced mainly by two main factors: how strong the economic ties were to Türkiye and the country's geographical proximity to Türkiye.

When looking at the domestic natural disasters' impact on US equities from 1960 to 2015, Malik et al. (2020) found that the impact can look different based on multiple factors. The two most decisive factors were which industry the equity belonged to and the nature of the natural disaster. The same disaster usually displayed opposing effects on different industries. Though most industries usually see a negative post-disaster effect, some industries, such as the pharmaceutical and construction industries, often experience a positive impact. However, though some industries more commonly see a positive effect than a negative, and vice versa, no industry reacts the same way to all types of natural disasters. This indicates that there is no clear market reaction pattern, which is true for all types of natural disasters, but rather the effect of each event is case-specific. Thus, the specific circumstances of each natural disaster need to be considered when trying to predict its impacts on the market.

The study also looks into how the predictability of a natural disaster impacts market reaction. Meteorological and hydrological disasters are often predictable; thus, the markets are aware of

their potential impact before their actual occurrence. When public warnings are issued, the markets tend to have a slower response during the pre-disaster period than they do to news being released about the occurrence of an unpredictable disaster. The study argues that this is likely due to the market's awareness that the warnings could be false alarms. Thus, concerns regarding the legitimacy of the warning led to a weaker response. Even though reactions to warnings tend to be weak, post-disaster reactions to predictable disasters also tend to be weaker than the post-disaster reactions for unpredictable disasters, as the warning has removed the surprise element, which can lead to uncertainty and overreactions for unpredictable disasters.

Huynh et al. (2021) examine how investors react to natural disasters in the US markets. Like previously mentioned studies, they find that the general immediate reaction to disasters is negative, but as the disaster starts to ease off, the markets recover. Observations from the study indicate that the immediate negative reaction is an overreaction. Because declines in fundamentals do not fully justify the price drop, insider stock purchases increase during the price drop period, indicating that it is undervalued. Furthermore, the price drops became more extreme after 2006, when the “Stern Review” on climate change was released, which increased awareness of climate risk. The paper also finds that these negative overreactions are lower for firms that have a strong environmental profile, as their investors tend to have non-pecuniary motives to a greater degree. This indicates that strong environmental performance can protect against negative reactions from natural disasters.

This phenomenon is further researched in a paper by Malik et al. (2023), which examines whether CSR makes a difference in how the market reacts to natural disasters. After looking at 471 separate disasters during the 1995-2015 period, the results showed that the firms with high CSR ratings consistently outperformed the low CSR-rated firms, and this was the case for all different types of natural disasters. There are multiple potential explanations for this: investors feel more trust towards firms that actively invest in CSR. By making CSR investments, firms create a reciprocal relationship with their investors, which results in investors staying with them to a greater degree in bad times. The size of the benefits gained from having high CSR ratings varied, but the firms that gained the most from having high ratings were firms with both low financial constraint and low information asymmetry and high social capital. The study also found that the environmental part of CSR was the strongest driver of resilience towards natural disasters. CSR firms with a strong environmental profile outperformed other CSR firms.

2.5 Hypothesis

The literature points towards a noticeable difference in the stock market reactions to the California 2025 wildfires for companies with high versus low environmental scores. The reaction will likely be worse for low-rated companies than for highly rated ones. This is based on the following four potential reasons:

1. According to Wang et al. (2024) high ESG rated firms tend to have a higher share of institutional investors, who invest more long term and thus the reaction to a market shock is less pronounced for a firm with higher ESG ratings. Since environmental performance is one of the main drivers for ESG ratings, it is reasonable to assume that firms with high environmental scores also have a higher share of institutional investors and thus also experience similarly muted reactions to shocks.
2. The environmental actions that lead to companies achieving high environmental scores are a type of CSR activity. In the article by Malik et al. (2023), it is presented that investors tend to have higher trust and have a feeling of reciprocity towards firms with high CSR performance. Since the firms are spending resources towards addressing social and environmental challenges, the investors are more willing to stick with them during bad times to “give back” for their good initiatives, leading to the market performance of these companies being stronger during events such as natural disasters.
3. The extreme severity of the 2025 California wildfires could lead to the government taking larger action than previously done to combat future wildfires. As outlined in the papers by Baker et al. (2020) and Yousaf et al. (2022), there is a clear connection between the wildfires in the western US and anthropogenic climate change. Therefore, in order to combat the wildfires, anthropogenic climate change has to be combated, and this could potentially be done by implementing new policies and rules for how companies must operate in environmentally friendly ways, this could lead to companies having to put a lot of capital into operational adjustments to comply with new rules. However, firms with high environmental scores are likely better positioned for these changes, giving them a financial benefit as they can use that capital elsewhere. This benefit is something that investors will likely be aware of, and therefore, they will be more inclined to invest in these companies, which would boost the stock prices.
4. Huynh et al. (2021) find that even though the market as a whole tends to overreact negatively to natural disasters, firms with high environmental performance tend to be penalised less due to their investors' higher degree of non-pecuniary motives. It is reasonable to believe that this was also the case during the 2025 California wildfires,

and thus, firms with a high environmental score will outperform those with a low environmental score.

With these four reasons in mind, we consider the most likely hypothesis to be:

- H1a: The stock performance of companies with high environmental performance exhibited a statistically significant difference in reaction compared to companies with low environmental performance following the 2025 California wildfires.
- H1b: Companies with high environmental performance experienced higher abnormal returns than companies with low environmental performance in the aftermath of the 2025 California wildfires.

3. Methodology

3.1 Data Sources and Timeline

In order to examine how environmental performance affected stock market responses to environmental disasters, we conducted an event study on the companies listed in the S&P 500, as of January 1st, 2025. We constructed our event study in line with the procedure presented in the classical paper by MacKinlay (1997). We made some additions to improve and adjust the study for our specific purpose. Our event is the outbreak of the California wildfires on January 7th, 2025, and our analysis concentrates on the abnormal stock returns before and after this date. We take this as the study date mainly because it was the beginning of the fires at Palisades and Eaton, which were among the most impactful fires during this period. After reviewing news coverage and search engine data, we concluded that investors' attention and media exposure were both at their peak just as the fires broke out, so we naturally made this date our anchor point when analysing the market reaction (Google Trends, 2025).

We have two primary data sources: Refinitiv Eikon and Yahoo Finance. From Eikon, we collect firm-level financial and environmental metrics for the companies in the S&P 500, including environmental scores, market capitalisation, GICS industry names, beta values, and debt-to-equity ratios. These data points are taken at fixed dates close to the event window to reflect individual firm characteristics as of the event date. Specifically, the environmental scores are taken as of December 31, 2024; beta and market capitalisation as of January 1, 2025; and debt-to-equity as of December 31, 2024. The reason for choosing different dates was the availability of the data.

From Eikon, we got stock price data for each company in the S&P 500 from July 15, 2024, to March 4, 2025. This stretch covers 160 trading days, enough pre-event and post-event data for us to estimate and analyse. Together with the closing price, we also obtained dividend and stock split data for all 503 stocks during the same period. This was done to adjust the raw price data and ensure that our return calculations reflect actual market reactions rather than mechanical changes, as MacKinlay (1997) stresses should be done. Dividends and stock splits can distort price movements if not accounted for. Dividends lower the stock price on the payout date, while stock splits change a company's nominal share price without affecting firm value. To adjust for this, each time a dividend is distributed, it is subtracted from the closing price on that day, and when a stock split occurs, pre-split prices are retroactively multiplied by the reported split factor. Adjusting returns accordingly ensures that our figures are fair and consistent for comparison across different firms over time. We also obtain daily S&P 500 adjusted index prices from Yahoo Finance, spanning the same 160 trading days, for comparison in our analysis.

3.2 Sample Construction and Cleaning

The dataset was made up of 503 companies included in the S&P 500. Firstly, we exclude businesses classified as “Financials” or “Energy” according to their GICS industry names. Financial firms are excluded due to their unique regulatory structures and capital requirements, which make their stock behaviour difficult to compare with firms in other non-financial industries (Fama et al., 1992). Energy firms are excluded because they are likely to be directly and disproportionately affected by environmental disasters such as wildfires, due to resulting power outages, potentially driving price movements unrelated to investor perception of environmental performance. Including these firms could bias the estimated relationship between environmental scores and abnormal returns. This exclusion results in a reduced sample of 408 firms. Out of the 95 firms that were excluded, 73 of them were classified as “Financials”, while the remaining 22 were classified as “Energy”.

Table 1. Cleaning of the sample

Original sample of S&P 500 stocks	503
Less financial and energy companies	-95
Less missing debt-to-equity ratio	-30

Original sample of S&P 500 stocks	503
Less missing values environmental score & beta	-2
Final Sample	376

We also exclude firms with missing values for the following important variables: environmental score, beta, and debt-to-equity. Even though the GICS industry and market capitalisation are important variables, no firm was missing this data. After applying this filter, we get a final sample of 376 companies. The exclusions made during the cleaning process are detailed in Table 1. These companies cover a wide range of industries to minimise industry concentration bias. Table 2 shows the final sample's industry distribution:

Table 2. Industry distribution

GICS Industry Name	Number of Firms
Industrials	74
Information Technology	63
Health Care	56
Consumer Discretionary	38
Consumer Staples	36
Utilities	31
Real Estate	30
Materials	28
Communication Services	20
Total	376

To improve our data quality and reduce the influence of extreme values, all of the continuous variables used in our regression analysis were winsorized. The environmental score, market capitalisation, debt-to-equity ratio, and beta were done at the 1st and 99th percentile cutoff points, respectively.

3.3 Event Study Framework

In order to estimate the reaction of the stock market to the outbreak of California wildfires, we use an event study based on the market model, which MacKinlay (1997) recommends. This helps us isolate firm-specific abnormal returns by comparing actual stock returns to general market movement trends. The core idea is that, if markets respond differently to firms depending on their environmental performance, these differences should show up as abnormal returns around the event date.

We model the expected return for each firm using the market model:

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

$ER_{i,t}$ is the expected return of firm i on day t , $R_{m,t}$ is the daily return of the S&P 500 index, and α_i and β_i are firm-specific parameters estimated through OLS regression.

We then calculate daily rates of return for each company based on the adjusted closing prices. To estimate the parameters α and β , we used a 90-day lookback period, ending on the last trading day before each event window, as recommended by MacKinlay (1997). These estimation windows are chosen to reflect market conditions in the run-up to the event itself. This approach is particularly relevant where environmental and macroeconomic events might affect firm-specific expectations over short periods. By keeping the estimation window free of overlap with the event window, the event itself has not disturbed our expected return calculations.

The choice of a 90-day estimation window was mainly motivated by several large-scale events before the period, which could distort our results. These events were, for example, the tech-sector layoffs, unexpected monetary policy shifts, and political uncertainty during the early U.S. primaries, all making the market volatile. Extending the estimation window further back may bring more robustness to our findings, but could also introduce noise unrelated to the

environmental event we study. This is consistent with MacKinlay (1997), who claims one should avoid estimation windows affected by major external shocks.

Prior research also suggests that in the case of environmental disasters, rapid shifts can occur in investor perceptions, making a shorter estimation window more suitable (Flammer, 2013). A more contained window can allow α and β to be estimated under market conditions that better match investor sentiment during the wildfires, instead of being too affected by unrelated economic shocks.

Using this estimation window, we generate expected returns for the event window corresponding to a firm by applying its unique α and β . The abnormal returns for each firm on each day are then calculated as:

$$AR_{i,t} = R_{i,t} - ER_{i,t}$$

We calculate abnormal returns for firm i on day t by subtracting the expected return from the actual return. We analyse abnormal returns across three different event windows: A short-term window covering the day before and the day after the event ($[-1, +1]$ day); a medium-term window running for five days before and after the event ($[-5, +5]$ days); and a long-term window taking in price movements thirty days ahead of the event and thirty days after it ($[-30, +30]$ days). These windows reflect different possible market responses: immediate reactions, delayed price corrections, and long-term adjustments. The short window captures any sharp reaction as news of the wildfires breaks. The medium window allows time for investors to reassess firm exposure. The long window captures effects that may play out over several weeks as information about the damage, recovery, and public discourse develops.

For each company, we total the abnormal returns within each window to give CARs. Since we have three event windows, we end up with three CARs measures per firm. These become the primary dependent variables in the later t-tests and regression analyses.

3.4 Environmental Classification

The main independent variable in our analysis is the firm's environmental score. These figures attempt to quantify each firm's environmental performance. By taking a snapshot of these

scores just before our wildfire event began, we can be sure they represent firm characteristics as known to the market at the time of the event and are unaffected by anything after it.

We use the environmental score in two ways. First, we create a binary classification of firms' environmental status. We calculate the median environmental score for our sample and then break the firms into two groups based on that score: the high environmental score group, which includes all firms above this median score, and the low environmental score group, which includes firms below it. This median split lets us conduct mean comparison tests between firms with relatively strong and relatively weak environmental profiles.

The binary classification helps us see if investors treated firms with visibly higher environmental scores differently from those with lower scores. This kind of setup is useful for seeing non-linear or threshold effects, such as whether investors primarily reward firms that are clearly environmentally responsible rather than responding proportionally.

Second, we treat it as a continuous variable in our regression models. This permits us to see whether incremental differences in environmental performance are associated with differences in stock market responses. A higher score indicates better environmental performance, and we test whether this leads to a more muted or favorable market response during the event windows.

3.5 Control Variables

We incorporate the following control factors to isolate the effect of environmental performance on abnormal returns:

Market Cap: Firm size is adjusted for by including market capitalisation. Larger firms tend to have more diversified operations, stronger investor confidence, and greater access to capital, which may affect their resilience to shocks. We also applied a logarithmic transformation to normalise the values and reduce the impact of extreme observations.

Debt-to-Equity Ratio: The ratio between debt and equity measures the firm's financial leverage. Highly leveraged firms may find it hard to cope with sudden disruptions or keep their operations going through uncertain periods without access to funding, making them more vulnerable to damage from negative market reactions.

Beta: Firm-level beta captures systematic risk. Firms with higher beta are more vulnerable to overall market movements and may react more strongly during periods of chaos. Including beta in the analysis helps us disentangle market-related volatility from environmental-specific effects.

Industry fixed effects: By including GICS industry dummies, we are controlling for structural features that may differ between industries. This allows us to better isolate the impact of firm-level environmental performance from broader industry trends.

3.6 Empirical Tests and Estimation

After each firm's CAR was tallied, we tested whether the returns have a relationship with environmental performance. Two approaches were used for the test: mean comparison tests and multiple linear regressions.

As stated earlier, in our two-sample t-tests, we compare firms with above- and below-median environmental scores. We test whether the average abnormal returns differ significantly between the two groups for each of the three CAR variables, corresponding to the three event windows. These tests give an initial indication of whether firms with stronger environmental profiles are treated differently by investors.

We then use OLS regression analysis to control for other firm characteristics. CAR is the dependent variable in these regressions, whereas the environmental score is our main independent variable. Specifically, we run the regressions separately for each event window: [-1, +1], [-5, +5], and [-30, +30].

All three models contain the same control variables: market cap, debt-to-equity ratio, beta, and industry dummies. These aim to account for other factors that may explain firm responses to external shocks. For further analysis of the environmental performance's impact on stock return, we estimate three regression models for each window. The first model includes only the environmental score variable. The second model adds the control variables market cap, debt-to-equity ratio, and beta. The third model includes all control variables, including industry dummies, and acts as our main regression. The main regression equation is specified as follows:

$$CAR_i = \beta_0 + \beta_1 \times EnvScore_i + \beta_2 \times MarketCap_i + \beta_3 \times Debt-To-Equity_i + \beta_4 \times Beta_i + \Sigma IndustryDummies + \varepsilon_i$$

3.7 Robustness Considerations

As MacKinlay (1997) suggests, we conduct several additional tests related to model specification and underlying assumptions to increase the robustness of our findings.

Firstly, we create an alternative version of our regression models, reducing the 90-day estimation window when calculating alpha and beta to 30 days. We chose to focus on a shorter time window instead of a longer one because of the risks of unrelated events distorting our results, which we discussed earlier. By comparing the relationship between environmental scores and abnormal returns with the original 90-day period and our alternative model of 30 days, we can see whether less historical data leads us to draw different conclusions.

Secondly, we test for multicollinearity among the variables by calculating variance inflation factors (VIFs). We do this with and without industry dummies to see if fixed effects introduce collinear relationships or are present among the core independent variables. We also created an alternative model where we removed one of the most collinear variables to examine if our results still hold.

Finally, we study the distribution of regression residuals. We plot the residuals in a histogram to look for a normal distribution. If the distribution is linear, it validates the linearity assumption and strengthens the argument that OLS estimates are consistent. All regression models in the study also employ heteroskedastic-robust standard errors to rectify the likely non-constant variance of error terms.

4. Results

4.1 Overview of the Results Section

The findings of our empirical analysis are presented in this part of the paper. Firstly, we discuss the main characteristics of the firms in our sample, including both overall and by environmental performance. Next, we present t-tests comparing CARs between companies with high versus low environmental scores at three event windows. We present regression results examining the relationship between environmental performance and abnormal returns for the same event windows. Finally, we sum up some findings from robustness checks, such as multicollinearity diagnostics, model comparison, and residual analysis.

4.2 Descriptive Statistics

4.2.1 Overall Sample Characteristics

Before detailing the results of our t-tests and regression analyses, we summarise the distribution of key variables in our sample.

Table 3. Characteristics of key variables, indicating how they are distributed

Variable	Mean	St. Dev.	Min	Max
CAR, -1 day +1 day	0.001928	0.028635	-0.171732	0.125395
CAR, -5 day +5 day	0.007379	0.062700	-0.238286	0.312715
CAR, -30 day +30 day	-0.048330	0.217537	-0.732860	2.199914
Environmental Score	63.985357	1.217169	15.850347	92.458744
Market Cap	24.432204	1.123802	22.730463	28.472317
Debt-to-Equity Ratio	1.489803	2.721994	0.000000	21.091304
Beta	1.031097	0.407820	0.196021	2.614683

The mean CAR for all event windows is close to zero. The short-term and medium-term windows show a positive mean CAR, while the long-term window switches and shows a negative value. There is no trend that can be seen as, the mean CAR increases from the short-term window to the medium-term window, but then decreases to the long-term window. On the other hand, the standard deviation increases from the short-term window to the long-term window. All these values are also close to zero, but notably, the standard deviation of the long-term window is almost 4 times larger than that of the medium-term window. This is also shown by the distinct minimum and maximum points of the three event windows. While the short- and medium-term windows have minimum and maximum points close to zero, the spread in the long-term window is substantially larger, with a maximum point close to 2.2, and a much smaller minimum point.

The mean of the environmental scores shows a value over the middle of the score scale (0-100), with a value of approximately 64. This means that, on average, the companies in our dataset perform better than the mean of their respective industry. The standard deviation is also quite small, which suggests our dataset clusters around this score of 64. Even though the majority

falls between this small range, there is significant variation for the maximum points. We can see that one company has a score as low as approximately 15.9, and another company has a score as high as 92.5.

The size of firms, as measured by the logarithm of market capitalisation, are less diverse. This is natural when taking the logarithm of a variable. On the other hand, debt-to-equity ratios cover a wider range. The mean is around 1.5, while the standard deviation is approximately 2.7. This indicates that our dataset is fairly leveraged and that there is a wide spread. Some firms have no leverage at all with the minimum showing 0, while others have considerable leverage such that the ratio exceeds 21. Thus, the sample contains both conservative and heavily leveraged firms, which could affect their financial flexibility. Firm betas, averaging close to one, are in line with market-level exposure. However, the range is also quite broad, from approximately 0.2 to 2.6. This means that while most companies follow the market rhythm, there are a few which are either uncorrelated or significantly more volatile.

4.2.2 Comparison of High and Low Environmental Groups

To explore potential differences between firms with high and low environmental performance, we split the sample based on the median environmental score of 67.7774. Each group contains 188 firms. The industry composition for the two groups is shown in Figure 1. All industries are present in both groups. However, the low environmental score group shows a larger preponderance for “Industrial”, “Information Technology”, and “Utilities” firms. In contrast, the high environmental score group includes more firms in “Consumer Staples”, “Real Estate”, and “Materials”. “Health Care” is evenly distributed between these two groups.

Figure 1. Distribution of high vs low environmental score firms per industry

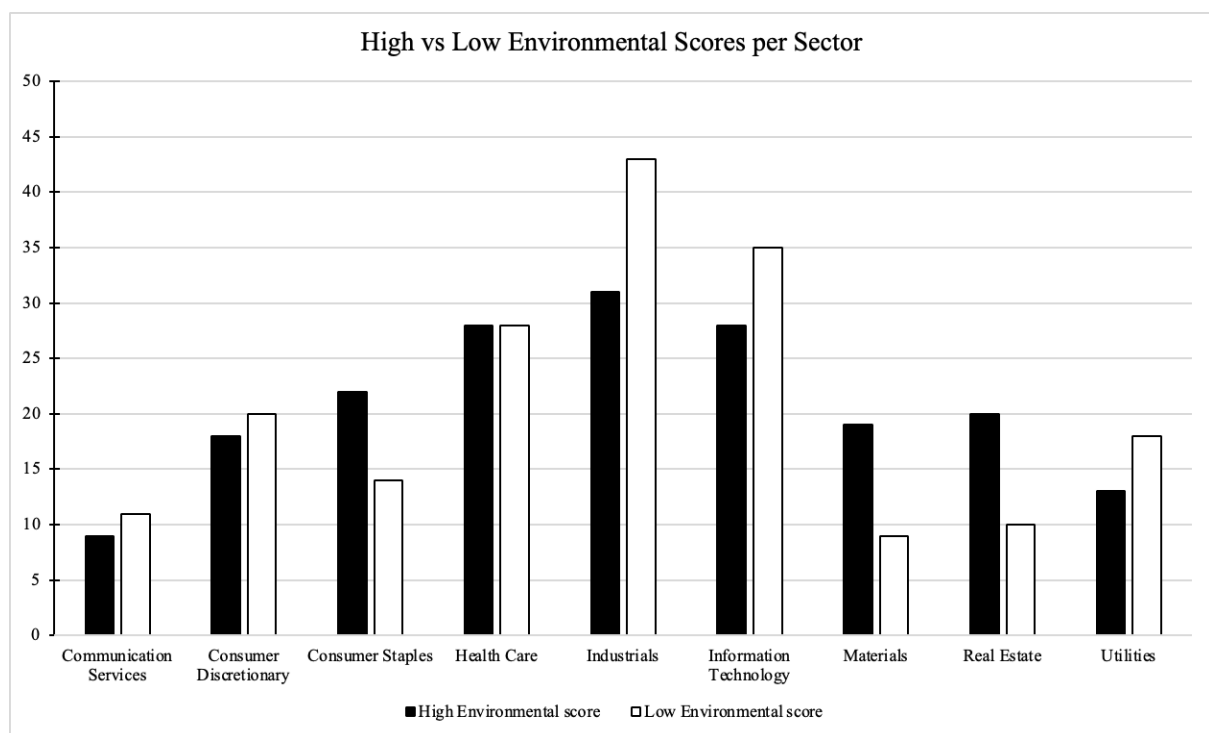


Table 4 presents summary statistics of important characteristics for the two groups. It can be expected that the average environmental score will differ greatly between high environmental score and low environmental score companies, which is also the case, as shown by high environmental score firms having a mean environmental score of approximately 78.4 and low environmental score firms having a mean score of approximately 49.6. Firms with high environmental scores are also, on average, larger, with the mean for the high environmental score group being approximately 0.5 higher compared to the low environmental score group. However, the standard deviations for both groups are large in comparison to this difference, which indicates that both groups have a diverse range of firm sizes. Regarding debt-to-equity, the observation is very similar. The high environmental score group exhibits a higher mean, but the standard deviations for both groups indicate large variation. The beta values are similar across both groups and are evenly centered around 1, hinting at equivalent market risk exposure.

Table 4. Mean and St. dev. of key variables for high and low environmental score firms

Variable	Mean	St. dev.
High Environmental Score		
Environmental Score	78.409723	6.677706
Market Cap	24.690572	1.287853
Debt-to-Equity Ratio	1.744892	3.150241
Beta	1.011482	0.430439
Low Environmental Score		
Environmental Score	49.560991	14.232480
Market Cap	24.173836	0.860132
Debt-to-Equity Ratio	1.234715	2.191637
Beta	1.050710	0.384021

4.3 T-Test Results

To detect whether environmental performance affects abnormal stock returns, we compare the mean CARs of the high environmental score group and the low environmental score group through independent t-tests in the three event windows. The full results are presented in Table 5 below.

Table 5. T-test result, mean comparison tests

Variable	CAR -1 day +1 day	CAR -5 day +5 day	CAR -30 day +30 day
High Env_Score Mean	0.000404	0.004265	-0.031901
Low Env_Score Mean	0.003453	0.010493	-0.064758

T-statistic	-1.032146	-0.962988	1.466661
P-value	0.302744	0.336198	0.143427

In the short-term window, the mean CAR for both the high and low environmental groups is close to zero, with the low group having a higher mean. However, the difference is not statistically significant. The same pattern can be seen in the medium-term window. The mean CAR remains small for both groups but has increased, with the low group still showing a higher mean. Once again, the difference is not statistically significant.

In the long-term window, the pattern changes. Firstly, both groups show a negative mean CAR. Secondly, the high environmental group has less of a negative mean CAR. The difference between the two groups can now be seen as greater than the other two windows. However, it is still not statistically significant.

Overall, over three windows, there is no strong evidence of an association between environmental performance and abnormal stock returns when comparing the two groups. While the direction of the differences between the two groups varies, none of the scenarios shows any statistical significance.

4.4 Regression Results

We ran a regression model for the three event windows that estimated the relationship between environmental performance and abnormal returns. For each event window, three specifications were run: (1) Model by itself using only the environmental score as an independent variable; (2) Model including firm-specific control variables (market cap, debt-to-equity, and beta); (3) The model also includes both firm controls and industry fixed effects. The findings are presented in Table 6 below.

In the short-term event window ($[-1, +1]$ day), the environmental score presents no statistically significant relationship with CARs across models. Coefficients are at or near zero, and p-values remain high. Contrastingly, among the control variables, debt-to-equity is statistically significant at the 5% level in Model 2 but not when industry fixed effects are included. The adjusted R-squared values are all very low in each of these models, which means they provide very little explanation for what they are trying to describe.

The environmental score remains statistically insignificant across all specifications in the medium-term event window ([-5, +5] days). Similar to the short-term results, debt-to-equity is significant at the 5% level in Model 2 but not when industry fixed effects are added. None of the firm controls stand out as consistently significant. Adjusted R-squares rise slightly relative to the short-term models but remain close to zero.

In the long-term event window ([-30, +30] days), the environmental score has a statistically positive relationship with CARs in Model 3 at the 10% level. This hints at companies with better environmental performance, after controlling for firm characteristics and industry effects, have experienced greater returns. Debt-to-equity has high statistical significance across Models 2 and 3 at the 1% level. Beta is insignificant across all three windows. The adjusted R-squared increases with the addition of industry fixed effects for all event windows, indicating that our main model provides the best fit.

Table 6 shows our estimated coefficients and adjusted R-squared values for all models. We indicate statistical significance with, *, ** and ***, for the 10%, 5%, and 1% levels, respectively.

Table 6. Multiple linear regressions results

Variables	Short-Term (1)	Short-Term (2)	Short-Term (3)
Environmental Score	-2.768e-05	-9.669e-0.6	2.702e-05
Market Capitalization		0.0004	-0.0009
Debt to Equity		-0.001**	-0.0004
Beta		0.0027	-0.0046
Sector Dummies			Yes
Constant	0.0037	-0.0079	0.015
Adjusted R-squared	-0.002	-0.000	0.188

	Medium-Term (1)	Medium-Term (2)	Medium-Term (3)
Environmental Score	1.975e-05	0.0001	0.0001
Market Capitalisation		-0.0046	-0.0047
Debt-to-Equity Ratio		-0.0018**	-0.0007
Beta		0.0089	0.0014
Industry Dummies			Yes
Constant	0.0061	0.1052	0.0853
Adjusted R-squared	-0.003	0.005	0.114
	Long-term (1)	Long-term (2)	Long-term (3)
Environmental Score	0.001	0.0011	0.0013*
Market Capitalisation		0.0037	-0.0085
Debt-to-Equity Ratio		-0.0094***	-0.0096***
Beta		-0.0199	-0.0324
Industry Dummies			Yes
Constant	-0.1139**	-0.1733	0.1307
Adjusted R-squared	0.005	0.013	0.085

4.5 Robustness Considerations

To increase the robustness of our findings, we conducted several additional tests related to model specification and underlying assumptions.

Firstly, heteroskedasticity-robust standard errors were used in all regressions to correct potential violations of the homoscedasticity assumption in the residuals.

Secondly, we address potential multicollinearity among the independent variables using Variance Inflation Factors (VIFs). In the full model (which includes both firm-specific variables and industry dummies), several variables show high VIF values. Specifically, market

capitalisation (38.64), environmental score (15.17), and beta (11.12) all clearly exceed the typical threshold of 5 (James et al., 2017). Full VIF results for the complete model are presented in Appendix B.

To see whether industry dummies mainly drove multicollinearity, we re-estimate VIFs excluding industry fixed effects. Although VIF values fall slightly, high multicollinearity persists, with market capitalisation (22.08), environmental score (14.28), and beta (7.29) all still above the acceptable range. These results are shown in Appendix C.

We then re-estimate the model, excluding market capitalisation while retaining industry fixed effects. As shown in Appendix D, this adjustment significantly reduces multicollinearity. Most VIFs fall below 5, although the environmental score (9.96) and beta (8.27) remain moderately high. In summary, this indicates that market capitalisation was the primary source of multicollinearity in the original model. Although VIFs for environmental score and beta remain above 5, no further variables were removed due to their theoretical importance to the model.

After removing market capitalisation from the model, all regressions were re-estimated across short-term, medium-term, and long-term intervals. The results are summarised in Appendix E. When we removed market cap, no significant changes occurred in the main findings. In the short- and medium-term windows, the coefficient on environmental score remains statistically insignificant, and the explanatory power of the models (adjusted R-squared) remains very low. Environmental score and CARs are positively correlated in the long-term window, with a statistical significance at the 10% confidence level. Debt-to-equity continues to have a strong negative relationship with abnormal returns across all windows. Taken as a whole, these robustness checks establish that the original findings do not emerge from multicollinearity caused by market size and that the link between environmental performance and stock returns is consistent with or without market cap.

We also test the sensitivity of our results to the estimation window choice. In addition to the main analysis using a 90-day estimation window, we re-run all regressions using a shorter 30-day estimation window. Results from the 30-day estimation window are presented in Appendix F.

The results from our alternative model are generally in line with the original analysis. For the short-term and medium-term event windows, the environmental score remains statistically

insignificant in the full set of specifications, and the models' explanatory power remains low. However, the long-term window shows different results. Here, the relationship between environmental score and CARs becomes stronger, showcasing a positive coefficient at a 1% significance level for all specifications.

Debt-to-equity shows a negative relationship with abnormal returns in the long-term window. However, the relationship weakens somewhat compared to the 90-day estimation window. In our main model, beta was previously insignificant. This shifted in the alternative model, where beta now shows a statistically significant negative relationship with abnormal returns at the 5% level in the long-term window. The adjusted R-squared values also increase slightly in the long-term models.

Lastly, we plotted the distribution of residuals from our main regression model to test for their normality. The distribution appeared to be bell-shaped, supporting the suitability of our linear model framework. The graph of the residual distribution can be seen in Appendix G.

5. Discussion

5.1 Interpretation of Results

Our results indicate that environmental performance was not reflected in a firm's abnormal stock returns in the immediate and medium-term aftermath of the January 2025 California wildfires. However, the long-term results are less clear, with some signs of environmental performance affecting firms' abnormal returns.

In the short window ($[-1,+1]$ day), none of the CAR models (1-3) indicate any significant relationship between firms' environmental score and their CAR. The same is true for the t-tests, where, though a slight difference exists between firms above and below the median environmental score, it is not significant. This indicates that environmental performance was not a factor investors considered when reacting to the initial shock of the fire outbreak. This behaviour could have a couple of different explanations. One likely reason is that, due to the shock of the fires starting unexpectedly, the lack of available details about the fires, and the scarcity of time to make in-depth analysis, the investors' reactions in the short term were mainly emotional. This emotional reaction would entail that investors decided to buy, hold, or sell without much analysis supporting the decision, and thus, firms' environmental scores did not have an impact. An alternative explanation could be that, as the fires had just started and due to

the uncertainty surrounding the damages they would cause, investors were unsure about how to consider the environmental performance of firms when making investment decisions, thus leading to no clear relationship.

The result remains unchanged in the medium window ($[-5,+5]$ days). Significance still cannot be found, as neither the regression nor the t-test shows any significant relationship between environmental and market performance. This points towards the market still not considering environmental performance as a deciding factor, even after the initial shock. As the fires were still highly active during this period, the uncertainty about their total impact and how to incorporate environmental scores in investment decisions could still explain this. Of course, another possible explanation for the lack of relationship is that the market does not think that environmental performance is relevant to how a firm is affected by wildfires. If investors do not see a connection between the two, then it makes sense not to make any investments based on environmental performance. Lastly, investors may consider environmental performance relevant, but their analyses prioritize other variables. Therefore, even though it is included in investors' analysis, there is no significant connection between environmental performance and CAR.

However, things change when the event window is lengthened ($[-30,+30]$ days). Over this approximately two-month period, the t-test still does not indicate a significant relationship, and the same goes for models 1 and 2 regression. However, the model 3 regression, which includes control variables and industry fixed effects, shows a slightly significant positive relationship between firms' environmental performance and their CAR, at a 10% significance level. The fact that there is only a significant relationship when we control for multiple variables points towards the fact that other factors have a more substantial impact on CAR, so unless they are controlled for, environmental performance's significant positive impact will not be visible. Since significance only exists in our main model (including control variables and industry fixed effect), omitted variable bias may exist in the simpler models. This could explain the lack of significance in the t-test, as it does not include any controls.

This means that while investors did not consider the environmental aspect in the short- or medium-term, in the long term, to a certain degree, investors started to reward (or give less punishment) to firms which had a strong environmental performance. This raises the question of why investors changed their behaviour and started considering it when making investment decisions. One apparent potential explanation is that all fires were put out during the long-term

window. This means the shock, the emotional reactions, and the uncertainty regarding the scale of damage had passed. As the uncertainty disappeared, it likely became easier for investors to include environmental performance in their analyses. Once they did, they may have viewed high environmental performance companies as better investments after the wildfires, either because they seemed more prepared for future regulations, or because they felt such firms deserved less punishment for non-pecuniary motives. An alternative explanation for this change in market behaviour could be that the behaviour of firms caused investors to inadvertently treat firms with high environmental performance more favourably than those with low performance. Likely, firms with higher environmental performance responded directly or indirectly to the wildfires in line with their typical practices, for example, presenting certain initiatives or precautions for the future. It is also likely that firms with low environmental performance did not respond in the same way or to the same extent. The market may have rewarded this difference in behaviour, which could thus have led to environmental performance having a significantly positive impact on CAR. This is not because investors specifically look at firms' environmental performance when making decisions, but because the market appreciates the behaviour that results in high environmental performance in the post-disaster stage.

It is important to highlight that the significance of the environmental factor was sensitive to the choice of estimation window for the market model. When we, as a part of our robustness consideration, tried to run the same regression, but instead based on a 30-day estimation window, the results were similar in the short- and medium-term, showing no significant relationship. However, in the long term ($[-30,30]$ days) the 30 day estimation window results indicated a significant positive relationship between environmental performance and CAR for all three models. The fact that the estimation window has such a large effect on the significance level is problematic, making our results less robust. It also raises the question of the optimal number of days for the estimation window. On the one hand, using only 30 days could be considered too short to capture normal market conditions, as seasonal biases could influence those days. This would make a 90-day period more robust. On the other hand, the longer 90 day period might include unrelated events that distort the estimation, such as the US election, which had a major market impact. In contrast, the shorter 30 day window might better reflect expectations before the wildfires without being affected by external shocks. Many different estimation windows could be argued for. However, the results are sensitive to the estimation window, and thus a singular result from one estimation window should not be seen as a definitive conclusion.

The control variables in the regressions offer additional insights into what drove abnormal returns during the wildfire event. Firm size (market cap) was not a significant predictor of CAR in any specification, suggesting that large-cap stocks were impacted similarly to mid-cap stocks in the S&P 500 after controlling for other factors. However, financial leverage (debt-to-equity ratio) acted as a negative and significant predictor of CARs in model 2 for all estimation windows and in model 3 for the long-term window. Firms with higher debt levels tended to underperform, which makes intuitive sense in a crisis context. Highly leveraged firms may be viewed as riskier and less flexible regarding shocks. The stock level beta (systematic risk) did not significantly affect the CAR in any time period or model. Though one would think that beta should have a strong effect, considering that it is connected to market movements, this result indicates that beta has a weak effect in the event of a market shock. These effects of the control variables seem relatively reasonable and reinforce the model's validity. They align with typical risk factors that would exacerbate or mitigate the impact of a market-wide shock like a natural disaster.

5.2 Comparison to Hypothesis and Previous Literature

The findings clearly indicate that our hypothesis is rejected in the short- and medium-term windows. In the long term, evidence points towards both rejecting and accepting our hypothesis. Though the t-test and the model 1 and 2 regressions do not show any signs of a significant relationship between environmental performance and CAR, the third model does indicate a slightly significant relationship. Additionally, when using a shorter estimation window, results for both the t-test and all regression models indicate a strongly significant relationship. With this in mind, we can neither reject nor accept the hypothesis in the long term, as the results are inconclusive. Therefore, more research needs to be conducted to achieve clear results.

The contrasts between our hypothesis and actual results indicate that the overall positive sentiment in academia surrounding the usefulness of companies having a strong environmental performance might not be as clear in reality, something which is pointed out in the article by Margolis & Walsh (2003). The article finds that much of the research that points towards the usefulness of ESG is conducted in a doubtful manner, which puts its results into question, indicating that environmental performance does not necessarily need to positively affect firm performance. Our findings further support this reasoning, with only some signs of environmental performance positively affecting firm performance in the long term and no evidence pointing towards a relationship in the short- and medium-term.

Both the articles by Huynh et al. (2021) and Malik et al. (2023) indicate that environmental performance positively impacts companies' stock market performance in the case of natural disasters, as it gives firms increased resilience towards sell-offs. As mentioned, in the short- and medium-term, our results do not align with the findings from these articles. This could potentially be explained by the nature of the disaster that our study covered. The wildfires spanned for many weeks and resulted in a lot of uncertainty, with the total damages not becoming clear until a long time after the fires started. In comparison, these papers investigate multiple types of natural disasters. The average natural disaster may only have lasted for a few days, and thus patterns in the stock market reaction might have been identified quickly. In the long term, we have some results that point towards environmental performance, providing the type of resilience mentioned in the previous literature. However, as has been established, our results are inconclusive and not robust, whereas the articles indicate a clear relationship. The difference in robustness of results can likely be explained by the fact that both papers investigate multiple natural disaster events, while we look at one specific instance. It could be more likely that strong patterns emerge when you observe a higher number of events.

Our short- and medium-term findings align with past research suggesting low investor differentiation during crises. Studies such as Sakariyahu et al. (2023) note that initial market reactions to disasters often lack differentiation due to the high emotional impact and intense media coverage. In our case, this likely delayed the market's recognition of differences in environmental performance until the shock had passed and the damage became clearer.

Overall, our findings align with the previous literature in some aspects but contradict it in others. This highlights the need for more research in this area, which has received relatively limited attention so far.

5.3 Limitations & Suggestions for Future Research

While our findings offer valuable insights, several limitations should be acknowledged. First, our analysis focused on a single event, the January 2025 California wildfires. The generalisability of our findings was naturally limited as a result. Depending on the type, size, publicity level, and effects of the disaster, investors' behaviour and the impact of environmental performance may differ greatly. Future research could take our line of inquiry a step further by conducting the same comparison over more than a single environmental event to see if these trends apply more widely.

Second, we attempted to improve our empirical design by using a second estimation window (30 days in addition to the original 90 days) to test the sensitivity of our model. The results of this test suggest a certain sensitivity to this variation. The environmental performance coefficient's significance and size changed depending on the window applied, especially in long-term analysis. This suggests more work should be done to assess how varying estimation spans may affect event studies in environmental performance contexts.

A third limitation is that scores on environmental performance may suffer from measurement error. We rely on Refinitiv Eikon's environmental score as a proxy for firm-level environmental performance. Environmental scores are subjective and vary by provider, which may limit comparability. This could result in some investors' reactions to environmental performance not being captured in our study, as they may have relied on other rating providers that differ from Refinitiv Eikon's. Furthermore, suppose investors choose to look at multiple environmental scores, including Refinitiv Eikon's, and they differ, as found in the study by Serafeim et al. (2022). In that case, investors may not react to environmental performance, as the conflicting information can create confusion about how to interpret it. Future work might compare alternative sources of environmental performance data to see if results differ. It could also examine ESG scores, including social and governance factors.

An additional limitation of the study is that we only look at S&P 500 companies. Though these companies make up the majority of the American market cap, this does not necessarily mean that they accurately represent the entire market. Companies with smaller market caps or that are less actively traded might not respond in the same ways to fires as the companies in the S&P 500. In the overall sample characteristics we also saw that most environmental scores clustered around 64, with low variation across firms. This suggests that the S&P 500 may be too homogeneous in terms of environmental performance, which limits our ability to detect meaningful differences. A natural extension of our research could thus be to conduct larger studies, including more companies than those in the S&P 500.

Finally, multicollinearity was an issue in our regression models, particularly concerning firm size. While we conducted a robustness check excluding market capitalisation, which produced much the same results, the presence of high-variance inflation factors in our full model indicates that one should be cautious when interpreting individual effects from intercorrelated variables to a certain extent. Future research may also want to try alternative methods or expand the sample size so as not to confront these difficulties.

6. Conclusion

This thesis explored the impact of firms' environmental performance on their stock returns during the January 2025 California wildfires. We used an event study approach on the S&P 500 companies as of 1 January 2025, where we controlled for key firm characteristics and analysed abnormal stock returns across a short-, medium-, and long-term event window. Our investigation aimed to determine if the market would treat firms with higher environmental scores differently when faced with a climate-related crisis.

The results show no significant differences between firms with high and low environmental scoring in the short- and medium-term event windows. In the long-term, the results are mixed. Two models show no significant effect, while our main model shows a weak relationship. Furthermore, short- and medium-term effects remained the same when conducting the same test based on a shorter (30-day) estimation window. However, all results for the long-term window pointed towards a strongly significant positive relationship between environmental performance and CAR. The results' sensitivity to the estimation window adds to the uncertainty about the long-term effect.

Concerning these findings, previous research has suggested that firms with high environmental performance are particularly resilient in times of crisis. Although initial market responses may be non-discriminatory, evaluations indicate greater trust in businesses with strong environmental profiles over time. This provides empirical support for the idea that environmental performance can offer reputational or behavioural advantages in adversity, resulting in relatively superior performance during recovery phases.

At the same time, our results also suggest that there is no immediate environmental effect, as no significant association was found between environmental performance and stock returns in either of the short or medium-term windows. This is consistent with existing theories of investor overreaction and initial non-discriminatory reactions across the entire market. However, our inconclusive results in the long-term window do not fully align with much of the previous literature but do also not directly contradict it.

In sum, this thesis adds to the growing literature on environmental performance and financial performance by investigating whether environmental performance affected market responses to the January 2025 California wildfires. The results indicate no clear relationship between the two in the short- and medium-term, while the long-term results are inconclusive. This highlights the need for more research to clarify the long-term relationship.

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8. Appendices

Appendix A. Variable definition table

Term	Definition
Adjusted R-squared	A modified version of R-squared, which is adjusted for the number of predictors.
$AR_{i,t}$	Abnormal Return - Calculated as follows: $AR_{i,t} = R_{i,t} - ER_{i,t}$, where $AR_{i,t}$ is the abnormal return of firm i on day t , $R_{i,t}$ is the actual return of firm i on day t and $ER_{i,t}$ is the expected return of firm i on day t .
CAR_i	Cumulative Abnormal Return for firm i , calculated as the sum of abnormal returns over the event window
CSR	Corporate Social Responsibility
Environmental score	A score which assesses a company's environmental performance.
$ER_{i,t}$	Expected Return - Calculated as follows: $ER_{i,t} = \alpha_i + \beta_i \times R_{m,t}$, Where $ER_{i,t}$ is the expected return of firm i on day t , $R_{m,t}$ is the daily return of the S&P 500 index, and α_i and β_i are firm-specific parameters estimated through OLS regression.
ESG	Environmental Social Governance
Estimation window	The period that is used to estimate α_i and β_i for each firm and the specific time window.
Fuel aridity	How dry the wildfire fuel (grass, trees, leaves, etc.) is.
GICS	Global Industry Classification Standard
Industry Dummies	Binary variables capturing GICS industry classification to control for industry-specific effects
Market Cap	Market Capitalisation - The total value of a firm's outstanding shares.
Non-pecuniary	Not consisting of money
Refinitiv Eikon	A provider of financial data.
S&P	Standard and Poor - A provider of financial data.
S&P 500	Standard and Poor's 500 - An index with the 500 biggest firms in the US.
Significance levels	In our paper we define the significance levels in the following manner: $*$ =10% , $**$ =5% , $***$ =1%.
St. Dev.	Standard Deviation

Appendix B. Variance Inflation Factor (VIF) for each Variable

Variable	VIF
Environmental Score	15.171194
Market Cap	38.638980
Debt-to-Equity Ratio	1.362030
Beta	11.119646
Consumer Discretionary	2.989977
Consumer Staples	2.758168
Health Care	3.612140
Industrials	4.416256
Information Technology	4.096587
Materials	2.301185
Real Estate	2.423501
Utilities	2.443253

Appendix C. Variance Inflation Factor (VIF) for each Variable without industry effects

Variable	VIF
Environmental Score	14.275198
Market Cap	22.082884
Debt-to-Equity Ratio	1.320085
Beta	7.285471

Appendix D. Variance Inflation Factor (VIF) for each Variable without market cap

Variable	VIF
Environmental Score	9.962034

Debt-to-Equity Ratio	1.361732
Beta	8.272959
Consumer Discretionary	2.656085
Consumer Staples	1.919039
Health Care	2.486872
Industrials	3.220399
Information Technology	3.174459
Materials	2.005607
Real Estate	2.113153
Utilities	1.723706

Appendix E. Multiple linear regressions results without market cap

Variables	Short-Term (2)	Short-Term (3)
Environmental Score	-4.937e-06	1.316e-05
Debt-to-Equity Ratio	-0.001**	-0.0004
Beta	0.0027	-0.0043
Industry Dummies		Yes
Constant	0.001	-0.0069
Adjusted R-squared	0.002	0.189
	Medium-Term (2)	Medium-Term (3)
Environmental Score	7.179e-05	4.732e-05
Debt-to-Equity Ratio	-0.0018**	-0.0007
Beta	0.0095	0.003
Industry Dummies		Yes
Constant	-0.0043	-0.0302*

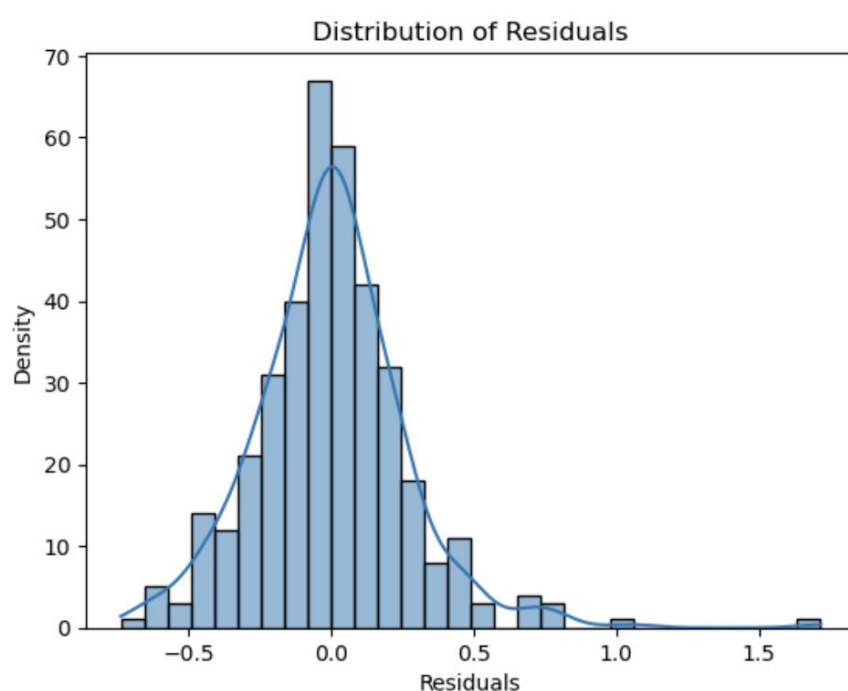
Adjusted R-squared	0.001	0.11
	Long-term (2)	Long-term (3)
Environmental Score	0.0011	0.0012*
Debt-to-Equity Ratio	-0.0094***	-0.0096***
Beta	-0.0204	0.0295
Industry Dummies		Yes
Constant	-0.0859	-0.0781
Adjusted R-squared	0.015	0.086

Appendix F. Multiple linear regressions results with 30-day estimation window

Variables	Short-Term (1)	Short-Term (2)	Short-Term (3)
Environmental Score	-4.234e-05	-2.989e-05	-1.084e-05
Market Capitalisation		0.0004	-0.0001
Debt-to-Equity Ratio		-0.0006	-6.881e-05
Beta		0.003	-0.0031
Industry Dummies			Yes
Constant	0.0066	-0.0051	-0.0021
Adjusted R-squared	-0.002	-0.005	0.158
	Medium-Term (1)	Medium-Term (2)	Medium-Term (3)
Environmental Score	-5.739e-05	4.81e-05	1.174e-05
Market Capitalisation		-0.0046	-0.0032
Debt-to-Equity Ratio		-0.0009	0.0004
Beta		0.0091	0.0031
Industry Dummies			Yes
Constant	0.0194	0.1170	0.0599
Adjusted R-squared	-0.002	-0.001	0.132
	Long-term (1)	Long-term (2)	Long-term (3)
Environmental Score	0.0024***	0.0025***	0.0027***

Market Capitalisation		-0.012	-0.0239
Debt-to-Equity Ratio		-0.0088**	-0.0085*
Beta		-0.0835**	-0.1013**
Industry Dummies			Yes
Constant	-0.1564***	0.228	0.4356
Adjusted R-squared	0.021	0.036	0.097

Appendix G. Distribution of residuals



Appendix H. AI-disclosure

We used ChatGPT to clarify complex concepts, troubleshooting coding issues, and being a brainstorming partner. It also helped optimise our time by organising our reference list in the correct format and order. To avoid misinformation from AI, all information was cross-checked with academic sources, and we ensured full understanding before including anything in our thesis. We also used Grammarly's AI to correct spelling and minor language issues. We believe these tools improved the quality and efficiency of our study. We take full responsibility for the content and analysis presented in our thesis, regardless of the support provided by AI tools.