

IMPACT OF HURRICANES ON OIL COMPANIES STOCK PRICES

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ABSTRACT

This study explores how approaching Atlantic Hurricanes impact the stock value of United States Oil Companies. It looks for trends in stock prices of oil companies as hurricanes approach and make landfall. The study also attempts to predict the variation of oil companies stock prices based on a hurricane's location and intensity.

Three hypotheses are purposed. First, when hurricanes approach the United States, the stock price of oil companies will fall. Second, hurricanes that enter the Gulf of Mexico will impact oil companies' stock price more than hurricanes that do not enter the Gulf of Mexico. Lastly, stronger hurricanes will impact oil companies' stock price more than weaker hurricanes.

The results did not support these hypotheses. The distance a hurricane is to the United States coastline showed to have little effect on the stock price of oil companies. Days when a hurricane was present in the Gulf of Mexico had a slightly smaller effect on the stock price as compared to days when there was a hurricane located outside of the Gulf of Mexico. Also, oil company stocks seemed to remain stable regardless of the intensity of the storms.

INTRODUCTION

The production of oil is critical to the United States' economy. Many Americans use oil to power their cars, heat their homes and produce electricity. Oil companies who extract and refine crude oil to develop the products consumers use, such as gasoline and kerosene, satisfy these oil needs. Many of these oil companies have offshore drilling platforms in the Gulf of Mexico, which are extremely vulnerable to hurricanes. An intense hurricane can do critical damage to these platforms and cause a slowdown in the production of oil. The risk of this

happening when a hurricane is moving toward the United States could affect the stock prices of oil companies.

How does the stock market react to an approaching hurricane? Does the price of an oil company's stock fall when a hurricane is about to strike the Gulf of Mexico? By understanding how the stock prices of oil companies change in the days leading up to a hurricane making landfall, shareholders can make better decisions on their investments. This study explores how approaching Atlantic Hurricanes impact the stock value of United States Oil Companies. It looks for trends in stock prices of oil companies as hurricanes approach and make landfall. The study also attempts to predict the variation of oil companies stock prices based on a hurricane's location and intensity.

The Gulf of Mexico is very important for the production oil in the United States. An estimated 35% of the US's oil production occurs in the Gulf of Mexico and 10% of oil imports come through the Gulf of Mexico (Sever 2005). On average, 1.2 million barrels of crude oil are produced from the Gulf of Mexico every day (Considine 2004). With all of this production in one area, a large natural disaster such as a hurricane has the potential to critically harm an oil company's ability to meet the demand of their consumers.

Hurricanes can critically damage oil platforms in the Gulf of Mexico. One article suggests offshore platforms are on the "front line of hurricane hazards" (Considine 2004). In 2008, Hurricanes Gustav and Ike destroyed 60 offshore oil platforms and caused extensive damage to an additional 124 (Kaiser 2010). In 1992, Hurricane Andrew destroyed 13 offshore oil and gas platforms (Considine 2004).

Repairing or replacing damaged platforms can become extremely costly for oil companies. If a platform is destroyed beyond repair, it must be taken out of service and removed

from the Gulf of Mexico. This can cost anywhere from 5 to 25 times more than the amount it would cost to remove an undamaged platform (Kaiser 2010). When a platform is damaged, extra precautions must be taken to prevent harm to the environment. The total cost for oil companies to repair facilities after a major hurricane can be in the millions of dollars (Weidermann 2008).

In addition to the removing destroyed platforms, checking for damage on a platform can be costly as well. Each oil platform that is exposed to hurricane force winds is required by the Minerals Management Service to undergo an above water inspection before producing more oil. The Minerals Management Service may also issue additional inspections including underwater inspections if damage is found. In 2008, Hurricane Gustav exposed 677 oil and gas platforms to hurricane strength winds (Kaiser 2010). Conducting all of these inspections takes time. This lack of production means lost profits and could possibly damage oil companies stock prices. One article estimated an average slow down of 1 million barrels of oil per day during the week following Hurricane Katrina in 2005 (Sever 2005).

Complete destruction or damage to an oil platform is not the only worry for oil companies in the days leading up to a hurricane entering the Gulf of Mexico. They must maximize their profits without putting their crew or the environment at risk. One article suggested oil companies have two decisions to make when a hurricane is approaching a platform. They must first decide when to shut down production of the platform. Then they must decide when to evacuate their crew (Considine 2004). The timing of these decisions relate to this project because if a platform shuts down too early, the company loses potential profits from the production of oil at that platform. If a platform shuts down too late, the company is risking an oil spill or injury to their workers. Both outcomes have the potential to affect the stock price of the

oil company. Leading up to Hurricane Katrina entering the Gulf of Mexico, 80% of the manned oil platforms located there were evacuated (Sever 2005).

One study conducted by Weiderman and Bacon (2008) is very similar to this project. Their research looked at Hurricane Katrina's effect on oil companies' stock prices. They chose 15 oil companies with invested interests in the Gulf of Mexico and examined the stock price movement of those companies in the days leading up to the landfall of Hurricane Katrina. This study also examined the price of these companies stocks 30 days after the hurricane had passed. In addition to the 15 oil companies, this study looked at the S&P500 Index to evaluate the overall impact Katrina had on the stock market. The results showed that Hurricane Katrina caused the oil company stock prices to fall significantly in the days before the hurricane made landfall. This article noted that, "The market rapidly anticipated the devastation of Hurricane Katrina" (Weiderman 2008). Their findings also revealed that even though the stock prices of these oil companies fell in the short term, in the long term the industry recovered and has been strong overall.

Weiderman and Bacon's study is similar to this study in that they examined how oil stocks moved in the days leading up to the striking of a hurricane. There are a few differences though. This study will be examining all hurricanes from 2000-2009 instead of just one case. Weiderman and Bacon examined 15 oil companies whereas this study will only look at 5. This study will also not be looking at stock prices in the days after a hurricane strikes.

United States oil companies rely on the Gulf of Mexico for a large portion of their production. A hurricane striking this area can be very harmful to the industry as a whole. Due to the cost of repairs and the slowdown of production, oil companies short-term stock prices can be affected by the potential for a hurricane to strike the Gulf of Mexico.

This study explores three hypotheses. First, when hurricanes approach the United States, the stock price of oil companies will fall. Second, hurricanes that enter the Gulf of Mexico will impact oil companies stock price more than hurricanes that do not enter the Gulf of Mexico. Last, stronger hurricanes will impact oil companies stock price more than weaker hurricanes. This study investigates each one of these hypotheses in detail and attempts to find out if they are supported.

STUDY AREA

Geographically, this study will focus on the Gulf of Mexico, Caribbean Sea and the Atlantic Ocean. This is shown in Figure 1. More specifically, the study will examine hurricanes as they form in the Atlantic Ocean and move westward toward the United States. Hurricanes entering the Gulf of Mexico are a very large concern to oil companies because platforms are located there. However, one cannot focus on the Gulf of Mexico alone while dealing with this issue. When a Hurricane first forms in the eastern Atlantic Ocean, there is uncertainty as to where that hurricane will travel. One of the goals for this project is to determine the relationship between oil company stock prices and hurricanes as a hurricane approaches the United States. Simply the possibility of an Atlantic Hurricane entering the Gulf of Mexico may be enough to influence the stock price of oil companies. Therefore, hurricanes in the Atlantic Ocean will be considered in addition to hurricanes in the Gulf of Mexico.

The study will use stock prices from five different oil companies. All of the selected companies own and operate oil platforms located in the Gulf of Mexico. The five businesses are also publicly traded on the New York Stock Exchange. These five companies include British

Petroleum (BP), Anadarko Petroleum Corporation, Conoco Phillips, Chevron Corporation, and Exxon Mobil Corporation.



Fig. 1. Map of Study Area. Also highlighted is the Gulf of Mexico's Offshore Oil Drilling Area

The time frame for this study will be from 2000 through 2009. Only days when a Hurricane or Tropical Storm is present in the Atlantic Ocean or Gulf of Mexico will be used. Also, the New York Stock Exchange is closed on weekends and national holidays. A hurricane's impact on stock price can only be observed when the market is open, so days in which the stock market is closed will also not be used.

DATA DESCRIPTION

Data for this project was obtained from a variety of sources. Hurricane data was from the National Hurricane Center's Archive of Hurricane Seasons (<http://www.nhc.noaa.gov/>). This data set is in the form of ten different maps, one for each year being studied. These maps show the daily movement of hurricanes and tropical storms. The locations also have a corresponding date next to it. Storms are categorized each day by strength. The storm tracks are color coded to indicate a tropical depression, tropical storm, hurricane or major hurricane. Unisys Tropical Data Archive was used to get a more accurate measurement of the strength of each hurricane (<http://www.weather.unisys.com/hurricane>). This categorizes each tropical system into a subtropical storm, tropical depression, tropical storm, or category level of hurricane. These categories are based off the Saffir-Simpson Hurricane Scale.

The stock prices for the five oil companies being studied were found via Yahoo Finance (<http://www.yahoo.com/finance>). This data set came in the form of comma separated variable files and includes daily stock information for each company from 2000 through 2009. The information includes each stock's daily opening price, closing price, intraday high, intraday low, and trading volume. For this project, only the opening and closing prices for each stock will be used.

One last piece of data was taken from the United States Energy Information Administration (<http://www.eia.doe.gov/>). This information contained crude oil's daily price per barrel and was laid out in a comma separated variable file. Like stocks, the cost of crude oil fluctuates daily. This data contained prices from 1986 through 2009; however, this study will only be looking at prices from the years 2000 through 2009.

METHODOLOGY

This study seeks to answer three different hypotheses. First, when hurricanes approach the United States, the stock price of oil companies will fall. Second, hurricanes that enter the Gulf of Mexico will impact oil companies' stock price more than hurricanes that do not enter the Gulf of Mexico. Lastly, stronger hurricanes will impact oil companies' stock price more than weaker hurricanes.

In order to answer the first hypotheses, the daily percent change of each oil company's stock price (BP, Anadarko Petroleum, Conoco Phillips, Chevron and Exxon Mobil) for each day from January 1, 2000 to December 31, 2009 must be calculated. This calculation is executed by taking each stock's daily closing price and subtracting the same days opening price. This result is divided by the opening price and multiplied by 100. In equation form: $(\text{Close Price} - \text{Open Price}) / (\text{Open Price}) \times 100 = \text{Daily Percent Change}$. This calculation must be performed because the hypothesis is only concerned with the daily change of stock price. Calculating daily percent change ensures a standard in measuring how much each company's stock price moves relative to its own opening price. This also allows comparison between companies with a wide range of stock prices. However, by carrying out this calculation the study will be ignoring any intraday fluctuations.

Daily percent change for the price of crude oil for each day from January 1, 2000 to December 31, 2009 must also be calculated. This data set only contains each day's closing crude oil price. Therefore this study will assume the opening price of each day is the previous day's closing price. This calculation follows the form: $(\text{Close Price} - \text{Previous Close Price}) / (\text{Previous Close Price}) \times 100 = \text{Daily Percent Change}$.

Each storm's daily distance from the United States' coastline is approximated. For hurricanes making landfall, the distance between the point on the United States' coast that the hurricane makes landfall and the individual locations of the hurricane is considered. For hurricanes not making landfall, the distance between the closest point on the United States' coast the hurricane comes to making landfall and the individual locations of the hurricane is considered. Only tracks that at some point reached Hurricane status (declared by the National Hurricane Center) and are located in the Northern Hemisphere of the Atlantic Ocean, Caribbean Sea or the Gulf of Mexico are considered. The entire track of the storm is evaluated, not just the part that met hurricane status. Storm tracks are acquired from the National Hurricane Center's Archive of Hurricane Seasons (<http://www.nhc.noaa.gov>).

Correlation between each oil company's daily percent change of stock price and the distance each storm is from the US coastline is calculated. This study only considers days when the stock market is open and a hurricane, tropical storm, or tropical depression is present in the Northern Hemisphere of the Atlantic Ocean, the Gulf of Mexico or the Caribbean Sea. This correlation indicates how each individual company's stock moves in relation to an approaching hurricane. This also shows if some companies are affected more by hurricanes than other companies.

Also, correlation between the average oil company's daily percent change of stock price and the distance each storm is from the US Coastline is used. This is executed by averaging the five oil company's daily percent change and then using this average to determine correlation. This result gives an overview as to how the oil industry moves when a hurricane is approaching.

In addition to stock prices, this study calculates correlation between daily percent change of crude oil and distance each storm is from the US coastline. Because oil companies sell their

product for the price of crude oil, this could give some insight into why stock prices move the way they do. Plus it shows how the price of crude oil impacts the oil industry as hurricanes approach the United States.

To test the second hypothesis, hurricanes that enter the Gulf of Mexico will impact oil companies' stock price more than hurricanes that do not enter the Gulf of Mexico, a slightly different approach must be taken. Like the first hypothesis, daily percent change of each oil company's stock price must be calculated. The daily percent change for the price of crude oil for each day in the study area must be calculated as well. These are executed the same way as before.

Each hurricane and hurricane active day is separated into two categories. These categories include tracks that entered the Gulf of Mexico and those that did not enter the Gulf of Mexico. From these two categories of hurricane location, we can create two categories of days as well. These consist of days when a hurricane was present and located in the Gulf of Mexico and days when a hurricane was present and not located in the Gulf of Mexico.

The daily percent change for the oil company's stocks are then averaged based on these categories. For each individual oil company stock, the average daily percent change for days when a hurricane was present and located in the Gulf of Mexico is calculated. Also, the average for days when a hurricane was present and not located in the Gulf of Mexico is calculated. Comparing these two averages gives insight into how the company's stock price moves for hurricanes in the Gulf of Mexico versus hurricanes outside the Gulf of Mexico. Calculating and comparing the standard deviation of the two categories will also provide an idea of how volatility changes across the different set of dates.

Likewise, the average daily percent change for all of the oil companies together for both categories of days is calculated. This gives an idea of how the oil industry is affected by hurricanes in the Gulf of Mexico as compared to hurricanes outside the Gulf of Mexico. For the price of crude oil, the average daily percent change for days when a hurricane was present and located in the Gulf of Mexico and average for days when a hurricane was present and not located in the Gulf of Mexico is calculated. Again, this information shows how the industry is affected by hurricanes in the Gulf of Mexico as compared to hurricanes outside the Gulf of Mexico.

The last hypothesis of this study, stronger hurricanes will impact oil companies' stock price more than weaker hurricanes, will be tested in a similar way the first two were. Daily percent change of each oil company's stock price is calculated. Likewise, calculations are made to find the daily percent change for the price of crude oil. This is done in the same fashion as before.

Using hurricane tracks, each day is grouped by intensity. These groups include days when a category 3-5 hurricane is present, days when a category 1-2 hurricane is present, days when a tropical storm is present, and days when a tropical depression is present. On days when more than one storm is present, the highest intensity is used. For example, one day has both a category 2 hurricane and tropical depression in the Atlantic. This day is grouped as a day when a category 1-2 hurricane is present.

For each oil company stock, the average daily percent change for days when a category 3-5 hurricane is present, category 1-2 hurricane is present, tropical storm is present and tropical depression is present is calculated. Also, the average daily percent change for all of the oil companies together for each of the four categories of days is calculated. Lastly, the daily percent

change for crude oil for each of the four categories of days is calculated. Collectively, this shows how oil companies and the industry are affected by different strengths of tropical storms.

RESULTS AND DISCUSSION

The first hypothesis for this study is, “when hurricanes approach the United States, the stock price of oil companies will fall.” After testing this hypothesis, the results show that this is simply not true. In general, the distance a hurricane is to the United States coastline appears to have little effect on the stock price of oil companies.

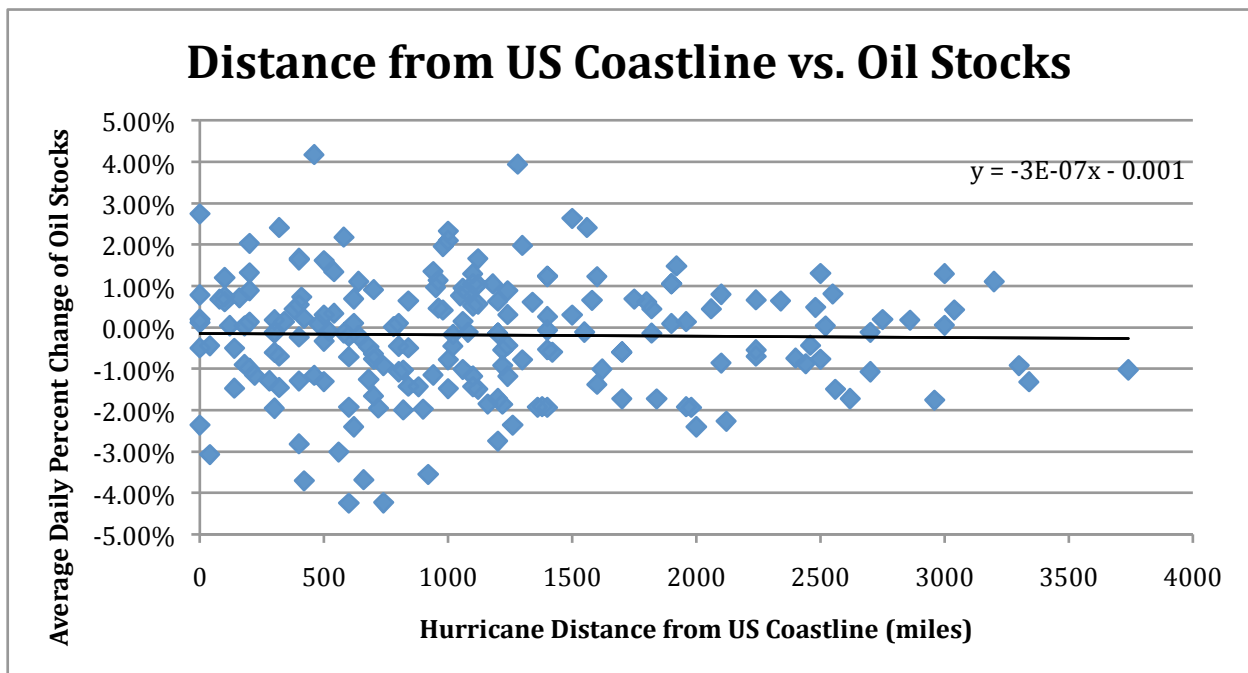


Fig. 2. Scatter plot of average daily percent change of oil stocks and hurricane distance from United States coastline.

Figure 2 shows the distance each hurricane is from the United States coastline and the average of all five oil companies stock price daily percent change. For hurricanes making

landfall, the distance from the US coastline is calculated by using the point on the United States' coast that the hurricane makes landfall and the individual locations of the hurricane. For hurricanes not making landfall, the distance between the closest point on the United States' coast the hurricane comes to making landfall and the individual locations of the hurricane is considered. This gives some insight as to how the oil industry as a whole moved when there was an approaching hurricane. When the average daily percent change of oil stocks is 1%, it indicates an average gain of 1% for the stock price of the five oil companies being studied. Likewise, when the average daily percent change of oil stocks is -1%, then the average stock price of the oil companies fell by 1% on that particular day.

Looking at Figure 2, we can see that the number of days share prices rose and number of days when share prices fell are about the same. If this hypothesis is true, the closer a hurricane was to the coast the further the stock price should fall. The correlation coefficient between the average daily percent change of oil stocks and the hurricane distance from the US coastline is .01386. This indicates that the distance a hurricane is from the US coast has little to do with fluctuations in the five oil companies' stock prices.

Evaluating each oil company individually also did not support the hypothesis. Exxon Mobil has the largest correlation coefficient, which is .02624 (see Figure 3). This is nowhere close to being statistically significant. The other companies included Chevron with .02089, BP with .01038, and ConocoPhillips with .00840. The Anadarko Petroleum Company has the smallest correlation coefficient of the five with .00103.

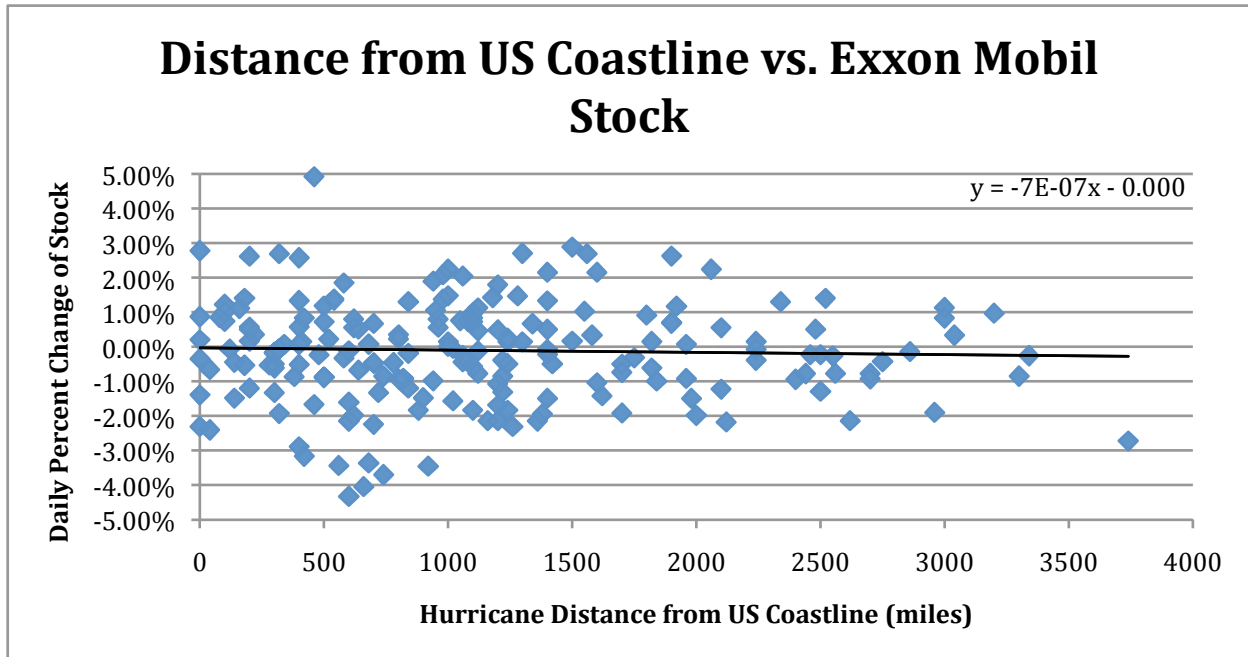


Fig 3. Scatter plot of average daily percent change of Exxon Mobil stock and hurricane distance from United States coastline

The lack of correlation between the stock price and the distance a hurricane is from the US coast is somewhat difficult to explain. In an attempt to discover a possibility as to why there is a lack of correlation, this study also compares the daily percent change of crude oil price to the distance hurricanes are from the US coast. A hurricane could cause a slow down in the production of crude oil from the Gulf of Mexico. A lower supply of crude oil will drive the demand for this product higher and thus drive the price higher as well. If the price of crude oil increases as hurricanes approach the US coast, the oil companies will be paid more per barrel of oil that they produced. This could possibly help the companies recover from any lost profit due to a hurricane.

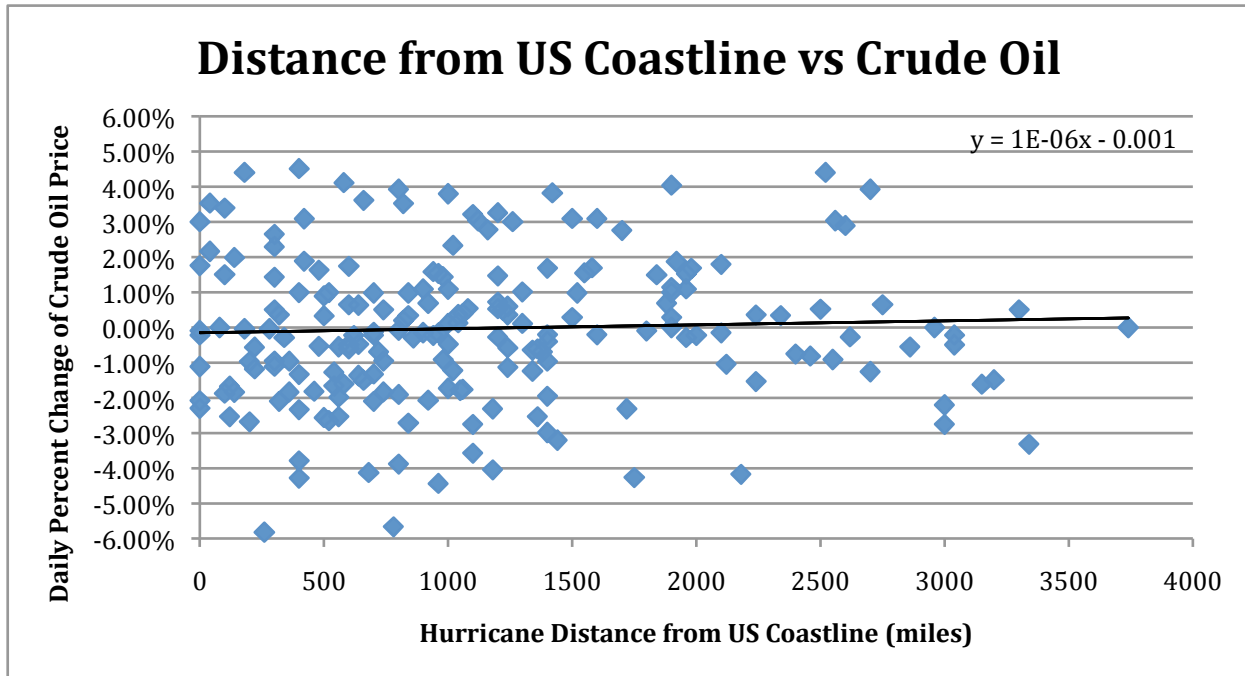


Fig 4. Scatter plot of average daily percent change of crude oil price and hurricane distance from United States coastline.

As shown by Figure 4, the daily percent change of crude oil price and the distance from US coastline shows very little relationship between variables. The correlation coefficient between these two variables is .04112. This is also nowhere close to being statistically significant in proving a correlation. What this does tell us is that the price of crude oil is unpredictable even with a hurricane approaching the United States. This indicates that an increase in the price of crude oil does not always occur as a hurricane approaches the United States.

The second hypothesis for this study is, “hurricanes that enter the Gulf of Mexico will impact oil companies stock price more so than hurricanes that do not enter the Gulf of Mexico.” The results also do not support this hypothesis. Days when a hurricane was present in the Gulf of Mexico has a smaller effect on the stock price as compared to days when a hurricane located outside of the Gulf of Mexico.

In order for this hypothesis to be true, the average daily percent change of the oil company stock prices should be significantly lower for the in Gulf of Mexico days than the outside Gulf of Mexico days. However, this is not the case. The average daily percent change of all five of the oil companies stocks on days where there was a hurricane present in the Gulf of Mexico is 0.03%. This is pretty much no movement for the average. For days there is a hurricane located outside of the Gulf of Mexico, the average daily percent change of the oil companies stock price is -0.15%. This means on average the stock price of the oil companies decreases by 0.15% when a hurricane is located outside of the Gulf of Mexico and increased in value by 0.03% on days when a hurricane is located in the Gulf of Mexico. Both of these percentages are fairly low and indicate no sharp turns in share prices when a hurricane is located in or outside the Gulf of Mexico.

Table 1. The average daily percent change of individual oil company stocks when a hurricane is located in the Gulf of Mexico and when a hurricane is located outside the Gulf of Mexico.

	BP	Anadarko	ConocoPhillips	Chevron	Exxon Mobil
Hurricane located in Gulf of Mexico	-0.03%	-0.16%	0.04%	0.10%	0.17%
Hurricane located outside Gulf of Mexico	-0.12%	-0.09%	-0.22%	-0.19%	-0.12%

The stock prices of each individual oil company are also slightly affected more by hurricanes located outside the Gulf of Mexico than hurricanes located in the Gulf of Mexico. Relatively speaking, the average movements of these stocks balanced out to be pretty much flat. None of the averages move more than a quarter of a percent. Most of these averages show a very small movement lower; however, some of the stocks show an average increase in share price when a Hurricane is located in the Gulf of Mexico. On average, Chevron's stock price increases

by 0.10%. Exxon Mobil increases its share price by 0.17% while hurricanes are located in the Gulf of Mexico. ConocoPhillips also posted a slight gain.

Even though the averages for the percent change of oil companies are all pretty much the same for when a hurricane is located in the Gulf of Mexico and when a hurricane is located outside the Gulf of Mexico, it does not say anything about the volatility of the stock price. One would also assume oil stock prices would be more volatile while a hurricane is in the Gulf of Mexico as compared to when a hurricane is located outside the Gulf of Mexico. This also proved to be false.

By using standard deviation, we can measure the volatility of the stock prices. The standard deviation for the average of the five oil stock prices daily percent change is 1.46% on days when a hurricane was located in the Gulf of Mexico. The standard deviation for days when a hurricane is located outside the Gulf of Mexico is 1.88%. This means that the volatility of stock prices for the oil industry is about the same for days when a hurricane is located in the Gulf of Mexico as compared to days when a hurricane is located outside the Gulf of Mexico.

Table 2. The standard deviation of individual oil company stocks daily percent change when a hurricane is located in the Gulf of Mexico and when a hurricane is located outside the Gulf of Mexico.

	BP	Anadarko	ConocoPhillips	Chevron	Exxon Mobil
Hurricane located in Gulf of Mexico	1.09%	1.87%	2.21%	1.38%	1.54%
Hurricane located outside Gulf of Mexico	1.50%	2.71%	2.02%	1.95%	2.03%

Looking at the standard deviation of each oil company individually in Table 2, we can see that most follow the trend of the average. BP, Anadarko, Chevron and Exxon Mobil all have

slightly more volatility when a hurricane is located outside the Gulf of Mexico. ConocoPhillips on the other hand has slightly more volatility when a hurricane is located in the Gulf of Mexico.

The price of crude oil was also compared when a hurricane was located in the Gulf of Mexico to when a hurricane was located outside the Gulf of Mexico. When a hurricane is located in the Gulf of Mexico, the supply of crude oil could be lowered significantly. With the possibility of a lower supply, one would suspect the price of crude oil to increase. However, this is not the case. On days when a hurricane is located inside the Gulf of Mexico, the average daily percent change in the price of crude oil decreases by 0.51%. When a hurricane is present outside the Gulf of Mexico, the price increases by 0.12%. These are not large price jumps; however, it is opposite to what ones intuition may suggest.

The standard deviation of these daily percent changes in crude oil price is nearly identical. When a hurricane is outside the Gulf of Mexico the standard deviation is 2.36% as compared to 2.40% when a hurricane is in the Gulf of Mexico. This shows that the volatility in the price of crude oil is pretty much the same when a hurricane is located in or outside the Gulf of Mexico.

The last hypothesis of this study is that “stronger hurricanes will impact oil companies stock price more than weaker hurricanes.” Like the other two hypotheses, the results do not support this hypothesis. Oil company stocks remained fairly stable regardless of the intensity of the storms.

In order for this hypothesis to be true, the average daily percent change of the oil companies would have to be fairly small for weak storms and decrease much more for stronger storms. To test this, the strength storms are broken down into four groups. The groups are tropical depressions, tropical storms, category 1-2 hurricanes and category 3-5 hurricanes. On

days when only a tropical depression is present, the average daily percent change of the oil stocks are -0.26%. During a tropical storm, the average oil stock price actually increases by 0.07%. Oil stock prices decrease by 0.11% during a category 1-2 hurricane. While a category 3-5 hurricane is present, the average daily percent change of oil stock prices remains flat at 0.00%.

Table 3. The average daily percent change of individual oil company stocks when a tropical depression, tropical storm, category 1-2 hurricane or category 3-5 hurricane is present in the Atlantic Ocean, Caribbean Sea or Gulf of Mexico.

	BP	Anadarko	ConocoPhillips	Chevron	Exxon Mobil
Tropical Depression	-0.21%	-0.09%	-0.34%	-0.30%	-0.26%
Tropical Storm	-0.11%	-0.09%	-0.02%	-0.06%	0.07%
Category 1-2 Hurricane	-0.11%	-0.09%	-0.20%	-0.12%	-0.05%
Category 3-5 Hurricane	-0.04%	0.15%	0.02%	-0.02%	0.01%

Table 3 shows how each individual oil company's stock moves on average given certain strengths of storms located in the Atlantic Ocean, Caribbean Sea or Gulf of Mexico. Similar to the other findings, most of the stocks remain flat regardless of the storm that is present. Even when a category 3-5 hurricane is present, the daily percent change in stock price for these companies do not decrease significantly. In fact, for this category Anadarko, ConocoPhillips and Exxon Mobil show an average increase in share price. Only BP and Chevron have a slight decrease.

The volatility of the average daily percent change for average of the oil stocks shows a fairly consistent result. The standard deviation for the average daily percent change when a tropical depression is present is 2.39%. During a tropical storm, standard deviation is 1.66%. For a category 1-2 hurricane it is 1.36% and for a category 3-5 hurricane the standard deviation is

1.84%. This would indicate that oil stocks on average are most volatile when a tropical depression is present and slightly less volatile during the three stronger storms.

Table 4. The standard deviation of individual oil company stocks daily percent change when a tropical depression, tropical storm, category 1-2 hurricane or category 3-5 hurricane is present in the Atlantic Ocean, Caribbean Sea or Gulf of Mexico.

	BP	Anadarko	ConocoPhillips	Chevron	Exxon Mobil
Tropical Depression	1.97%	3.07%	2.42%	2.35%	2.89%
Tropical Storm	1.52%	2.56%	1.96%	1.90%	1.66%
Category 1-2 Hurricane	1.24%	2.00%	1.69%	1.54%	1.41%
Category 3-5 Hurricane	1.52%	2.47%	2.14%	1.98%	1.96%

An overview of the standard deviation for each individual oil stock as compared to storm strength is given in Table 4. Anadarko is slightly more volatile than the other companies during all four categories of storm strength. However, volatility for each individual company is relatively consistent across all categories. This shows that the strength of a hurricane does not directly affect the volatility in any significant way.

Without any other hard evidence, only speculations can be made as to why this study shows hurricanes have such little impact on oil companies' stock prices. Hurricanes can obviously affect the oil industry in a negative way. Shutting down oil platforms for crew evacuations and safety inspections along with repairing and removing damaged platforms caused by hurricanes can be extremely costly to oil companies. While these things have the potential to harm the stock prices of oil companies, it appears that most of the time the stock market is not significantly affected by hurricanes.

This may be due to the fact that there are so many other variables that affect the stock market. There may simply be too many other things interfering with the stock price of an oil company that doesn't have anything to do with weather. A good earnings report or the discovery of a new oil field may boost a companies' stock price even if there is a hurricane present in the Gulf of Mexico. Likewise, a lawsuit or strike can seriously harm stock prices without the threat of a hurricane.

Weiderman and Bacon (2008) study on Hurricane Katrina found that the stock price of oil companies fell significantly in the days before Hurricane Katrina made landfall. Why is this not true for all hurricanes that are approaching the Gulf of Mexico and United States? This might be because Hurricane Katrina was a very special scenario. In the days leading up to Katrina, it became obvious that the amount of damage to the Gulf of Mexico and gulf coast was going to be incredibly devastating. When Katrina started making top news stories it more than likely also grab the attention of investors. However, most hurricanes do not receive so much publicity and therefore might explain why stock prices are not affected by most hurricanes. If other stories relating to the company are in the news, a hurricane threat may be of little importance to shareholders.

CONCLUSIONS

This study evaluates the how oil companies stock prices are influenced by hurricanes. Three hypotheses are tested to further this understanding. First, when hurricanes approach the United States, the stock price of oil companies will fall. Second, hurricanes that enter the Gulf of Mexico will impact oil companies' stock price more than hurricanes that do not enter the Gulf of

Mexico. Lastly, stronger hurricanes will impact oil companies' stock price more than weaker hurricanes.

The first hypothesis is, "when hurricanes approach the United States, the stock price of oil companies will fall." The results show that this is not always true. In general, the distance a hurricane is to the United States coastline appears to have little effect on the stock price of oil companies.

The second hypothesis for this study is, "hurricanes that enter the Gulf of Mexico will impact oil companies stock price more so than hurricanes that do not enter the Gulf of Mexico." After testing this hypothesis, the results did not support it. Days when a hurricane was present in the Gulf of Mexico have a slightly smaller effect on the stock price as compared to days when there was a hurricane located outside of the Gulf of Mexico.

The last hypothesis is that "stronger hurricanes will impact oil companies stock price more than weaker hurricanes." Like the other two hypotheses, the results do not support this hypothesis. For the most part, oil company stocks remain stable regardless of the intensity of the storms.

Determining how hurricanes impact the stock price of oil companies is important for investors. Shareholders need to make sound decisions when choosing to put money into or pull money out of a stock. By understanding how the stock prices of oil companies change in the days leading up to a hurricane making landfall, investors will be better informed to make these decisions during the hurricane season.

FUTURE WORK

This study opens the door for work to be done in the future. A lot of questions are still left unanswered. Why do some hurricanes appear to cause the market to fall, like Weideman and Bacon (2008) found with Hurricane Katrina? What criteria must hurricanes have in order to have a significant impact on the share price of oil companies? How does media coverage of hurricanes play into the share price of oil companies?

One possible study could be done to look at only the most devastating hurricanes that actually impact the Gulf of Mexico's Offshore Oil Drilling Area. These major hurricanes that cause the most damage may cause the share price to fall after the hurricane has struck. While this study was only concerned with hurricanes up to the day they impacted the coast, another study could be done with the most devastating hurricanes in the days after hurricanes impact the Gulf of Mexico.

Perhaps a hurricane must have certain criteria to impact stock prices significantly. One could look to see if there are any pattern to the type of hurricanes that cause stock prices to move the most. Maybe late season hurricanes impact prices more than hurricanes that form early in the season. One can examine if the origin of the hurricane has any significance to share price. Perhaps hurricanes that form in the Caribbean Sea have more of an impact on oil prices than hurricanes that form in the far east of the Atlantic Ocean.

The media could play a part in the share price of an oil company too. It is very possible that the more media coverage a hurricane receives, the more it will affect the share price of oil companies. Even if a hurricane is about to strike the Gulf of Mexico, stock prices may not be influenced if there is another news story that is overshadowing the hurricane. Likewise, a weaker

hurricane may receive more coverage than a stronger hurricane if there are no other major news stories going on.

REFERENCES

- Considine, T.J., and C. Jablonowski, 2004: The Value of Hurricane Forecasts to Oil and Gas Producers in the Gulf of Mexico. *Journal of Applied Meteorology*, **43**, 1270-1281.
- Kaiser, M.J., 2010: The impact of Hurricanes Gustav and Ike on offshore oil and gas production in the Gulf of Mexico. *Applied Energy*, **87**, 284-297.
- Sever, M., 2005: Katrina blows in higher gas prices. *Geotimes*, **50**, 48.
- Weiderman, I., and F. Bacon, 2008: Hurricane Katrina's Effect on Oil Companies Stock Prices. *Academy of Strategic Management Journal*, **7**, 11-16.