The Impact of Hurricanes on Different Industries

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ABSTRACT

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In this paper, we investigate impacts on five industries (food, construction, gas and petroleum industry, industry, and transportation industry) from three hurricanes (Katrina, Irene and Sandy) that lead to tremendous economic losses in U.S. history. Our sample consists of 529 public firms from S&P 1500. We find that different industries are affected by hurricanes differently. Hurricanes pose a potential threat to food and insurance industry but could boost gas and petroleum markets and bring benefits to transportation industry if the rise in oil price is not extremely high. Hurricane Katrina, which is the strongest hurricane amongst the three, causes lower effect on the insurance industry than other two hurricanes; and it benefits gas and petroleum industry while other two adversely affect the industry. Furthermore, we notice that, during hurricane period, big companies suffer more than smaller companies. Higher returns on assets and Tobin's Q are related to higher abnormal returns. Increase in capital expenditures after hurricanes could help companies gain better expectations from investors.

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1. Introduction

Catastrophic events are always a big concern for the U.S. stock markets, especially in recent years when natural disaster events have become more frequent and more destructive. However, among the natural disasters, tropical cyclones have the most significant impact, since they always cause the biggest economic losses. According to National Centers for Environmental Information (NCEI), during 2005 to 2017, the total cost for major natural disasters is about 986 billion dollars, and about 630 billion dollars losses are caused by hurricanes, representing 64% of the total natural disaster costs.

Therefore, it is necessary to have a better understanding of these tropical storms for enterprises that experience natural disasters to manage risks; for financial regulators and policymakers to cooperate, communicate and create disaster recovery plans that can be put in place to provide a quick, effective and flexible response to these events; for governments to complete the risk-control system; and for investors to improve their portfolio risk/return profile.

However, according to Sam Stovall, chief investment strategist at Standard & Poor's, it is hard to draw any conclusions about the link between hurricane damage and stock-market performance. Instead of only creating such tremendous costs, hurricanes offer investment opportunities, although it is not typical. For example, The Standard & Poor's 500-stock index jumps up 6% in the six months following Hurricane Katrina in August 2005, the costliest hurricane in U.S. history. Also, the stock market edged up 3% in six months after Hurricane Andrew slammed the U.S. in August 1992 and yet the market fell 3% in six months after Hurricane Hugo hit in September 1989.

Existing research has demonstrated that hurricanes adversely affect the insurance industry. Angbazo and Narayanan (1996) find an adverse impact to insurers after Hurricane Andrew. Lamb (1995) also examines the effects from Hurricane Andrew and concludes that significant negative abnormal returns are found around the event day.

However, natural disasters may positively affect other industries: construction, food production, transportation, and oil and gas. The need to rebuild residential houses or re-establish infrastructure when a natural disaster occurs may cause the market to anticipate an increased demand for construction works. To transfer needed goods, freight carrier use increases dramatically. And more gas may be needed for the recovery of disaster areas. The same may apply to food production because of reduced capacity to produce and acquire daily necessities (food, clean water, etc.) locally.

Our study aims at examining hurricanes effects on both industry's daily stock market performances and industry's cumulative abnormal returns. Two main research questions are investigated: how different industries react when hurricanes occur? How different hurricanes affect the same industry?

Instead of testing one single hurricane, we investigate the catastrophic effects from three hurricanes (Hurricane Katrina, Irene and Sandy). Hurricane Sandy's peculiar path was exceedingly rare and the trajectory is hard to track. Differed from most North Atlantic hurricanes, Sandy approached the New Jersey shoreline with a nearly perpendicular angle. And a hurricane, like Sandy, with the near-perpendicular path is highly unlikely to occur under late 20^{th} to early 21^{st}. So, we want to compare the effect from the hurricane with such unusual path and effects from other two costly hurricanes.

Sandy is the largest hurricane that hits the U.S. Northeast region which is one of the most densely populated areas in U.S.; Katrina is considered the most destructive hurricane in the U.S. history and strikes the Gulf Coast; while Irene sweeps northwards along the U.S. eastern coast. We use firm data of insurance and four other industries from S&P 1500. Our sample consists of 528 publicly traded companies and we divide them into five industries by following Fama-French 48 Industrial Classifications. We first run event studies to see daily stock markets performances. We also run OLS regressions to see impacts on firm's cumulative abnormal performances.

Our study fills a gap in the literature as currently no existing studies have examined effects from several hurricanes to different industries and have explained why hurricanes can elicit different market reactions even in the same industry. Besides, most of previous studies just focus on insurance industry, so effects from hurricanes on other industries are always ambiguous.

The paper proceeds as follows: sections 2 reviews the literatures about catastrophic effects; section 3 presents hypotheses development of the paper; section 4 describes the paper's data sources and variables and discusses the methodology employed; our empirical results and analyses are dealt with in section 5; and the robustness tests results are shown in section 6; the last section provides our conclusions.

2. Literature reviews

Worthington, and Valadkhani (2004) examine the effect from a few natural disasters, such as severe storms, floods, cyclones, earthquakes and bushfires (wildfires), and they find that these natural events all exert influence on market returns.

Borden and Sarkar (1996), and Anderson (2000) discuss the issue of property catastrophe risk and insurance and reinsurance. Within this industry, there are two main opposing hypotheses that exist; the first one is that people believe when disasters occur, insurers will bear large reimbursements for the damage of insureds. Therefore, such unfavorable expectation should decrease insurance firms' stock prices. The other hypothesis supports that insurers can benefit, since some disasters result severe damages and only very a small portion of individuals or companies will be covered before, the short-run demands for coverage will surge and so insures can obtain profits by raising insurance rates.

Similarly, Chen, Doerpinghaus, Lin, and Yu (2008) define two effects: the claim effect and the growth effect. The claim effect is the impact from the unexpected loss on insurer short-run earning profitability. And they suggest that the more property-liability coverage insurers provide, the greater claim effect they will experience. Whereas, the growth effect is a long-term effect. If price increases dominate quantity reductions and insurer profitability increases, growth opportunities appear. And they demonstrate the evidence of claim effect in the wake of catastrophic loss while they are not able to find obvious evidence for growth effect.

In related papers, Shelor, Anderson, and Cross (1992) find that property-liability and multiple insurers stock prices show a significant positive response to the Loma Prieta earthquake and they conclude that expectations of higher demand for insurance from investors cover up the potential earthquake losses. And Aiuppa, Carney, and Krueger (1993) examine the market response of property and casualty (P&C) insurance companies around the same earthquake and find a similar result. Cagle and Harrington (1995), Cummins and Danzon (1997), Gron (1994) and Winter (1991) analyze models that the insurance supply is an increasing function of the insurer's capital. Gron

(1990) and Shelor, Anderson, and Cross (1992) show that natural disasters could increase the demand for insurance from previously uninsured consumers, leading to premium increases.

However, Lamb (1995) suggest that Hurricane Andrew produced a significant negative impact on property-liability stock price if insurers have direct premium in Florida or Louisiana. They find that markers do efficiently absorb the information generated by the hurricane and distinguish property-liability insurers based on the existence and magnitude of insurance written. Similarly, although there are expectations that the insurers can recoup some of their losses because of the subsequent premium increases and the impact can be offset by the subsequent premium increases to some extent, Angbazo and Narayanan (1996) find a large negative impact from Hurricane Andrew. Cagle (1996) concludes that high exposure insurers react significantly and negatively after Hurricane Hugo while firms with low exposure are not affected. However, unlike Cagle (1996), Lamb, Reinhold P (1998) compare two hurricanes, Hurricane Andrew and Hurricane Hugo, and find that these two hurricanes produce dramatically different reactions from markets. Companies are largely unaffected by Hurricane Hugo whereas there is a significant negative impact from Andrew on exposed firms. The market shows an ability to discriminate by the magnitude of hurricanes and by the level of loss exposure of insurance companies. Also, markets incorporate the information quickly, since the response is concentrated within two days after Hurricane Andrew strike.

Therefore, it seems that there are no consistent conclusions for impacts from natural disaster events. To see the various reactions from firms in different industries to different hurricanes, followed by Lamb, Reinhold P (1998), this paper continues to examine effects from natural disasters on stock markets but by focusing on three different hurricanes and five industries.

The use of multiple industries instead of one was chosen as nearly all past research papers about the financial impact of natural events and disasters tend to just focus on a single industry. Especially, most of the existing financial research into natural disaster focuses almost primarily on the property-liability insurance industry, even though it is well known that natural events and disasters have substantial effects on other industries. Thomas and Kopczak (2005) find that, in the aftermath of natural disasters, transportation companies face many challenges due to the destruction of physical infrastructure such as roads, bridges and airports, remoteness of the area and limited transport capacity. Shelor, Anderson, and Cross (1990) indicate that the California earthquake has significant effects on real estate companies, since the earthquake conveys important new information to the market and the information is reflected in the reduction of stock values.

Market reaction varies among industries to the same disaster. Shelor, Anderson, and Cross (1992) examine the market response from property-liability insurers around the earthquake, and they find that, in contrast with the real estate-related firms, the property-liability insurers show a significant positive reaction to the earthquake.

Furthermore, these non-insurance impacts are often positive. For instance, Skidmore and Toya (2002) discuss that the efforts from construction and manufacturing industries to replace the loss of capital and durable goods caused by natural disasters often increase economic output. Besides, they find that climatic disasters are positively correlated with economic growth, human capital investment and growth in total factor productivity. With one-standard-deviation increase in climatic disasters, there is a 22.4% increase in the average annual economic growth rate.

When we consider the impact from natural disaster events, there are other potential factors that we need to concern. For example, Worthington and Valadkhani (2004) mention that the Shelor, Anderson and Cross (1992) analysis of the 1989 Loma Prieta earthquake is compromised because it neglects the lowering of official US interest rates two days later.

3. Hypothesis Development

Hypothesis 1: hurricanes adversely affect insurance industry while may positively affect other industries.

The first hypothesis suggests that hurricanes can cause negative impacts on insurance industry while bringing positive effects on other industries. Insurers will bear large reimbursements for the damage of insureds, which could decrease insurance firms' stock prices; however, the need to rebuild residential houses or re-establish infrastructure may cause the market to anticipate an increased demand for construction works. The same may apply to food production because of reduced capacity to produce and acquire daily necessities (food, clean water, etc.) locally. To transfer needed goods, the use of freight carrier increases dramatically, and more oil and gas may be needed for the recovery of disaster areas. All of these, on the other hand, can bring benefits to these industries.

Hypothesis 2: hurricane effects could vary according to hurricane paths.

While for the second hypothesis, we hold that hurricanes paths play an important role on the storms' effects to the markets. Hurricanes' path which is barely mentioned by previous studies, we believe, is a very important factor, because the peculiarity of hurricanes path can cause completely different results to industries. Hurricane Sandy's path was exceedingly rare. Unlike most North Atlantic hurricanes, Sandy perpendicularly barreled in to New Jersey which is one of the most populated areas in the country. Other two hurricanes, Katrina and Irene, struck the Gulf Coast region which accounts for a large percentage of U.S. oil production, and veered west over the northeastern U.S. respectively. Because hurricanes have different affected areas, they must affect different industries in different levels. And yet, even the same industry could react non-uniformly and even diametrically oppositely to different hurricanes.

Hypothesis 3: large firms with low ROA are likely to suffer more during hurricanes.

Next, we hypothesize that firms' characteristics, such as firm assets tangibility, firm size, return on assets (ROA), Tobin's Q have relationships with cumulative abnormal returns of companies during the storm period. We expect that firms with high ROA and Tobin's Q could be punished less during hurricanes, as these firms normally have high profitability, adequate resources to manage risks, better financial positions and better expectations from investors. By contrast, we expect that big firms are likely to suffer more because of their large tangible assets and large-scale business that are easily to be affected by hurricanes.

Hypothesis 4: companies could gain confidence from investors by increasing capital expenditures and research and development expenses after hurricanes.

Lastly, we suggest that post event explanatory variables, such as research and development expenses increase, and capital expenditures increase after hurricane events, are correlated with firm performances. Sometimes the market reaction knows more than what is public information. They may know beforehand how the firms will react to these disasters. But these variables are seldom used in prior studies, so in this paper, we want to examine whether these variables will contribute to a firm's abnormal performances. And we believe that increases in capital expenditures and research and development expenses after hurricanes can be favoured by the markets.

4. Data and Methodology

4.1 Data sources and sample descriptions

We choose three billion-dollar hurricanes (Katrina, Irene, Sandy) that occurred between 2005 and 2012 from NCEI, that have different paths and have a longer time interval between each other. Hurricane Sandy is the largest hurricane that struck the mid-Atlantic and Northeast areas of U.S on Oct. 29, 2012. while Katrina, which is considered the most destructive hurricane in U.S., hit the Gulf Coast on Aug.29, 2005, Irene swept ashore on North Carolina on Aug. 27, 2011, causing wide-spread floods across eastern areas after several subsequent landfalls. As shown in Table 1, these three hurricanes caused significant amount of losses in the history of U.S., with estimated costs of 161.3, 15.1 and 70.9 billion USD respectively. Here, we use the hurricane start date from NCEI as hurricanes' event date.

Hurricane Sandy's peculiar path was exceedingly rare, and the trajectory is hard to track. Differed from most North Atlantic hurricanes, Sandy approached the New Jersey shoreline with a nearly perpendicular angle. And a hurricane, like Sandy, with the near-perpendicular path is highly unlikely to occur under late 20th to early 21st. So, we want to compare the effect from the hurricane with such unusual path and effects from other two costly hurricanes

Fama-French 48 Industries was used to collect information about companies for the five different industries (food, construction, gas & petroleum, insurance, transportation) from Standard & Poor's 1500 index in Compustat. All accounting data was acquired from Compustat. To see if firms with larger percent of tangible assets, such as machinery, plants and buildings, will be punished more when hurricanes appear, we include the measure of asset tangibility which represents the ratio of a firm's physical asset to its total asset. To see if the abnormal return can notice the size difference between firms, and we include the firm size variable which, in our study, is the natural logarithm of total assets. We expect that large firms are likely to be affected by hurricanes since they have more tangible assets and more wide-spread businesses. Furthermore, we want to examine if firms with strong profitability could manage their risks well during hurricanes. We use return on assets to measure a firm's ability to make profits. High Tobin's Q means great intangible assets and it represents the market's confidence for a company. So, Tobin's Q is included to see if higher Tobin's Q leads to higher abnormal returns during hurricanes. To see if there are distinguishing results among areas, we include a geographic dummy variable. To see if the capital shift from a company's other assets to it's tangible assets would contribute abnormal returns, two post variables, the research and development expense increase and the capital expenditure increase, are added. Share price data is obtained from CRSP. Detailed descriptions of these variables are shown in Table 2.

Table 3 shows the summary statistics for these variables, where the mean value for asset tangibility is 0.5633; the mean value for firm size is 8.062; the mean value for ROA is 0.034; the mean value for Tobin's Q is 0.253; the mean value for CAR (-5, 5) is 0.3%; the mean value for CAR (-1, 1) is 0.0007; the mean value for expenses of research and development change is 0.9201; and the mean value for capital expenditure change is 70.9707.

Tables 4 shows the correlation between explanatory variables and the table does not suggest serious concerns for multicollinearity problems among independent variables.

4.2 Methodology

To estimate the impact from hurricanes on these five industries' daily stock price performances, we run event studies for each industry separately by using market model. The market model is employed to measure stock price reactions and therefore it is widely used in prior catastrophic effects researches. The sign and the statistical significance of the excess returns suggests if there are market responses to hurricane-related information.

Following a bivariate normal distribution, the expected return for securities in our sample can be expressed through the market model as

$$R_{j,t} = \alpha_j + \beta_j R_{m,t} + \varepsilon_{j,t}, (1)$$

Where $R_{j,t}$ = the stock return for company j in day t,

$R_{m,t}$ = the CRSP equally-weighted market return on day t,

α_j = a parameter which represents the market independent stock return for firm j,

β_j = a constant which measures the market sensitivity of security j,

$\varepsilon_{j,t}$ = a random variable followed normal regression assumptions.

Next, CARs are used to estimate stock return performances during an event window which in this paper is 5 days prior to the hurricane date and 5 days after and 1 day prior to the hurricane date and 1 days after in our robustness test. The difference between the actual return and predicted return for firm *j* in day *t* is the excess return which can be defined as:

$$ER_{j,t} = R_{j,t} - (\alpha_j + \beta_j R_{m,t}). (2)$$

And the average excess return (AER) for day *t* can be calculated as

$$AER_t = \frac{1}{n}\sum_{j=0}^{n} ER_{j,t}, \ (3)$$

Where *n* is the number of firms in our sample.

Cumulative abnormal returns can be represented as the sum of average excess returns over the event window as:

$$\text{CAR}\ (t_1, t_2) = \sum_{t_1}^{t_2} AER_t \,.\, (4)$$

Where t_1 and t_2 are the first day and the end day of an event window respectively. In this paper, we use two windows, window (-5,5) for our basic regressions while window (-1,1) for the robustness test.

Next, we run Ordinary Least Square (OLS) regressions for each industry between CARs and firm control variables, geographic and industry dummy variables, and two post variables. To avoid multicollinearity between industries, we run sperate regressions instead of only one regression with all the industries. The model is shown as the following:

$$\text{CAR}\ (t_1, t_2) = \beta_0 + \beta_1\text{CAPLNT} + \beta_2 SIZE + \beta_3 ROA + \beta_4 Tobin'sQ + \beta_5 GEO + \beta_6 Industry_j + \beta_7\text{RD} + \beta_8\text{CAPX} + \varepsilon_i \ (5)$$

Where $CAPLNT$ is the firm assets tangibility; $SIZE$ represents firm size; ROA is return on asset; GEO is the geographic dummy; $Industry_j$ is the industry dummy; RD is the research and development expenses increase; $CAPX$ is the capital expenditures increase.

5. Empirical Results:

5.1 Stock markets daily performances

From Table 5, we find that different hurricanes have different effects on industries; there is a significant positive return in day +4 under Hurricane Katrina, a positive return in day -2 and day +1 and a negative return in day +5 under Hurricane Irene, while no results found are significant under Hurricane Sandy. However, this does not mean that Hurricane Irene has the largest and Sandy has the least effect on industries. In Table 5, where we have aggregate results for all industries, we can observe that the hurricane effects on these different industries might cancel each other out and may make the total result ambiguous. Therefore, we look at the effect from these three hurricanes on a single industry.

As the demand for temporary construction rises and rebuilding kicks in, constructors can benefit after the hurricane period. From Table 6 we can see that, for construction industry, the stock market reacts positively in day +4 under Hurricane Katrina, in day -2, day -1 and day 0 under Hurricane Irene, and in day +3 and +5 under Hurricane Sandy. This suggests that the market sees benefits on the prospects for work orders to repair the devastation caused by Hurricane Katrina. However, we also find significant and negative reactions from the market in day -3 and day +4 under Hurricane Irene. This is probably because hurricanes always come with heavy flooding, companies that are not related to emergency repairs will face lost work time and productivity from rain and flooding. Therefore, concerns about the delay or suspension of planned constructions may arise.

We find that food industry sees both significant positively and negatively impacts during these hurricanes, as shown in Table 7. And the positive returns always show up earlier than the negative returns. Prior to or around the event of hurricanes, the market can see net sales boost as customers stocked up on hurricane essentials, such as bottled water, milk, canned goods and beer etc.

However, followed by the sale rises, the adverse impacts from hurricanes will be realized by the market since the heavy flooding and high-speed wind will destroy crops and shut down food processing plants, and food distribution system will suffer due to thousands of truckloads of food being stuck on roadsides and in warehouses after the disruption of roads and bridges.

From Table 8, we find significant and positive returns in day +3 and day +4 under Hurricane Katrina for the gas and petroleum industry. By contrast, we didn't find positive results under Hurricane Irene and Sandy, instead we find quite negative and significant results for these two hurricanes in day -4. We believe that the difference is due to the different areas that Katrina and other two hurricanes affect

Next, we find that hurricanes generally cause significant negative effects on insurance industry as we can see from table 9 that the insurance stock market reacted negatively in day -1, day 0 and day +5 to Hurricane Irene and in day 0 to Hurricane Sandy.

Also, we can see that the insurance market suffered by Hurricane Irene on August 25th and 26th. However, surprisingly there is also a significant and positive result on the day after Hurricane Irene landed.

For transportation industry, in table 10, we find a significant and negative result in day -3 and a significant positive result in day -4 under Hurricane Sandy. We find only significant positive results in day -4 and day -2 for Hurricane Irene and only a significant negative return for Hurricane Katrina.

5.2 Industries' cumulative abnormal return results

Unlike daily stock markets performances which are likely to be influenced by unrelated factors, such as firm acquisitions and firm financial reports releases, results for cumulative abnormal returns are more likely to reflect pure hurricanes related information.

In Table 11, we find a quite significant and positive result for construction industry under Hurricane Irene, which supports our expectation that the construction industry can benefit from the need for building and repairing infrastructure and post-storm cleanup and debris removal efforts. And profits from post-hurricane activities can compensate the losses caused by the hurricanes.

However, results under Hurricane Katrina and Sandy are not significant. Prior to Hurricane Katrina, due to the housing market's robust expansion and shortage of construction materials, construction prices had already risen dramatically, for example, gypsum, cement, machinery prices were up 12.4 percent, 12.7 percent, and 7 percent respectively. On top of the already high construction material prices, many cements ports are located in New Orleans and the major ports of entry for steel imports in Gulf of Mexico were disrupted. Following the devastation caused by the storm, the shortage increased, driving prices even higher. Therefore, the negative effects from high costs for constructors may counteract the significant positively return we find in daily stock market performances table.

While with Hurricane Sandy, we believe that the insignificant result is due to the suspension or cancellation of many on-going constructions. As we mentioned before, unlike the other two hurricanes, Hurricane Sandy hits many major metropolitan areas directly, e.g. New York City where works on skyscraper and other projects were stopped, bringing work to a standstill. Even though we saw the boom of post-Sandy works and the returns in day +3 and day +5 in Table 6 are significant positive, the result here is not significant and the sign is even negative, which may suggest that margins from post-storm works for construction industry cannot overweight losses if there are large number of projects delayed or cancelled.

We also find that ROA always has a large positive relationship with CARs and Tobin's Q is positively related to CARs but only significant under Hurricane Katrina. The rate of return on assets (ROA) is used to measure how successful a firm at using its assets to generate earnings independent of the financing of (debt versus equity) those assets, and we use it here as a company's ability to make profits. And Tobin's Q measures a firm's market performance. So, the positive and significant sign here tells that investors could have good expectations for the future of companies with high ROA and high Tobin's Q. However, we find that the firm size is negatively related to CARs and significant under Hurricane Sandy, which means that large firms are more likely to suffer than small firms when hurricanes come. However, geographic dummy is negative and only significant under Hurricane Katrina.

For the two post-event variables, the result of the research and development expenses increase is insignificant while the result for the capital expenditures increase is significant and positive under Hurricane Katrina. This might suggest that markets do know beforehand how firms will react to these disasters and could have better expectations for firms that increase their capital spending after hurricanes events.

We are not able to find any significant results for food industry from Table 12 and this is probably due to the offset of the positive and negative returns that we find in food industry stock market performances table. But all the signs of coefficients for food industry are negative, which probably means that the positive effects from the boom of food product sales cannot cover up the adverse effects from the damage caused by hurricanes. And again, we find that ROA is always positive and significant, and Tobin's Q is positive but only significant under Hurricane Katrina and the firm size is negative but significant under Hurricane Katrina and Sandy. Geographic dummy is negative and only significant under Hurricane Katrina. Still, we couldn't find significant results for the research and development expenses increase, but the capital expenditures increase is positive and significant under Katrina and Sandy.

From Table 13, we find quite significant results for gas and petroleum industry under all three hurricanes, where the sign is positive under Katrina and negative under Irene and Sandy. This corresponds to the results in Table 8 that the positive and significant return is only found during Hurricane Katrina and negative and significant results are found during both Hurricane Irene and Sandy.

Sandy threatens oil supply as it disrupts oil and gas platforms in Gulf of Mexico, where large quantities of U.S. oil and gas is produced. As a result, the gas price soared, and the crude price hit record high and rose around 6%. With such high prices and demands that exceed outputs, oil and gas companies can realize higher margins to cover up the damage caused by the hurricane. Unlike Katrina that tore through Gulf of Mexico where most of oil and gas productions are made as we mentioned before, Irene and Sandy affected U.S east coast regions that have large amount of oil and gas productions consumers in the country. Because of the severe disruption from Irene and Sandy, roads, airport and ports were closed, meaning oil and gas products can hardly be transported. And because of many economical activities were stopped, the demand for oil and gas products therefore was reduced. Besides, during Irene oil prices only settled modestly higher and during Hurricane Sandy the oil price even fell by 1.1 per cent. Consequently, with low price and low demands, the oil and gas companies experience tremendous losses during Hurricane Irene and Sandy.

Also, ROA and Tobin's Q are always positively related to CARs while firm size is negatively related to CARs. And there is a significant and positive result for capital expenditure increase under Hurricane Sandy.

From Table 14, we find a significant and negative result for insurance industry under Hurricane Irene. This significant negative result corresponds to what we hypothesized; people may assume that when hurricanes come, insurers will bear large reimbursements for the damage caused by the storm. Therefore, such unfavorable expectation will decrease insurance firms' stock prices. Again, we didn't find the significant result for Hurricane Katrina, although it is the strongest one among these three Hurricanes. However, the negative sign of geographic dummy shows that Katrina dose adversely affect exposed insurers. Surprisingly, we did not find the significant result for Hurricane Sandy. Again, ROA and is positively and firm size is negatively related to abnormal returns. No significant results for capital expenditures increase under Hurricane Irene while they are significant and positive under Hurricane Katrina and Sandy.

In Table 15, we find that results under both Hurricane Irene and Sandy are positive for the transportation industry. And we believe that hurricanes could benefit the transportation industry to some extent because the demand for delivering needed goods largely increases during pre-storm period.

However, we find a significant and negative result for the industry under Hurricane Katrina and we attribute this to the new record high oil price driven by the storm. Unlike other industries, transportation industry highly relies on oil products and the oil price is strongly related to the industry's stock markets. The dominant input cost for transportation firms is fuel.

So, it is reasonable to believe that transportation firms could benefit from hurricanes if the oil price doesn't reach considerably high.

6. Robustness Tests

In our robustness test, to see how different industries react in a shorter window, we keep all the variables that we use in our basic regressions but choose CAR (-1,1) instead of CAR (-5,5). Again, we find that the result for construction industry only under Hurricane Irene is significant, and CAR (-1,1) is negatively correlated to the Gas & Petroleum industry under Hurricane Irene and Sandy but is positively correlated to the industry under Hurricane Katrina.

Still, results for the food industry under both Katrina and Irene are negative but turn into significant. This might suggest that hurricanes potentially have negative impacts on the food industry even though no significant results are found for our basic regressions. For insurance industry, apart from the negative and significant result under Irene, we find a quite significant negative result under Hurricane Sandy. This is in line with the only significant negative return that we find at day 0 in the daily stock market performances table. And we believe that the reason we find the significant result for the industry only in a shorter period under Sandy is, on Oct 29th and 30th, NYSE (New York Stock Exchange) was closed because of Sandy's battering, and 27th and 28th was the weekend, so there was no chance for the market to reflect Sandy's impact. And when the market reopened in Oct 31st, the market reflected all the information. And still we didn't find any significant results for Hurricane Katrina.

We find the capital expenditures increase negatively and significantly for all CARs in our robustness test under Irene, even though no results of the capital expenditures increase are significant under Hurricane Irene for CAR (-5,5). Usually, markets have positive expectations for companies that expand their capitals after hurricane events. However, when firms increased their capital spending after Irene in 2011, they experienced another severe storm Sandy in 2012. Markets might see that these firms are likely to suffer more, since, after increasing expenditures on capitals, they lack financial resources to manage their risks during hurricane Sandy. Note that, there are no billion-dollar hurricane events in the year after Katrina and Sandy.

7. Conclusions and Discussions

Our results show that market reactions of firms in different industries are different to hurricanes. All food industry results are negative for CAR (-5, 5), but significant under Hurricane Katrina and Irene for CAR (-1,1). Also, we find that results for insurance industry are negative and significant under Hurricane Irene and Sandy for CAR (-1,1). So, we believe that hurricanes could pose potential threatens to food and insurance industries. However, transportation companies could benefit from hurricanes if the oil price doesn't reach extreme highs. And we find a significant positive result for the construction industry under Hurricane Irene. Hurricanes can boost the market of gas and petroleum industry or cause losses to the industry depending on the path of the storm. Besides, we find a significant result for the geographic dummy variable only under Hurricane Katrina. Probably because Katrina is the one with the highest magnitudes among these three hurricanes, so it creates distinguishing results between affected and unaffected areas.

Apart from the various reactions among industries, it is also hard to draw a conclusion between the effects from different hurricanes to the same industry and we believe that severity of hurricanes does not always translate to sever effects on markets, since there are many factors that we need to consider when we try to understand the effects from hurricanes. As we know, different hurricanes have different paths, for example, unlike Katrina, Sandy and Irene mainly affect the U.S. eastern coast regions where many institutions run insurance businesses, so they have more impacts on insurance industry than Hurricane Katrina has, even though Katrina is the strongest hurricanes in the history of the U.S.; and because Sandy and Irene severely affect areas where most oil products are consumed in the U.S., they reduce significant amount of demands, therefore resulting tremendous losses to the industry.

Except the irregular paths, the oil price is a concern when it comes to the transportation industry, since, unlike other industries, oil price is strongly correlated to transportation market performance. For construction industry, the construction material price needs to be considered as we believe that, to some extent, the insignificant result we find for the industry under Hurricane Katrina is caused by the negative effects from the already extreme high construction prices that counteracts the positive effects from high demands for post-storm works.

We also find that ROA is positively and significantly related to abnormal returns and companies with high Tobin's Q could potentially suffer less. But hurricanes are likely to affect larger firms more, since we find that firm size is always negatively related to CARs. And we couldn't find the relationship between cumulative abnormal returns and firm's asset tangibility.

Lastly, we find that almost all industries experience increases in capital expenditures after Katrina and Irene and they have positive abnormal returns. No significant results for the research and development expenses are found. So, we believe that normally firms could have better expectations from investors if they increase their capital expenditures after hurricane events. Market reaction does know more than what is public information and markets do know beforehand how firms will react to natural events.

This paper briefly shows the reaction of different industries to hurricanes. To construct a more comprehensive study in this area, deeper analyses of each industry is encouraged. Due to the limited accesses to data resources, we couldn’t obtain a large company sample, but a big database can be used in future research to make the results more concrete. Besides, because there are researches showing that there is a link between hurricanes and global warming, so, in future researches, global climate change can be considered when conduct a study about the hurricanes effects. Furthermore, since the CAR (-5, +5) window in our study is not long enough to show the industries’ post-hurricane recovery which might take few years to be done, a two-year or three-year window can be applied in further study, and instead of testing the effect from separate hurricanes, we can test the aggregate effect by pulling all hurricanes together. Lastly, a variable of the hurricane category can be added.

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Appendices

Table 1 Three Hurricane Events

Date	Hurricane	States Affected	CPI-Adjusted Estimated Cost (in billions)	Strength	Deaths
2005-08-25	Hurricane Katrina	FL, LA, MS, AL, TN, KY, IN, OH, GA	$161.30	Category 3	1833
2011-08-26	Hurricane Irene	NC, VA, MD, NJ, NY, CI, RI, MA, VT	$15.10	Category 1	45
2012-10-30	Hurricane Sandy	MD, DE, NJ, NY, CT, MA, RI, NC, VA, WV, OH, PA, NH	$70.90	Category 1	159

Note: This table includes three hurricanes that landed at different areas of U.S. Hurricane costs are adjusted estimated costs (in billions). All the information is from National Centers for Environmental Information of National Oceanic and Atmospheric Administration.

Table 2 Variable Definitions

Variable	Description	Source
CAR (x, y)	Cumulative abnormal returns over different windows.	CRSP
CAPLNR	Asset tangibility: the value of gross property, plant and equipment divided by total assets.	Compustat
SIZE	Firm size: the natural logarithm of total assets.	
ROA	Return on assets: the ratio of net income to total assets.	Compustat
Tobin's Q	the sum of market value of equity and book value of liabilities divided by book value of assets.	Compustat
GEO	Geographic dummy equals to 1 if the firm is in affected areas, otherwise equals to 0.	Compustat
XRD	Research development expenses increase: research expenses of the year after the hurricane year subtract research expenses of the hurricane year.	Compustat
CAPX	Capital expenditures increase: capital expenditures of the year after the hurricane year subtract capital expenditures of the hurricane year.	Compustat
$Industry_j$	Industry dummy	

Note: Cumulative abnormal returns are acquired form CRSP, other accounting data are from Compustat. Here, we define areas that hurricanes passed through as affected areas and decide if firms are in affected simply by seeing if their headquarters are in the affected areas.

Table 3 Statistical Description Summary

	N	Mean	Std.	Max.	Min.
CAPLNT	528	0.5633	0.5972	4.7247	0.0000
SIZE	528	8.6022	1.6088	13.6373	4.3676
ROA	528	0.03399	0.0993	0.3449	-1.7026
Tobin's Q	528	0.2531	40.4351	105.2770	-797.1770
CAR (-5,5)	528	0.0030	0.0591	0.2598	-0.3206
CAR (-1,1)	528	0.0007	0.0326	0.1676	-0.1335
XRD	528	0.9201	16.7220	152	-240
CAPX	528	70.9707	652.5607	7047	-7134

Note: Our sample consists of 528 companies for three separate years: 2005, 2011 and 2012. All accounting data are from Compustat and CARs are acquired from CRSP.

Table 4 Pearson Correlation Coefficients

	CAPLNT	SIZE	ROA	TobinsQ	RD
SIZE	-0.15186*** (-0.0005)				
ROA	-0.22916*** (<.0001)	0.02874 (0.5099)			
TobinsQ	0.03509 (0.421)	-0.00307 (0.9439)	0.00391 (0.9286)		
RD	0.0507 (0.2448)	0.05427 (0.2132)	0.08262 (0.0578)	0.03412 (0.4340)	
CAPX	0.04545 (0.2972)	0.15897*** (0.0002)	0.14074*** (0.0012)	0.00231 (0.9578)	0.29334*** (<.0001)

Note: This table displays the correlation between independent variables. The symbols *, **, and *** denote statistical significance at 10%, 5%, and 1% level, respectively.

Table 5 Stock Markets Performances for All Industries

	Hurricane Katrina			Hurricane Irene			Hurricane Sandy		
Day	Date	Mean Abnormal Return	t-Test	Date	Mean Abnormal Return	t-Test	Date	Mean Abnormal Return	t-Test
-5	Aug-18	0.05%	0.132	Aug-19	-0.40%	-1.369*	Oct-22	-0.26%	-0.673
-4	Aug-19	0.30%	0.739	Aug-22	-0.24%	-0.822	Oct-23	-0.08%	-0.203
-3	Aug-22	-0.18%	-0.458	Aug-23	-0.22%	-0.745	Oct-24	-0.14%	-0.345
-2	Aug-23	-0.44%	-1.094	Aug-24	0.46%	1.544*	Oct-25	0.31%	0.797
-1	Aug-24	0.29%	0.726	Aug-25	0.02%	0.061	Oct-26	-0.14%	-0.346
0	Aug-25	-0.19%	-0.466	Aug-26	0.12%	0.402	Oct-31	-0.12%	-0.296
+1	Aug-26	-0.26%	-0.655	Aug-29	0.49%	1.674**	Nov-01	-0.01%	-0.027
+2	Aug-29	0.21%	0.517	Aug-30	0.17%	0.563	Nov-02	-0.37%	-0.948
+3	Aug-30	0.29%	0.723	Aug-31	-0.07%	-0.235	Nov-05	0.34%	0.864
+4	Aug-31	0.52%	1.291*	Sep-01	0.22%	0.745	Nov-06	0.30%	0.769
+5	Sep-01	0.19%	0.474	Sep-02	-0.46%	-1.555*	Nov-07	0.35%	0.892

Note: This table presents the event study results for the three hurricanes impacts on all five industries in this paper. For the event study, the market model is applied in Eventus and the CRSP equally weighted index is used. The date gap between Oct 26 to Oct 31 under Sandy is due to the New York Stock Exchange shutdown caused by the storm.
*Statistically significant at the 10 percent level.
** Statistically significant at the 10 percent level.
*** Statistically significant at the 10 percent level.

Table 6 Construction Industry Stock Market Performances

	Hurricane Katrina			Hurricane Irene			Hurricane Sandy		
Day	Date	Mean Abnormal Return	t-Test	Date	Mean Abnormal Return	t-Test	Date	Mean Abnormal Return	t-Test
-5	Aug-18	-0.85%	-0.798	Aug-19	-0.64%	-1.064	Oct-22	-0.51%	-0.425
-4	Aug-19	-0.58%	-0.545	Aug-22	0.38%	0.636	Oct-23	-0.43%	-0.355
-3	Aug-22	-0.85%	-0.814	Aug-23	-0.99%	-1.688**	Oct-24	0.70%	0.576
-2	Aug-23	-0.42%	-0.406	Aug-24	1.44%	2.455***	Oct-25	-1.15%	-0.95
-1	Aug-24	0.67%	0.649	Aug-25	1.63%	2.788***	Oct-26	-1.15%	-0.954
0	Aug-25	-0.90%	-0.862	Aug-26	0.79%	1.340*	Oct-31	0.15%	0.128
+1	Aug-26	-0.18%	-0.171	Aug-29	0.41%	0.701	Nov-01	0.22%	0.179
+2	Aug-29	-0.49%	-0.471	Aug-30	0.67%	1.135	Nov-02	-1.54%	-1.273
+3	Aug-30	-0.13%	-0.122	Aug-31	-0.69%	-1.175	Nov-05	1.74%	1.440*
+4	Aug-31	2.61%	2.513***	Sep-01	-0.81%	-1.375*	Nov-06	-0.63%	-0.518
+5	Sep-01	-0.54%	-0.524	Sep-02	-0.63%	-1.078	Nov-07	1.83%	1.514*

Note: This table presents the event study results for the three hurricanes impacts on construction industry in this paper. For the event study, the market model is applied in Eventus and the CRSP equally weighted index is used. The date gap between Oct 26 to Oct 31 under Sandy is due to the New York Stock Exchange shutdown caused by the storm.
*Statistically significant at the 10 percent level.
** Statistically significant at the 10 percent level.
*** Statistically significant at the 10 percent level.

Table 7 Food Industry Stock Market Performances

	Hurricane Katrina			Hurricane Irene			Hurricane Sandy		
Day	Date	Mean Abnormal Return	t-Test	Date	Mean Abnormal Return	t-Test	Date	Mean Abnormal Return	t-Test
-5	Aug-18	1.08%	2.389***	Aug-19	-0.44%	-0.914	Oct-22	0.18%	0.315
-4	Aug-19	0.29%	0.634	Aug-22	0.19%	0.386	Oct-23	-0.08%	-0.142
-3	Aug-22	-0.19%	-0.409	Aug-23	1.00%	2.034**	Oct-24	0.03%	0.060
-2	Aug-23	-0.74%	-1.602*	Aug-24	-0.42%	-0.856	Oct-25	0.32%	0.546
-1	Aug-24	-0.39%	-0.855	Aug-25	-0.99%	-2.012**	Oct-26	-0.39%	-0.674
0	Aug-25	-0.54%	-1.173	Aug-26	-0.05%	-0.101	Oct-31	0.03%	0.050
+1	Aug-26	0.05%	0.113	Aug-29	0.53%	1.089	Nov-01	0.98%	1.704**
+2	Aug-29	0.38%	0.826	Aug-30	-0.01%	-0.021	Nov-02	-0.61%	-1.055
+3	Aug-30	0.03%	0.057	Aug-31	0.34%	0.691	Nov-05	-0.35%	-0.612
+4	Aug-31	0.93%	2.027**	Sep-01	-0.18%	-0.376	Nov-06	0.80%	1.385*
+5	Sep-01	-0.79%	-1.720**	Sep-02	-0.50%	-1.020	Nov-07	-0.15%	-0.259

Note: This table presents the event study results for the three hurricanes impacts on food industry in this paper. For the event study, the market model is applied in Eventus and the CRSP equally weighted index is used. The date gap between Oct 26 to Oct 31 under Sandy is due to the New York Stock Exchange shutdown caused by the storm.
*Statistically significant at the 10 percent level.
** Statistically significant at the 10 percent level.
*** Statistically significant at the 10 percent level.

Table 8 Gas and Petroleum Industry Stock Market Performances

	Hurricane Katrina			Hurricane Irene			Hurricane Sandy		
Day	Date	Mean Abnormal Return	t-Test	Date	Mean Abnormal Return	t-Test	Date	Mean Abnormal Return	t-Test
-5	Aug-18	-0.12%	-0.104	Aug-19	-0.69%	-0.78	Oct-22	-0.93%	-0.941
-4	Aug-19	1.34%	1.165	Aug-22	-1.73%	-1.970**	Oct-23	-1.37%	-1.392*
-3	Aug-22	-0.31%	-0.270	Aug-23	0.27%	0.317	Oct-24	-1.03%	-1.048
-2	Aug-23	-0.07%	-0.066	Aug-24	-0.55%	-0.630	Oct-25	0.78%	0.792
-1	Aug-24	1.16%	1.028	Aug-25	-0.27%	-0.309	Oct-26	0.01%	0.010
0	Aug-25	-0.55%	-0.482	Aug-26	0.25%	0.288	Oct-31	-1.11%	-1.124
+1	Aug-26	-0.79%	-0.695	Aug-29	-0.06%	-0.066	Nov-01	-0.62%	-0.634
+2	Aug-29	0.23%	0.206	Aug-30	0.37%	0.425	Nov-02	-0.28%	-0.283
+3	Aug-30	1.82%	1.610*	Aug-31	0.10%	0.111	Nov-05	0.45%	0.455
+4	Aug-31	1.68%	1.485*	Sep-01	0.83%	0.953	Nov-06	0.44%	0.442
+5	Sep-01	0.93%	0.826	Sep-02	-0.27%	-0.306	Nov-07	-0.39%	-0.400

Note: This table presents the event study results for the three hurricanes impacts on gas and petroleum industry in this paper. For the event study, the market model is applied in Eventus and the CRSP equally weighted index is used. The date gap between Oct 26 to Oct 31 under Sandy is due to the New York Stock Exchange shutdown caused by the storm.

*Statistically significant at the 10 percent level.

** Statistically significant at the 10 percent level.

*** Statistically significant at the 10 percent level.

Table 9 Insurance Industry Stock Market Performances

	Hurricane Katrina			Hurricane Irene			Hurricane Sandy		
Day	Date	Mean Abnormal Return	t-Test	Date	Mean Abnormal Return	t-Test	Date	Mean Abnormal Return	t-Test
-5	Aug-18	-0.08%	-0.138	Aug-19	0.08%	0.179	Oct-22	0.29%	0.518
-4	Aug-19	0.13%	0.223	Aug-22	0.02%	0.055	Oct-23	-0.23%	-0.398
-3	Aug-22	0.07%	0.123	Aug-23	-0.21%	-0.490	Oct-24	0.24%	0.424
-2	Aug-23	-0.33%	-0.550	Aug-24	0.52%	1.222	Oct-25	-0.08%	-0.150
-1	Aug-24	-0.28%	-0.480	Aug-25	-0.67%	-1.596*	Oct-26	-0.60%	-1.054
0	Aug-25	0.19%	0.318	Aug-26	-0.70%	-1.658**	Oct-31	-0.84%	-1.486*
+1	Aug-26	-0.22%	-0.376	Aug-29	1.14%	2.703***	Nov-01	-0.66%	-1.156
+2	Aug-29	0.08%	0.131	Aug-30	-0.47%	-1.119	Nov-02	-0.27%	-0.483
+3	Aug-30	-0.30%	-0.502	Aug-31	0.15%	0.345	Nov-05	-0.27%	-0.476
+4	Aug-31	-0.45%	-0.760	Sep-01	-0.16%	-0.380	Nov-06	0.44%	0.781
+5	Sep-01	0.32%	0.546	Sep-02	-0.68%	-1.621*	Nov-07	-0.22%	-0.381

Note: This table presents the event study results for the three hurricanes impacts on insurance industry in this paper. For the event study, the market model is applied in Eventus and the CRSP equally weighted index is used. The date gap between Oct 26 to Oct 31 under Sandy is due to the New York Stock Exchange shutdown caused by the storm.
*Statistically significant at the 10 percent level.
** Statistically significant at the 10 percent level.
*** Statistically significant at the 10 percent level.

Table 10 Transportation Industry Stock Market Performances

	Hurricane Katrina			Hurricane Irene			Hurricane Sandy		
Day	Date	Mean Abnormal Return	t-Test	Date	Mean Abnormal Return	t-Test	Date	Mean Abnormal Return	t-Test
-5	Aug-18	0.14%	0.206	Aug-19	-0.55%	-1.044	Oct-22	-0.27%	-0.42
-4	Aug-19	-0.24%	-0.344	Aug-22	0.78%	1.470*	Oct-23	1.71%	2.698**
-3	Aug-22	-0.23%	-0.323	Aug-23	-0.40%	-0.751	Oct-24	-1.13%	-1.792**
-2	Aug-23	-1.42%	-1.996**	Aug-24	1.04%	1.978**	Oct-25	0.49%	0.77
-1	Aug-24	0.43%	0.604	Aug-25	0.16%	0.296	Oct-26	-0.06%	-0.089
0	Aug-25	0.19%	0.262	Aug-26	0.35%	0.654	Oct-31	0.68%	1.075
+1	Aug-26	-0.07%	-0.094	Aug-29	0.15%	0.287	Nov-01	0.16%	0.253
+2	Aug-29	0.18%	0.248	Aug-30	0.34%	0.639	Nov-02	0.18%	0.282
+3	Aug-30	-0.31%	-0.435	Aug-31	-0.46%	-0.869	Nov-05	0.13%	0.199
+4	Aug-31	-0.81%	-1.147	Sep-01	0.13%	0.242	Nov-06	0.50%	0.785
+5	Sep-01	-0.41%	-0.58	Sep-02	-0.44%	-0.828	Nov-07	0.25%	-0.381

Note: This table presents the event study results for the three hurricanes impacts on transportation industry in this paper. For the event study, the market model is applied in Eventus and the CRSP equally weighted index is used. The date gap between Oct 26 to Oct 31 under Sandy is due to the New York Stock Exchange shutdown caused by the storm.
*Statistically significant at the 10 percent level.
** Statistically significant at the 10 percent level.
*** Statistically significant at the 10 percent level.

Table 11 Basic Regressions of Cumulative Abnormal Returns for Construction Industry

	CAR (-5,5)		
	Hurricane Katrina	Hurricane Irene	Hurricane Sandy
Intercept	0.04081*	-0.01287	0.09565***
	(0.0950)	(0.4684)	(0.0005)
CAPLNT	-0.00688	0.00178	-0.00622
	(0.5133)	(0.7382)	(0.4442)
SIZE	-0.00443*	0.00005959	-0.01077***
	(0.0845)	(0.9751)	(0.0003)
ROA	0.15069*	0.15097***	0.17665***
	(0.0596)	(0.0046)	(<.0001)
Tobin's Q	0.00011731**	0.00002337	0.00009791
	(0.0226)	(0.9171)	(0.5450)
GEO	-0.02264**	0.00186	0.00393
	(0.0252)	(0.7997)	(0.7247)
Construction	-0.00051594	0.03411***	-0.02091
	(0.9714)	(0.0005)	(0.1730)
XRD	-0.00020382	-0.00004869	-0.00033464
	(0.4276)	(0.7314)	(0.3308)
CAPX	0.00002406***	-0.00000406	0.00000765
	(0.0034)	(0.4737)	(0.2185)

Note: This table presents regression results of construction industry for CAR (-5,5). The control variables used are: assets tangibility (CAPLNT), firm size, return on assets (ROA), Tobin's Q. GEO, a dummy equal to one if the company is in hurricane affected areas. Two post event variables are: research and development expenses increase (XRD), capital expenditures increase (CAPX). P-values are reported in parentheses. The symbols *, **, and *** denote statistical significance at 10%, 5%, and 1% level, respectively.

Table 12 Basic Regressions of Cumulative Abnormal Returns for Food Industry

	CAR (-5,5)		
	Hurricane Katrina	Hurricane Irene	Hurricane Sandy
Intercept	0.05086**	0.03637*	0.06531***
	(0.0250)	(0.0967)	(0.0049)
CAPLNT	-0.00327	-0.00787	0.01108
	(0.7174)	(0.2357)	(0.1360)
SIZE	-0.00547**	-0.00395	-0.00875***
	(0.0230)	(0.1031)	(0.0006)
ROA	0.12414*	0.15918**	0.19497***
	(0.0836)	(0.0208)	(<.0001)
Tobin's Q	0.00013016***	0.00020744	0.00006257
	(0.0063)	(0.4880)	(0.6571)
GEO	-0.02182**	-0.00557	0.00588
	(0.0188)	(0.5590)	(0.5538)
Food	-0.00971	-0.01251	-0.00281
	(0.3310)	(0.2287)	(0.8075)
XRD	-0.00005879	-0.00011351	-0.00049010
	(0.8039)	(0.5489)	(0.1042)
CAPX	0.00001829**	7.232237E-7	0.00001057*
	(0.0161)	(0.9215)	(0.0526)

Note: This table presents regression results of food industry for CAR (-5,5). The control variables used are: assets tangibility (CAPLNT), firm size, return on assets (ROA), Tobin's Q. GEO, a dummy equal to one if the company is in hurricane affected areas. Two post event variables are: research and development expenses increase (XRD), capital expenditures increase (CAPX). P-values are reported in parentheses. The symbols *, **, and *** denote statistical significance at 10%, 5%, and 1% level, respectively.

Table 13 Basic Regressions of Cumulative Abnormal Returns for Gas and Petroleum Industry

	CAR (-5,5)		
	Hurricane Katrina	Hurricane Irene	Hurricane Sandy
Intercept	0.03185	0.00722	0.06028***
	(0.2306)	(0.6801)	(0.0056)
CAPLNT	-0.02475**	0.00532	0.01394
	(0.0373)	(0.4286)	(0.1255)
SIZE	-0.00367	-0.00137	-0.00755***
	(0.1969)	(0.4835)	(0.0015)
ROA	0.16111*	0.13283**	0.20662***
	(0.0677)	(0.0159)	(<.0001)
Tobin's Q	0.00009442*	-0.00000336	0.00007400
	(0.1145)	(0.9886)	(0.5597)
GEO	-0.02573**	-0.00552	-0.00032735
	(0.0275)	(0.4686)	(0.9709)
Gas & Petroleum	0.06499***	-0.01756*	-0.02511**
	(<.0001)	(0.0561)	(0.0263)
XRD	-0.00012877	-0.00003820	-0.00037813
	(0.6657)	(0.7978)	(0.1674)
CAPX	0.00000534	-4.04491E-7	0.00000879*
	(0.5869)	(0.9466)	(0.0749)

Note: This table presents regression results of gas and petroleum industry for CAR (-5,5). The control variables used are: assets tangibility (CAPLNT), firm size, return on assets (ROA), Tobin's Q. GEO, a dummy equal to one if the company is in hurricane affected areas. Two post event variables are: research and development expenses increase (XRD), capital expenditures increase (CAPX). P-values are reported in parentheses. The symbols *, **, and *** denote statistical significance at 10%, 5%, and 1% level, respectively.

Table 14 Basic Regressions of Cumulative Abnormal Returns for Insurance Industry

CAR (-5,5)

	Hurricane Katrina	Hurricane Irene	Hurricane Sandy
Intercept	0.04310*	0.00641	0.05862***
	(0.0547)	(0.7084)	(0.0044)
CAPLNT	0.00031259	-0.00781	0.00619
	(0.9774)	(0.2161)	(0.4569)
SIZE	-0.00578**	-0.00012157	-0.00779***
	(0.0226)	(0.9516)	(0.0012)
ROA	0.15867*	0.09865*	0.18200***
	(0.0562)	(0.0745)	(<.0001)
Tobin's Q	0.00011320**	-0.00005964	0.00008380
	(0.0190)	(0.8019)	(0.5016)
GEO	-0.02133**	-0.00332	0.00710
	(0.0242)	(0.6556)	(0.4190)
Insurance	0.01144	-0.01528*	-0.00394
	(0.3678)	(0.0691)	(0.7186)
XRD	-0.00009821	-0.00000519	-0.00042947
	(0.6859)	(0.9721)	(0.1077)
CAPX	0.00002083***	-0.00000327	0.00000980**
	(0.0074)	(0.5776)	(0.0427)

Note: This table presents regression results of insurance industry for CAR (-5,5). The control variables used are: assets tangibility (CAPLNT), firm size, return on assets (ROA), Tobin's Q. GEO, a dummy equal to one if the company is in hurricane affected areas. Two post event variables are: research and development expenses increase (XRD), capital expenditures increase (CAPX). P-values are reported in parentheses. The symbols *, **, and *** denote statistical significance at 10%, 5%, and 1% level, respectively.

Table 15 Basic Regressions of Cumulative Abnormal Returns for Transportation Industry

	CAR (-5,5)		
	Hurricane Katrina	Hurricane Irene	Hurricane Sandy
Intercept	0.03174	0.01008	0.04668**
	(0.2599)	(0.5636)	(0.0236)
CAPLNT	0.01149	-0.00403	0.00748
	(0.3792)	(0.4659)	(0.2683)
SIZE	-0.00331	-0.00179	-0.00691***
	(0.2737)	(0.3564)	(0.0023)
ROA	0.18456**	0.11791**	0.17998***
	0.0484)	(0.0353)	(<.0001)
Tobin's Q	0.00008913	0.00002972	0.00003891
	(0.1633)	(0.8996)	(0.7543)
GEO	-0.03427***	-0.00316	0.00656
	(0.0052)	(0.6766)	(0.4512)
Transportation	-0.04209***	0.01245	0.02727***
	0.0012)	(0.1264)	(0.0076)
XRD	-0.00020341	-0.00005585	-0.00045993*
	(0.5197)	(0.7087)	(0.0845)
CAPX	0.00001713*	-0.00000174	0.00000996**
	(0.0888)	(0.7711)	(0.0385)

Note: This table presents regression results of transportation industry for CAR (-5,5). The control variables used are: assets tangibility (CAPLNT), firm size, return on assets (ROA), Tobin's Q. GEO, a dummy equal to one if the company is in hurricane affected areas. Two post event variables are: research and development expenses increase (XRD), capital expenditures increase (CAPX). P-values are reported in parentheses. The symbols *, **, and *** denote statistical significance at 10%, 5%, and 1% level, respectively.

Table 16 Robust Regressions of Cumulative Abnormal Returns for Construction Industry

CAR (-1,1)

	Hurricane Katrina	Hurricane Irene	Hurricane Sandy
Intercept	-0.01075	-0.00891	0.03576***
	(0.1742)	(0.5128)	(0.0065)
CAPLNT	0.00194	-0.00130	0.00124
	(0.5829)	(0.7489)	(0.7539)
SIZE	0.00074850	0.00157	-0.00472***
	(0.3696)	(0.2836)	(0.0008)
ROA	-0.00691	-0.02645	0.09509***
	(0.7921)	(0.5143)	(0.0020)
Tobin's Q	0.00000392	-0.00004995	0.00000368
	(0.8163)	(0.7736)	(0.9616)
GEO	0.00114	-0.00833	0.00075012
	(0.7331)	(0.1367)	(0.8887)
Construction	0.00059949	0.04987***	-0.00960
	(0.8960)	(<.0001)	(0.2049)
XRD	0.00011368	0.00005823	-0.00002268
	(0.1823)	(0.5967)	(0.8894)
CAPX	-0.00000318	-0.00000823*	0.00000249
	(0.2374)	(0.0610)	(0.3955)

Note: This table presents robust regression results of construction industry for CAR (-5,5). The control variables used are: assets tangibility (CAPLNT), firm size, return on assets (ROA), Tobin's Q. GEO, a dummy equal to one if the company is in hurricane affected areas. Two post event variables are: research and development expenses increase (XRD), capital expenditures increase (CAPX). P-values are reported in parentheses. The symbols *, **, and *** denote statistical significance at 10%, 5%, and 1% level, respectively.

Table 17 Robust Regressions of Cumulative Abnormal Returns for Food Industry

CAR (-1,1)

	Hurricane Katrina	Hurricane Irene	Hurricane Sandy
Intercept	-0.00629	0.02777**	0.03193**
	(0.4143)	(0.0217)	(0.0109)
CAPLNT	0.00334	-0.00532	0.00182
	(0.3027)	(0.1368)	(0.6257)
SIZE	0.00029379	-0.00188	-0.00446**
	(0.7204)	(0.1519)	(0.0011)
ROA	0.00528	-0.00536	0.08744***
	(0.8333)	(0.8852)	(0.0044)
Tobin's Q	0.00000488	0.00004563	0.00000553
	(0.7677)	(0.7711)	(0.9410)
GEO	-0.00069551	-0.00561	-0.00043003
	(0.8342)	(0.2689)	(0.9352)
Food	-0.00936**	-0.00958*	0.00814
	(0.0142)	(0.0859)	(0.1926)
XRD	0.00012012	0.00000234	-0.00000516
	(0.1495)	(0.9811)	(0.9743)
CAPX	-0.00000433	-0.0000068*	0.00000237
	(0.1039)	(0.0784)	(0.4105)

Note: This table presents robust regression results of food industry for CAR (-5,5). The control variables used are: assets tangibility (CAPLNT), firm size, return on assets (ROA), Tobin's Q. GEO, a dummy equal to one if the company is in hurricane affected areas. Two post event variables are: research and development expenses increase (XRD), capital expenditures increase (CAPX). P-values are reported in parentheses. The symbols *, **, and *** denote statistical significance at 10%, 5%, and 1% level, respectively.

Table 18 Robust Regressions of Cumulative Abnormal Returns for Gas and Petroleum Industry

CAR (-1,1)

	Hurricane Katrina	Hurricane Irene	Hurricane Sandy
Intercept	-0.01125	0.00508	0.02306*
	(0.2239)	(0.6240)	(0.0674)
CAPLNT	0.00365	-0.00200	0.01059**
	(0.3740)	(0.6063)	(0.0216)
SIZE	0.00099534	0.00011209	-0.00342**
	(0.3147)	(0.9211)	(0.0134)
ROA	-0.01313	0.00436	0.11301***
	(0.6669)	(0.8909)	(0.0002)
Tobin's Q	0.00000548	-0.00005573	-0.00000509
	(0.7916)	(0.6749)	(0.9444)
GEO	0.00107	-0.00659	-0.00169
	(0.7913)	(0.1276)	(0.7448)
Gas & Petroleum	0.00209	-0.00064361	-0.02031***
	(0.6202)	(0.8994)	(0.0019)
XRD	0.00012405	0.00004703	0.00004908
	(0.2329)	(0.5755)	(0.7560)
CAPX	-0.00000531	-0.0000081**	0.00000152
	(0.1221)	(0.0181)	(0.5899)

Note: This table presents robust regression results of gas and petroleum industry for CAR (-5,5). The control variables used are: assets tangibility (CAPLNT), firm size, return on assets (ROA), Tobin's Q. GEO, a dummy equal to one if the company is in hurricane affected areas. Two post event variables are: research and development expenses increase (XRD), capital expenditures increase (CAPX). P-values are reported in parentheses. The symbols *, **, and *** denote statistical significance at 10%, 5%, and 1% level, respectively.

Table 19 Robust Regressions of Cumulative Abnormal Returns for Insurance Industry

CAR (-1,1)

	Hurricane Katrina	Hurricane Irene	Hurricane Sandy
Intercept	-0.01008	0.00677	0.02307
	(0.1854)	(0.5032)	(0.1557)
CAPLNT	-0.00105	-0.00782**	-0.00148
	(0.7864)	(0.0366)	(0.8069)
SIZE	0.00121	0.00089788	-0.00237
	(0.1723)	(0.4334)	(0.2068)
ROA	-0.02576	-0.01724	-0.01358
	(0.3699)	(0.5938)	(0.5952)
Tobin's Q	0.00000497	-0.00013224	-0.00000753
	(0.7667)	(0.3210)	(0.9409)
GEO	0.00131	-0.00606	0.00459
	(0.6921)	(0.1487)	(0.5129)
Insurance	-0.00607	-0.01271**	-0.01869**
	(0.1663)	(0.0115)	(0.0242)
XRD	0.00012297	0.00008043	-0.00001034
	(0.1471)	(0.3344)	(0.9620)
CAPX	-0.00000366	-0.000009***	0.00000387
	(0.1748)	(0.0065)	(0.3219)

Note: This table presents robust regression results of insurance industry for CAR (-5,5). The control variables used are: assets tangibility (CAPLNT), firm size, return on assets (ROA), Tobin's Q. GEO, a dummy equal to one if the company is in hurricane affected areas. Two post event variables are: research and development expenses increase (XRD), capital expenditures increase (CAPX). P-values are reported in parentheses. The symbols *, **, and *** denote statistical significance at 10%, 5%, and 1% level, respectively.

Table 20 Robust Regressions of Cumulative Abnormal Returns for Transportation Industry

CAR (-1,1)

	Hurricane Katrina	Hurricane Irene	Hurricane Sandy
Intercept	-0.01052	0.00370	0.02142
	(0.2511)	(0.7187)	(0.1888)
CAPLNT	0.00146	-0.00311	0.00424
	(0.7302)	(0.3180)	(0.4033)
SIZE	0.00090489	0.00020944	-0.00350*
	(0.3569)	(0.8514)	(0.0525)
ROA	-0.00589	-0.00328	0.00179
	(0.8453)	(0.9183)	(0.9392)
Tobin's Q	0.00001167	-0.00006202	-0.00003723
	(0.5735)	(0.6367)	(0.7155)
GEO	0.00036465	-0.00625	0.00427
	(0.9262)	(0.1416)	(0.5425)
Transportation	0.00673	0.00676	0.01784**
	(0.1050)	(0.1297)	(0.0345)
XRD	0.00012263	0.00004586	0.00006361
	(0.2336)	(0.5817)	(0.7697)
CAPX	-0.00000418	-0.0000077**	0.00000322
	(0.2003)	(0.0215)	(0.4117)

Note: This table presents robust regression results of transportation industry for CAR (-5,5). The control variables used are: assets tangibility (CAPLNT), firm size, return on assets (ROA), Tobin's Q. GEO, a dummy equal to one if the company is in hurricane affected areas. Two post event variables are: research and development expenses increase (XRD), capital expenditures increase (CAPX). P-values are reported in parentheses. The symbols *, **, and *** denote statistical significance at 10%, 5%, and 1% level, respectively.