Research Article

Raining Money: An Empirical Analysis of the Impact of Severe Weather in The United States on Select Stock Market Performance

Blake Birenkrant

Manalapan High School, 20 Church Lane, Manalapan, New Jersey, 07726, United States

ABSTRACT

There are many conditions that can affect a public company's stock price. One condition that isn't completely direct is climate and natural disasters. Previous literature on this topic suggests that extreme-weather events mostly negatively impact company share prices, valuations, and crash risk, with hurricanes and earthquakes being focal points of research and S&P 500 effects being minimal. This project applies to an event study with a 60-day time frame (30 days before and 30 days after) by researching the prices of 100 public stocks across four types of disasters. The results of this study revealed that hurricanes have the most positive effect, wildfires have the most negative effect, and earthquakes have the most ambiguous impact, but these correlations cannot be completely confirmed. Further results also revealed that stock price dips are mainly temporary, and insurance companies were the most diversely impacted industry. Reasons for these results are likely the result of how a company was affected, whether it was disruptions in the supply chain, an increase in product demand, how much warning was given for the disaster, or other outside factors unrelated to any type of disaster. The results of this project mostly aligned with those in the previous literature, and when they did not, it was likely due to differences in project design and collected data. Overall, this study revealed that climate and natural disasters can have a positive or negative impact on the stock market, but these effects may be the result of random chance and outside factors.

Keywords: Stocks; Shares; Prices; Natural; Climate; Weather; Disasters

INTRODUCTION

The weather is an important aspect of everyone's life. It influences various decisions that we have to make every day, such as the appropriate attire to wear or whether or not we can travel by flight. Both daily weather and major climate disruptions can be extremely influential on societal health, economic success, and the ability for life to continue on a routine basis, where basic necessities are accessible. Some of the biggest dangers that come from weather are climate, natural, and environmental disasters. These events can be destructive to houses, buildings, and other infrastructure. They can also be dangerous to humans who are in the path of disaster when they hit. The aftermath of many natural disasters, such as hurricanes and wildfires, is the recovery of the impacted area. This can include the reconstruction of buildings, rebuilding landlines, and many other measures that must be taken

Corresponding author: Blake Birenkrant, E-mail: blake.birenkrant@gmail.com.

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to mitigate the disaster's effects to the greatest extent possible.

In addition to the physical effects that climate and natural disasters can cause, they also have a connection to another system that isn't entirely physical or direct. This is the impact that natural disasters can have on publicly traded companies. Climate and natural disasters have direct effects on companies, such as supply chain disruptions and physical operational damage to factories or machinery. However, these physical effects are what lead to the more or less indirect impact that disasters can have on public companies' stock prices.

Climate disasters have many impacts on the physical area that they hit. But in addition to houses, schools, and other buildings used for more public or personal reasons, public companies in the direct line of a disaster can also be heavily affected. For example, Hurricane Harvey was one of the most destructive hurricanes in the world, dropping over 27 trillion gallons of rain and damaging over 200,000 homes and businesses. These physical impacts of the storm are what potentially resulted in the indirect effects that Hurricane Harvey had on stock prices. Specifically, Hurricane Harvey had different possible effects on company share prices, such as decreasing Travelers' price by around 3.00% and increasing Valero Energy's price by around 10.00% (1).

This concept that climate and natural disasters can have effects on public company share prices is not new and already has various works completed on it to try and really figure out if it is reasonable to conclude that these disasters can have impacts on share prices. Many different research papers and articles have been written on the topic, with their research gathered in an event-study format (tracking a company's stock price over time). The work done on the topic differs based on the scale of the research completed, with some previous literature studying one type of disaster and others studying extreme weather as a whole. For example, Huerta and Perez-Liston's study was solely based on researching how hurricanes impact variables of the stock market (2), and Tas and Sen's study focused on the same factors but for earthquakes (3). Previous research on the general concept of extreme weather and its stock market implications has varied in terms of which elements of the stock market are studied, apart from just share price. Specifically, Altin's study related to extreme weather effects on the S&P 500 (4), and Seetharam's study focused on how climate and natural disasters as a whole effect returns, volatility, investor sentiment, and risk (5). Overall, much of the work done on this topic reveals a common theme that climate disasters have effects on company stock prices and performance, and some of these works will be analyzed in the literature review section.

Weather-related disasters are devastating for a number of reasons to the people and communities affected by them. How these effects translate to a more corporate level, specifically a public company's share price, still doesn't have a clear answer, as what impacts stock prices involves so many other outside variables. This study seeks to understand the role that climate and natural disasters play in affecting the stock prices of public companies, as well as possible reasons for why companies are impacted in certain ways.

LITERATURE REVIEW

As previously mentioned, there is a variety of completed work done on the topic of whether climate disasters impact the stock market. Most of the research done on the topic is completed with an event-study format, which allows researchers to accurately track company share price before, during, and after a disaster. The previous literature has varied from studying one singular type of disaster, such as hurricanes and earthquakes, to studying how disasters as a whole impact different variables studied, such as investor sentiment, stock price crash risk, and stock returns and volatilities. Overall themes from previous literature include that hurricanes tend to lead to decreases in stock returns and prices, earthquakes lead to more ambiguous impacts on stock variables, with some suggesting zero impact and others suggesting both positive and negative effects, and climate and natural disasters as a whole tend to lead to negative, abnormal stock prices, returns, and volatilities, with higher risk and minimal effects on the S&P 500 index.

Hurricanes are one of the most devastating and destructive climate disasters in the world. These tropical storms form in warm ocean waters and then continue to grow until they make landfall and cause mass destruction. In addition to the great physical effects of hurricanes, they can also have large impacts on the stock market, specifically investor sentiment and stock returns. And most of the time, these effects tend to be negative, as previous literature that specifically studied about hurricanes having an impact on the stock market suggests. Daniel Huerta and Daniel Perez-Liston researched three key variables regarding hurricane impact on the stock market: investor sentiment (attitude),

investor fear, and stock returns (revenue generated from a stock). The results indicate that, one, there is a significant decrease in stock market returns the day before and the day of the hurricane making landfall, primarily due to growing investor fear and anticipation from the impending storm. Two, results also showed that there is an increase in investor fear and a decrease in investor sentiment the week before and the day of the hurricane hitting land (2). This literature serves as a part of the common theme that hurricanes tend to have negative impacts on different stock-related variables.

Earthquakes are another commonly studied disaster in terms of their impact on stock prices. These short-lived events can cause mass destruction physically, all while occurring at completely random and unexpected times. Because of the mass damage earthquakes can cause to buildings and factories, they, like hurricanes, can impact the stock market, but the previous literature on this phenomenon is ambiguous in terms of what the effect is, if any. One conclusion about how earthquakes affect the stock market is that they actually have no effect at all due to a variety of factors. A study conducted by Susana Ferreira and Berna Karali in the form of research attempted to examine how earthquakes affect stock market indices' returns and volatilities. The results showed that these global financial markets, both developed and emerging, are mostly resilient to these disasters during the five-day event window following the earthquake. The reason for this stems from the fact that the variety of economic factors, such as GDP and trade openness, and the variety of earthquake factors, such as magnitude and distance from the epicenter, cancel each other out. This ends up resulting in a zero net effect of earthquakes on stocks (6). Additionally, Oktay Tas and Mine Ceren Sen researched the effects that earthquakes and tsunamis have on stock prices and indices. Their findings completely disagreed with the previous study. By using investor sentiment as the primary research variable, this research paper's results were ambiguous, in that the effects of the disasters depended on where they occurred. For example, earthquakes in Japan tended to negatively affect investor sentiment and stock returns, while earthquakes occurring around the Indian Ocean tended to have positive effects on the same variables. This difference is primarily due to how the changes in investor sentiment from the earthquakes affect stock returns. Japan, for example, has stock returns that are negatively impacted by alterations in investor sentiment (3). Both of these previous works on the subject express the theme that there isn't one common pattern when it comes to how earthquakes impact stock market elements. Some research, such as Ferreira and Karali's study, suggests little impact by using both macroeconomic and earthquake characteristic variables (6), while other research, such as Tas and Sen's paper, suggests a large impact while using trading volume and investor sentiment as primary variables (3). There is still no clear pattern in terms of the impact being positive or negative.

Previous work on this topic generally involves studying climate, natural, and environmental disasters as a whole in terms of their impact on the stock market. Much of the previous literature uses a variety of natural disasters to gauge whether the disasters have any measurable impact, rather than seeing which of the disasters has an impact. A general theme is that any sort of disaster tends to cause negative effects on specific stocks on the stock market, such as valuation and stock price. In a research study conducted by Ishuwar Seetharam that employed an event-study format, it was determined that environmental disasters do affect company stock performance, where the extent of this effect depends on the company's ability to adapt to the impending disaster. The specific effects of the disasters that directly affected companies involved valuations 0.3-0.7 percentage points lower, resulting in $9 million-$22 million USD lost in aggregated market capitalizations, measured 40 days post-disaster (5). Another metric studied involves stock crash risk, or how much of an effect climate and natural disasters have on causing a stock price to crash. Rui Zhao, Dayong Zhang, and Mengmeng Guo attempted to determine this relationship for stocks in emerging markets, and it was indeed found that firms geographically exposed to any disaster were at a higher risk of having their stock price crash, mainly due to risk-taking and dampening of company fundamentals (7). One last important metric in previous literature involves how different extreme weather events affect the S&P 500 return index. This is a very useful way to determine overall disaster effects, as the S&P 500 generally serves as a representation of how the entire U.S. stock market is performing. In a research article by Hakan Altin attempting to uncover this exact effect, an exponential GARCH model was used to determine the relationship between these variables. While the research revealed that extreme weather events do create financial uncertainty in companies, which leads to negative effects on firm cash flows, effects on the S&P 500 were minimal because many, but not all, of

these disasters are predictable, and the American stock market is close to the efficient market hypothesis. For the disasters that are not predictable, S&P 500 effects were minimal, mainly because not all companies and areas of the stock market are directly impacted by the disasters (4). Much of the literature available on how all climate and natural disasters impact the stock market shares the common theme of negative effects on companies' stock prices, volatility, and crash risk, with a lot of these effects dependent on where the disasters occur and which specific companies are impacted.

METHODS AND MATERIALS

In order to answer the research question of how different types of disasters affect public companies' stock prices and the reasons for it, accurate and appropriate data must be collected. The data in this project is measured in the form of an event study, meaning the main type of data gathered on stock prices is collected over time, before, during, and after the disaster occurs. The four types of natural climate disasters included in this research are earthquakes, hurricanes, floods, and wildfires. For each type of disaster, five specific instances were chosen. The criteria for these disasters were that they had to occur in the United States in recent history (1980-present). From each of the specific disasters chosen, five public companies were chosen. The specific public companies that were chosen were based on the criteria that some aspect of the firm had to be directly impacted by the disaster. For all of the companies, this included owning factories or warehouses in the impacted area, having disruptions in the resource supply chain, experiencing large changes in the cost of goods or services, or having a significant change in the supply or demand for their commodities. Additionally, the companies were not chosen by specific industry but instead randomly sampled based on if they met the criteria for being affected by the severe weather event.

With the public companies impacted by each disaster, data was gathered and measured on their stock prices over time. Google Finance was used to determine the exact price of the company's stock on a specific date. The specific dates chosen to measure the company's share price were in terms of when the disaster that impacted the company occurred: one month before the disaster hit, the date of the disaster, and one month after the disaster hit. With the accurate stock prices gathered for each company at different intervals, two different stock price differentials were calculated. These included the company's stock price differential from one month before the disaster to one month after the disaster hit and the stock price differential from the date of the disaster to one month after the disaster hit. Finally, averages were calculated based on each company's stock price differentials, along with confidence intervals tied to each disaster type and differential measured. For both of the differential cases calculated, the average for each differential was found in terms of each specific disaster and each disaster as a whole. Additionally, the movement of the S&P 500 index was measured over the same interval used to measure each company's stock price changes for each specific disaster.

The format of the event-study time frames was chosen to gather the most accurate before and after statistics on the stock prices, with the two-month time frame being long enough to see change and not too long to where outside conditions had a large impact. The specific differentials were calculated to make it easier for reasonable conclusions to be made from the data. The first differential, from one month before the disaster to one month after, was meant to show if a disaster can have a long-standing impact on a stock price or if any immediate price change was just temporary. The second differential, from the date of the disaster to one month after, was meant to reveal whether a stock price recovers after some time since the disaster has passed, or if the price continues to fall or falls from inflated conditions caused by the disaster. The overall format of the averages gathered for the research was meant to quantify each individual disaster's effect on stock prices and then the general impact tied to each type of disaster as a whole. The confidence intervals allow the data gathered in the study to be applied to larger sample sizes since the research conducted through this study used a relatively smaller number of disasters and public companies. The data gathered on the S&P 500 index was meant to serve as a benchmark for the entire U.S. stock market, where the individual stock data could be compared to the movement in the S&P 500 in order to see how the general market responded to the disaster. Overall, the exact design chosen for this project was created to make accurate and reasonable observations and conclusions from the data. For example, the project design allows the financial impact resulting from advanced warnings of hurricanes to be quantified against more surprising disasters without warnings, like wildfires.

RESULTS

This event study resulted in both expected and unexpected findings (Table 1). All of the results serve as being relevant to answering the core research question, and the data is limited to disasters occurring in the United States as well as to the small sample of stocks studied. However, many of the results are most likely applicable to a broader extent, especially when studying different companies from the same disaster. An important note is that when the averages tied to each specific disaster and the disaster as a whole are talked about, the "first average differential" refers to 1 month before and 1 month after the disaster, and the "second differential" refers to the date of the disaster and 1 month after the disaster. Additionally, all confidence intervals were calculated with a 95% confidence level.

Table 1. Summary of average stock price differentials tied to each disaster

	Average Stock Price Differential From 1 Month Before to 1 Month After Disaster	Average Stock Price Differential From the Day of Disaster to 1 Month After Disaster
Earthquake	0.57%	-0.27%
Hurricane	5.40%	3.43%
Flood	-4.58%	-4.61%
Wildfire	-9.58%	-10.08%

Earthquakes had the least impact out of all the types of disasters studied, mainly due to the unclear direction that earthquakes have on stock prices. The average stock price change tied to earthquakes is 0.57% between 1 month before and after the disaster (confidence interval of [-5.60%, 8.21%]) and -0.27% between the date of the disaster and 1 month after (confidence interval of [-6.35%, 7.84%]). The data for earthquakes in general being close to 0 is primarily the result of the ambiguous results of the specific disasters studied. The Puget Sound Earthquake (2001) had very negative impacts, with the average stock price changes being -7.83% and -8.92%, respectively, for the two differentials. On the other hand, both the Northridge Earthquake (1994) and Hawaii Earthquake (2006) had more positive impacts, with average stock price changes being 5.32% / 2.97% and 5.45% / 2.05% respectively. These countering effects more or less cancel each other out, which is what results in the general impact tied to earthquakes being minimal. The reason for these ambiguous impacts canceling each other out is most likely the result of how sudden and short-lasting earthquakes actually are. The randomness of earthquakes happens so quickly that the disaster's media coverage may be limited, and aspects of investor sentiment may not be a huge contributor to the stock price changes. The mixed results may also be due to the stock prices being affected by outside factors that have no connection to disaster. Additionally, the data collected for the S&P 500 generally agrees with data collected for each earthquake or has a minimal price change during the time frame (1).

Hurricanes, out of all the disasters studied, were the only disasters that had a clear positive impact on stock prices. The reason for this most likely stems from the fact that hurricanes usually have the most advanced warnings out of any disasters, making preparation and mitigating the disaster's impacts easier. It can also be somewhat of a coincidence that some of the companies were positively affected by other factors. The average stock price tied to hurricanes was 5.40% between 1 month before and after the disaster (confidence interval of [-0.68%, 11.02%]) and 3.43% between the date of the disaster and 1 month after (confidence interval of [-2.46%, 8.91%]). These positive stock price effects tied to hurricanes can be attributed to all of the hurricanes studied except Hurricane Ida (2021), which had average stock price effects of -1.47% and -2.52%. The largest contributors to the positive effects tied to hurricanes were Hurricane Katrina (2005), with average changes of 10.69% and 9.81% (with specifically Valero Energy increasing by 38.92%), and Hurricane Sandy (2012), with averages of 7.36% and 3.97% (with specifically Generac Holdings increasing by 30.00%). The general movement of the market based on the S&P 500 was mainly minimal in comparison to the large positive changes tied to each disaster, with the exception of the index's movement during Hurricane Ida's time frame, contradicting that disaster's effect results being 1.99% / 2.99% (in comparison to the average negative effects tied to Ida) (1).

The results tied to floods align strongly with the great damage that these disasters can cause. The average impact attributed to floods was -4.58% between 1 month before and after the disaster (confidence interval of [-9.89%, 1.51%]) and -4.61% between the date of the disaster and 1 month after (confidence interval of [-11.80%, 3.32%]). The two specific floods that had the greatest influence on these results were the Nashville

Flood (2010) and the South Louisiana Flood (2016). The average impact on stock prices for these two floods was -9.38% / -10.88% and -7.26% / -7.01%, respectively. The only flood out of the ones studied that had two positive average stock price differentials was the Great Flood of the Midwest (1993), with average stock price effects of 2.60% / 2.37%. This outlier may be the result of many of the stocks chosen for this disaster having an increase in the demand for their resources and services, with Union Pacific Railroad and Allstate Insurance both being positively affected during the time frame. Additionally, it is entirely possible that these effects could be due to random chance and weren't associated with any floods at all. In terms of how the entire market was affected during the time frame of these disasters, based on the movement of the S&P 500 index, the stock market generally moved in the same direction as many of the specific stocks, with large decreases in stock prices corresponding with large negative movements in the S&P 500. The only case where the market movement contradicted the movement of the companies studied was for the New England Floods (2023), where the S&P 500 increased by around 4.00%, but the stock prices studied had an average decrease of around -3.00% (1).

Lastly, wildfires showed the most negative average results in our sample for their overall effect on share prices. The average stock price change tied to wildfires as a whole was -9.58% between 1 month before and after the disaster (confidence interval of [-24.26%, 4.45%]) and -10.08% between the date of the disaster and 1 month after (confidence interval of [-22.08%, 1.58%]), the largest negative average out of all the disasters studied. Three of the five wildfires studied heavily contributed to this large, negative result, and these disasters also had at least one stock with an extremely large decrease in its price. The first one was Camp Fire in California (2018) with average stock price differentials of -13.12% and -16.25% (having the Pacific Gas and Electric (PG&E) stock decrease by around -46.00%). The next wildfire with large contributions to the overall results was the Maui Wildfires (2023), with average stock price changes of -23.20% and -18.73% (having the share price of Hawaiian Electric Industries negatively impacted by around -65.00%). The last disaster with heavy contributions was the Woolsey Fire (2018) with average changes of -17.48% and -16.54%, and it contributed to the decrease in Pacific Gas and Electric's (PG&E) stock price of -46.00% (both the Camp Fire and Woolsey occurred at the same time in California and contributed to this). Although the results correlate strongly that wildfires negatively impact stock prices, this cannot be made certain, as there are likely other reasons that some of the stock prices were affected. For the movement of the S&P 500 during the time of these wildfires, there were really no surprising results, as the market either moved in the same direction as many of the stock prices did or barely shifted at all, with price changes close to 0.00% (1).

DISCUSSION

The results of the research show that extreme weather events may possibly affect the stock prices of public companies. While there are trends seen in how different types of disasters affect stock market performance, the confidence intervals reveal that the data is not fully statistically significant at conventional levels, primarily due to the smaller sample size. The simple observations from the data show that disasters do have an impact on stock prices, with many of these effects being negative, but also many being positive, especially for hurricanes. However, these effects cannot be correlated to the disasters with complete confidence, as some of the impacts are likely to be the result of outside factors. The following information in this section, however, does include possible reasons as to why the disasters had these effects, assuming that further research would reveal that there is somewhat of a connection.

It was previously noted in the results section that the average stock price change tied to earthquakes as a whole was minimal, with the two differentials being close to zero. The reason for this, as found in the data, was that rather than company share prices not being affected at all by earthquakes, they were affected in ambiguous ways. In simpler terms, there were instances where specific earthquakes possibly had positive effects on stock prices and vice versa (1). A possible reason for this most likely tie into the surprise capability of earthquakes. These disasters are almost always unexpected, with usually no advanced warning before. The significant damage that they can cause happens suddenly and may last for less than a minute. The surprising nature of earthquakes may limit the direct effect that these natural disasters have on stock prices. The price changes seen in the event-study time frame may be the result of outside factors such as standard supply and demand, interest rates, and inflation. This would support the fact that no clear pattern is seen in terms of how earthquakes affect the stock market,

as these outside factors can have both positive and negative impacts on stock prices. On the other hand, the immediate damage may cause supply chains to be disrupted or factories and buildings to be demolished, or it may not significantly damage a company in the affected area, which can result in an increase in that company's services or a more positive investment sentiment for that industry.

As previously mentioned, there were many instances where a stock price may have been positively affected by a climate or natural disaster. Take, for example, hurricanes, which, from the results of the research, revealed that the general impact tied to this disaster was potentially positive on stock prices (1). A possible reason for this trend is that out of all the disasters studied, and also in general, hurricanes are the most predictable and therefore have the most advanced warnings. Meteorologists can spot tropical storms forming in the Caribbean and track them until they eventually form into hurricanes. Once they do form into hurricanes, advanced warnings can be given about the exact day the disasters may hit to leave time for emergency evacuations and preparations. By this concept, the predictability of hurricanes may lead to the mitigation of stock market losses and overall investor sentiment consistency. Additionally, the large amount of damage that hurricanes can cause may lead to an extremely inflated demand for different companies' products, resources, and services in order to repair and reconstruct the impacted area. So even though hurricanes may be the most destructive disaster physically, the predictability of them may lead to the mitigation of further losses in the supply chain, factory destruction, and more, which ultimately leads to fewer stock market losses and more increases in stock prices. However, this advanced notice only really benefits companies in engineering, energy, and home-improvement industries, as seen in the data for companies like Jacobs Engineering, Valero Energy, Fluor Corporation, and Home Depot (1). Other industries still take massive hits despite the warnings, but in the data from this project, companies in industries that benefit from hurricanes were the primary focus. Other possible factors besides predictability that could potentially be responsible for these results include the specific region of the United States that was impacted (since different regions may respond differently to similar disasters) or government and philanthropic aid given to people and groups impacted by hurricanes. Overall, there isn't a clear answer as to why there is this theme for hurricanes, but factors of predictability and others likely play some role in the results.

An important observation from the research results was that wildfires had the most negative average impacts on stock prices (1). This is most likely the case due to the nature of wildfire. These disasters come with almost no advanced warning. They happen suddenly, and while they start small, they can grow extremely quickly. In addition to the unpredictability of wildfires, these natural disasters are also very difficult to put out and stop, in comparison to other disasters, which either end on their own or can be mitigated quickly. Wildfires can unleash mass destruction since the conditions in which they take place allow them to spread quickly, making it very hard to stop the damage altogether. This demolition not only destroys homes and forests, but it also can damage or completely decimate physical aspects of different businesses. The mass damage can cause temporary, but long-standing, effects on resource prices, supply chains, and investor sentiment on different companies and industries. There is really no way to mitigate many of the losses companies face, as wildfires happen suddenly and can last for a long time. Some factories may be permanently destroyed, or the cost of goods heavily inflated. These effects are the reason for the results of wildfires, where stock prices are negatively affected with a long recovery time attached to them. However, it is important to recognize that this observation could be due to a multitude of factors besides the nature of wildfires. This can include various other outside factors that may be particular to just one of the specific wildfires or completely unrelated to any wildfire.

There are two other important observations from the data collected that do help address some of the aspects of the research. The first finding is related to the two stock price differentials calculated for each stock and then as averages for each specific disaster and each type of disaster as a whole. The majority of the time, the average stock price change when calculated between one month before the disaster and one month after is greater than the average stock price change when calculated between the date of the disaster and one month after. Although both differentials in many cases were negative, the first before-and-after stock price differential was generally a greater value than the second stock price differential, whether both values were positive or negative. This observation suggests that many of the impacts that climate and natural disasters can have on public companies are somewhat temporary,

and that many companies, to an extent, are able to recover both their firm and share price. Specifically, there were many cases where a stock price was able to return to its original value (one month before the disaster), or close to it, around one month after the disaster took place (or not decrease to an extremely high extent). This is most likely due to the disasters causing a temporary dip in a company's stock price, along with cases of internal company strength and general market (S&P 500) rebound post-disaster. In contrast, there were still some cases when a stock price couldn't recover as much from its price on the date of the disaster to one month after or just continued to go down because of the disaster's aftermath (1). An important note is that this pattern cannot be completely verified given the small sample of disasters studied. It is possible that this trend is true for other cases, possibly to a lesser or greater extent, or even coincidental in some cases, where the dips and rises were due to outside factors.

The second observation is about one specific industry that was commonly studied in this research project. Many of the industries studied, such as engineering, entertainment, and retail, generally had similar patterns in terms of what direction their stock prices moved (most of the time down). The industry that had the most diversity in this concept was the insurance industry. The three most common insurance stocks studied were Allstate, Chubb, and Travelers. All three of the companies experienced instances where their share price increased or decreased after a natural or climate disaster hit (1). These variations may be due to how the insurance industry is affected by extreme weather. While engineering companies may experience physical factory damage or an increase in their materials' prices, the insurance sector does not get affected physically. These disasters affect the companies, as they tend to lose a lot of money when disasters hit to pay for home rebuilding and other damage. This also affects these companies' strategies in terms of increasing their policy rates for homeowners' insurance, deductibles for specific disaster insurance, and general ability to get insurance coverage. All of these factors can have mixed effects on their share prices, which may be the result of the ambiguity of how insurance stocks are impacted by extreme weather events. The effects may also potentially be related to other factors that aren't associated with severe weather.

Much of the research and results done through this project relate to the previous research done in past literature written on the topic. Many relevant research papers on the topic were brought up in the literature review, and the studies' overall claims on certain topics were shared. From the data collected in this project, it is clear how it possibly aligns with past literature. In general, much of this research project's results agree with the previous literature, but there were cases where the findings didn't align for various reasons. Additionally, the alignments and misalignments with previous literature cannot be stated with complete certainty since the data collected from this study was from a relatively smaller sample.

The way in which the research in this project was designed allows the data to be analyzed at a micro-level, in terms of studying just one type of disaster, and at a macro-level, studying natural and climate disasters as a whole. Some of the previous literature focused only on one type of disaster and its impact on the aspects of the stock market. The first of these in the literature review section was Daniel Hureta and Daniel Perez-Liston's research published in 2010 on the impact of hurricanes on investor sentiment as well as stock market returns. The results gathered in Huerta's study showed that there is a significant decrease in stock market returns prior to and on the day of the hurricane hitting, with larger corporations being less affected (2). The results from this project don't necessarily align with these findings, as although there were some instances where a company's share price decreased on the date of the hurricane, most of the cases in the data were instances where a company's stock either stayed the same or actually increased (hurricanes were the only type of disaster to have positive impacts on stock prices in the research completed). The reason for this contradiction in the data may be that the industry's most negatively impacted by hurricanes in Huerta's study were those of technology and telecommunications, both of which didn't have a lot of representation in this study. Additionally, the difference in the results may also be due to differences in time frames for the event study and Huerta possibly having a large sample size of hurricanes and companies. However, this result does align with Huerta's assertion that firms with larger market capitalization are less affected by hurricanes, which many of the companies studied were. Moving on to the next specific disaster brought up in the literature and researched in this study: earthquakes. The two research papers mentioned both studied the same topic but had differing results. Susana Ferreira and Berna Karali's research article, published in 2015, found that all of the factors involved with major earthquakes, both

climate and financial variables, end up resulting in a zero-net effect on stock prices (except for Japan) (6). On the other hand, Oktay Tas and Mine Ceren Sen's study published in 2019 found that the results on how earthquakes affect stock prices were ambiguous, as the actual impacts the natural disasters had been dependent on where they occurred (3). The data from this project aligns much more with Tas and Sen's findings, as the earthquakes studied in this project definitely had impacts on share prices, although United States earthquakes may share some commonality with those in Japan. Furthermore, the data from this research aligns very well with Tas and Sen's findings, as the earthquake's impacts on stock prices were ambiguous, with some positively affecting companies and others in a negative way, which could have to do with where the earthquakes occurred and which companies they affected. Specifically, the ambiguity may relate to the exact region where the earthquake occurred, as areas that receive more earthquakes than others, such as northern California and Japan, may be affected differently than regions that receive fewer earthquakes, such as Washington and South Korea. The reason for this alignment in the data from this study and the data from Tas and Sen's study is most likely the similarity in the methodologies, where both this study and Tas and Sen's study used trading volume and investor sentiment as the primary representation for the data (stock price is very representative of a combination of trade volume and investor sentiment). The alignment may also be the result of both studies researching earthquakes in various places where a clear pattern isn't seen.

The macro-level of studying how climate and natural disasters affect stock prices (macro referring to market-wide indices) can just as easily be analyzed in comparison to the micro-level, based on how this project was designed. The general conclusions that can be made from the data relate back to the findings found in the previous literature, specifically the papers that focused the scope of their research on disasters as a whole. Firstly, in Ishuwar Seetharam's paper on environmental disasters and stock market performance, published in 2017, it was found that firms exposed to any sort of disaster did tend to have both lower valuations and greater stock market losses than firms that were not exposed to any disaster, with larger companies being able to mitigate these losses to some extent (5). Overall, the findings from this project align to an extent with Seetharam's claims, as many of the instances studied resulted in companies experiencing lower stock prices as a result of a disaster impacting on them. However, there were also many other instances, including the general type of disaster, hurricanes, where companies were positively affected by the severe weather event. Moving on to another aspect of the stock market brought up in the literature review section, Rui Zhao, Dayong Zhang, and Mengmeng Guo's article on how natural disasters affect stock crash price risk, which was published in 2024, found that natural disasters do indeed increase the risk of a company's stock price crashing if they were directly exposed to the extreme weather (7). The results from this project don't align with these findings for the most part, as even the companies that were negatively affected by the disaster didn't have their stock price completely crash and were many times able to recover one month after the disaster. The one case that does align with Zhao, Zhang, and Guo's claim is how the Hawaiian Electric Industries stock was impacted by the Maui Wildfires, where the share price decreased by around -65.00% (the closest to a price crash out of all the companies studied) (1). The final previous research study mentioned in the literature review talked about the extreme weather effects of the S&P 500 (general stock market). In Hakan Altin's research article published in 2024 on this topic, it was concluded that extreme weather events create unexplained market anomalies (by financial models) and financial certainty in companies, with overall impacts on the S&P 500 being minimal (4). The overall results from this project's data mostly agree with Atlin's findings. First, it is clear to see that the disasters studied did create stock price anomalies that may be the complete result of the disaster that impacted the company, in which case, a financial model would most likely not be able to explain it. Why financial models often miss disaster-induced anomalies is most likely due to the fact that many disasters are random in terms of when and where they occur, and the exact effects that they can have on companies differ from each disaster depending on whether the firm was directly or indirectly impacted. Second, there were cases in the data where the S&P 500 movement was relatively small and most likely coincidental, aligning with Altin's claim. However, there were also many instances where the movement of the S&P 500 was not only significant but also aligned with how individual stock prices responded to the disaster.

The previous discussion about the data mainly assumes that the research conducted is potentially statistically significant. This, of course, cannot be

verified given the confidence intervals and the size of the data sample. While it is likely that many of the effects could've been due to the climate and natural disasters, it is also likely that many of the impacts were due to random change and factors unrelated to severe weather. There is also a chance that how companies are potentially affected varies from disaster to disaster, which is why the confidence intervals are widespread.

CONCLUSION

The core research question for this project, centered around how and why natural, climate, and environmental disasters affect stock prices, has clear takeaways and conclusions that can be made based on the research completed and analysis of the data. The completed research revealed that extreme weather events possibly have an impact on company share prices, with hurricanes potentially impacting companies most positively and wildfires potentially impacting companies most negatively. As far as how the disasters affected the prices, it really depended on which type of disaster impacted the company and which company was impacted. This led to cases where stock prices were both positively and negatively affected, with negative impacts being much more common in the data. In terms of why these natural and climate disasters had an effect on company stock prices, it really delves into which part of the company's business was affected by the disaster, which cannot be truly known based on the project design. The data in this study suggests that specific cases where a company is affected include negative impacts such as supply chain disruptions, material cost rises, and decreases in investor sentiment for that company or industry, and positive impacts such as a greater demand for company resources or services and efficient efforts to mitigate company damage from disasters. The effects on company share prices may also be completely unrelated to climate and natural disasters and be the result of other outside factors. Overall, weather-related disasters may have varying impacts on company stock prices that occur because of the specific aspect of the company that gets impacted by the disaster and the nature of the disaster itself. The question of whether general climate patterns, such as excessive rain, snow, cloudiness, and fog, affect company share prices in the long run is similar to the question of how extreme weather events affect stock prices. However, general climate pattern impacts would most likely be less noticeable than disaster impacts if climate pattern impacts happened over a long period of time. An event study methodology would likely still work for chronic patterns, but the time frame of it would need to be extended much farther than for acute events. Answering this would help to understand how much of an impact not just climate and natural disasters have on stock prices, but how much of an effect the general concept of weather plays in the stock market.

Weather plays a key role in everyone's life on multiple levels. Not only do daily weather and incoming storms and disasters affect everyone's personal life, but they also have societal and financial implications. The question of how different disasters affect stock prices and why is intriguing, as many people know that there are many factors in play for the stock market, but there isn't necessarily a direct connection between climate and natural disasters, and company share prices. Research on this topic has included studying one singular type of disaster to study extreme weather as a whole and its impact on the stock market. The results from the previous literature vary, especially since the scope of previous research papers differs, but many share the common theme that generally disasters negatively impact a company's stock prices. To answer the core question for this project, an event study was set up by choosing five specific earthquakes, hurricanes, floods, and wildfires, along with five public companies that were impacted by each disaster. Then, the exact share price of each company was found using Google Finance on three dates: one month before the disaster, the date of the disaster, and one month after the disaster. Finally, stock price differentials were calculated for each company along with average stock price changes tied to each specific disaster and the general disaster, with confidence intervals also calculated for each average differential. Additionally, the movement of the S&P 500 index during each disaster's time frame was also tracked. The results of the research revealed that hurricanes had the most positive effect on stock prices, wildfires had the most negative effect, and earthquakes had the most minimal effect, mainly due to there being cases where some earthquakes had positive effects and others had negative effects. Additionally, the S&P 500 generally either followed the direction of the stock prices or had minimal movements during the time frame altogether (1). General observations and reasonable conclusions that can be made from that data include the nature of hurricane predictability contributing to advanced warnings resulting in investor response being prepared for the incoming disaster and positive stock

price effects, wildfires being sudden and long-lasting, contributing to negative effects, and earthquakes being sudden but short-lasting, contributing to ambiguous effects. Additionally, the data revealed that in many cases, stock prices can somewhat or fully recover to their original price one month after the disaster, and the insurance industry was the most varied in terms of how those companies were impacted by the climate and natural disasters. However, these results and observations cannot be verified with certainty due to the ranges of the confidence intervals and size of the data sample. Comparing this project's results to the previous work on the topic, a lot of the conclusions aligned with the literature, and in cases where they didn't, it was mostly a result of the scope of this project and previous research being different.

The general topic of how weather and disasters are related to the stock market has many opportunities for future research, other than just United States companies and disasters. Mainly a greater sample of disasters and public companies can be studied to gather evidence that is more statistically significant and can truly show a certain correlation. Additionally, other types of extreme weather can be studied, such as tornadoes, tsunamis, volcanic eruptions, etc., in terms of their impact on stock prices. Then, research on the topic can expand to other countries and disasters that have occurred in those countries. This can help determine whether similar disasters in other parts of the world, where extreme weather may be perceived and tackled differently, have similar impacts on different foreign markets. Nonetheless, the research gathered in this project reveals that climate and natural disasters in the United States potentially play some role in company stock prices, with specific effects being dependent on both the type of disaster and the specific company.

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CONFLICTS OF INTEREST

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REFERENCES

1. Google. Google Finance - Stock Market Prices, Real-time Quotes & Business News. *Google*, www.google.com/finance/ (Accessed on 2025-06-16).
2. Daniel Huerta, and Daniel Perez-Liston. The impact of hurricanes on investor sentiment and stock market returns. *Global Business and Finance Review.* 2011; 16.2: 136-149.
3. Oktay Tas, and Mine Ceren Sen. The comparative analysis of investor sentiment effect on two major earthquakes and tsunami incidents. *PressAcademia Procedia.* 2019; 10.1: 12-16. https://doi.org/10.17261/Pressacademia.2019.1135
4. Hakan Altin. The impact of extreme weather events on the S&P 500 return index. *International Journal of Sustainable Engineering.* 2024; 17.1: 642-649. https://doi.org/10.1080/19397038.2024.2393577
5. Ishuwar Seetharam. Environmental disasters and stock market performance. *Work. Pap., Dep. Econ., Stanford Univ., Stanford, CA* (2017).
6. Susana Ferreira, and Berna Karali. Do earthquakes shake stock markets?. *PloS one.* 2015; 10.7: e0133319. https://doi.org/10.1371/journal.pone.0133319
7. Rui Zhao, Dayong Zhang, and Mengmeng Guo. Do natural disasters affect stock price crash risk? Evidence from emerging markets. *Journal of International Financial Markets, Institutions and Money.* 2024; 93: 102001. https://doi.org/10.1016/j.intfin.2024.102001