Deepwater Horizon Oil Spill: Stock performance effects on the energy industry

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Dissertation submitted in partial fulfilment of requirements for the MSc in Finance, at the Universidade Católica Portuguesa, January 2025.

Abstract

This dissertation investigates the financial implications of the largest marine oil spill in history (Deepwater Horizon oil spill) on the Oil and Gas and Alternative Energy industries. Employing event study and regression methodologies, the analysis spans US and European markets to assess intra-industry and cross-industry effects, with a focus on the role of Gulf of Mexico exposure in driving abnormal stock returns.

Findings confirm significant negative market reactions for BP and its partners, with severe negative cumulative abnormal returns reflecting strong intra-industry contagion. The research further highlights the disproportionate impact of negative news on market reactions compared to positive developments, suggesting investors tend to overreact to adverse events. Additionally, exposure to the Gulf of Mexico during the spill was identified as a key driver of abnormal returns.

The study provides key insights for stakeholders in assessing financial risks associated with environmental disasters and offers a foundation for further exploration into long-term industry ramifications, such as regulatory impacts and shifts in energy policy.

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Title: Deepwater Horizon Oil Spill: Stock performance effects on the energy industry

Keywords: Event study, Oil Spill, Deepwater Horizon, Abnormal Returns

Resumo

Esta dissertação investiga as implicações financeiras do maior derrame de petróleo marinho da história (derrame de petróleo Deepwater Horizon) nas indústrias petrolífera e de Energias Alternativas. Utilizando metodologias como estudo de eventos e regressão, a análise foca-se nos mercados dos EUA e da Europa para avaliar os efeitos intraindustrial e inter-industrial, com especial foco no papel da exposição do Golfo do México na geração de retornos anormais das ações.

As conclusões confirmam reações negativas significativas do mercado para a BP e os seus parceiros, com retornos anormais cumulativos refletindo um forte contágio a nível intraindustrial. O estudo destaca o impacto desproporcional das notícias negativas nas reações do mercado em comparação com os desenvolvimentos positivos, sugerindo que os investidores reagem exageradamente a eventos adversos. Além disso, a exposição ao Golfo do México durante o derrame foi identificada como um fator-chave para os retornos anormais.

O estudo fornece informações importantes para as partes interessadas na avaliação dos riscos financeiros associados a desastres ambientais e oferece uma base para uma exploração mais aprofundada das ramificações da indústria a longo prazo, tais como impactos regulamentares e alterações na política energética.

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Título: Derrame de Petróleo Deepwater Horizon: Efeitos do desempenho das ações na indústria energética

Palavras-chave: Estudo de eventos, Derrame de Petróleo, Deepwater Horizon, Retornos Anormais

Acknowledgments

I would like to start by expressing my deepest gratitude to Professor Jörg Stahl for his invaluable guidance and constructive feedback throughout this journey. His expertise and mentorship alongside the steadfast support were key foundations of this dissertation. I would like to extend my gratitude to Católica Lisbon for allowing me to learn from top-notch professors in a field I'm so passionate about. This opened doors that I never imagined I would be able to achieve. I would also like to thank all of the friends and colleagues which were part of my university journey. In one way or another, all of you shaped my path during the most amazing years of my life, and for that my sincere gratitude.

On a more personal note, I would like to specially thank to my two closest friends. Chasqueira, my best friend from a very young age. A thank you would not be enough for all the patience and unwavering support throughout this journey. For all the brotherhood, the listening even when you did not know what to say and for being there every single time I needed, I will be forever grateful. Rita. From a simple colleague to a friendship I will take for life. Through all the ups and downs, you never let me stay behind. Without your kindness, understanding and never-ending availability, this journey would have been unquestionably harder and specially sadder. You were definitely the best that Católica gave me. Both of you mean the world to me, and I will never know how to retribute everything you've done.

Lastly, my family. My uncles, cousins, grandparents and especially parents and brother. Your unconditional love and support were what allowed me to get to this point. Simão, a huge thank you for your companionship and presence in every step of the way. Even though we don't usually say these things to each other, I couldn't ask for a better brother. Dad, you were always there for everything I needed. Anything, I always knew I could count on you. Your resilience, work ethic and invaluable lessons shaped who I am and led me where I never imagined, not even on my best dreams. Mom, your unmeasured love, strong values and invaluable advices were key cornerstones of my development. For sure that without them none of this would be possible, and for that I'll be forever thankful. Wherever life leads me, both of you are my role models. And if I manage to be half the person you are, I'm sure that I'll be very successful. On an ending note, a special thanks to my late grandfather. You always wanted to see me graduate, but never had the opportunity. This dissertation is also yours.

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1. Introduction

The Deepwater Horizon Oil Spill is considered to be the biggest marine oil spill in history and one of the most disastrous environmental events. The Deepwater Horizon oil rig was located in the Macondo prospect, off the Louisiana coast in the Gulf of Mexico (GOM). On the night of April 20th , 2010, the rig, which was owned by Transocean Ltd. and leased and operated by oil giant BP Exploration and Production Inc, exploded and sunk, causing the death of 11 workers and the injury of other 17. Around 4.9 million barrels of oil were leaked from the well for a total of 87 days, surpassing by far the magnitude of previous similar oil spills like the 1989 Exxon Valdez (Patten and Nance, 1998).

The period after the spill was shaped with great uncertainty surrounding the whole Oil and Gas industry, not only due to its massive environmental and social ramifications, but also due to its financial and legal implications. BP took a huge financial hit as they were the main responsible for the rig explosion and the cleaning of affected areas throughout the Gulf of Mexico. On July 2nd, 2015, BP settled at the federal, state and local level claims for up to $18.7 billion, more than five years after the disaster (BP, 2015). Moreover, there is strong evidence that the total cost of the event is spread throughout the whole industry. By September 19th, 2010, when the oil well was definitely sealed, BP had lost $68.2 billion in market value. On the other hand, its main rig partners had taken a loss of $23.8 billion, whereas other firms in the Oil and Gas industry had lost $183.7 billion (Lee et al., 2018). Besides the criminal charges and financial penalties imposed by the US Department of Justice (DOJ), there were further legal impacts on the Oil and Gas industry. The US Department of Interior (DOI) also imposed further restrictions on offshore drilling activities along the Gulf of Mexico coast through two moratoriums, which posed increased difficulties for the whole industry. All this uncertainty combined with the heavy dependence on fossil fuels spurred the debate on whether a transition to alternative energy sources would be a better solution for the energy sector.

This thesis investigates the financial repercussions of the Deepwater Horizon oil spill on the Energy sector, focusing on the Oil and Gas and Alternative Energy industries. By employing event study and regression methodologies, this dissertation studies the short-term abnormal returns in both U.S. and European markets, aiming to understand whether the event triggered intra-industry contagion or cross-industry effects. Another central aspect of this study is assessing the role of exposure to the Gulf of Mexico in shaping stock performance during key event windows.

The results demonstrate a pronounced negative market reaction within the Oil and Gas sector, particularly affecting BP and its primary rig partners. This effect was not confined to these firms alone, as significant intra-industry spillovers were observed across U.S. and European markets, underscoring the widespread impact of the disaster on investor sentiment. Interestingly, bad news reported far stronger reactions than positive developments. This asymmetry highlights the market's tendency to overreact to adverse events while underestimating favourable news. In contrast, the Alternative Energy industry exhibited no significant cross-industry effects. This lack of response suggests that the spill's immediate financial implications were largely contained within the Oil and Gas sector.

This study contributes to existing literature by providing a cross-industry and cross-continental perspective, as well as identifying exposure to the Gulf of Mexico as a key determinant of abnormal returns. These findings offer critical insights for investors and policymakers, emphasizing the importance of geographical exposure and highlighting how environmental disasters can disproportionately shape market behaviour.

The dissertation is structured as follows: Section 2 provides an overview of existing literature and the formulated hypothesis. Section 3 illustrates the research design, with a detailed explanation of the timeline of event, data, methodology and summary statistics. Section 4 reports the main output of the thesis. Sections 5 and 6 offer conclusions, limitations of the study and future research points to expand knowledge on this oil spill.

2. Literature Review and Hypothesis Formulation

2.1. Market Reaction to Environmental Disasters

Environmental disasters could severely impact the value of a firm. While academics and researchers generally agree on this statement, it is crucial to understand what factors could have significantly influenced the market performance of affected firms.

Usually, firms which are impacted by natural disasters can incur increased regulatory and lobbying costs. Moreover, investors' sentiment and awareness tend to be heavily shaped with negativity due to the possibility of another accident within the industry (Hsu et al., 2013).

Several disasters of different nature were already studied. The Three Mile Island nuclear accident led to significant negative abnormal returns for the nuclear industry (Hill & Schneeweis, 1983), while Union Carbide's Bhopal chemical leak did also lead to negative abnormal returns not only for the responsible companies, but also for other chemical firms leading to the existence of an intra-industry effect (Blacconiere & Patten, 1994). The one most similar to the Deepwater Horizon spill was the Exxon Valdez disaster. It consisted of a large oil spill which occurred in 1989, in Alaska. Findings on this event also show how equity prices of affected firms immediately reacted in a negative manner to the relevant information of the incident (Mansur et al., 1991).

Despite clear evidence of how other natural disasters led to negative abnormal returns of the responsible parties, it is still important to look at past literature regarding the Deepwater Horizon oil spill. After the announcement of the rig explosion, BP's securities did indeed take a severe hit. Not only did BP lose more than 50% in share value, but also dividends were cut and implied volatility and CDS prices skyrocketed (Fodor & Stowe, 2012).

After observing all this evidence, a negative market reaction is expected for BP and its responsible counterparts for the Deepwater rig.

H_1: BP and its operating partners experience significant negative abnormal returns.

2.2. Spillover Effects

A review of the literature highlights that firm-specific announcements can trigger a contagion effect. The contagion effect arises when external investors interpret announcements from one firm as indicative of the profitability of other firms in the same industry (Hertzel & Officer, 2012).

Even though literature massively agrees that responsible parties for environmental disasters tend to suffer negative market reactions, spillover effects are unclear. Environmental disasters like earthquakes have presented negative impact on the stock returns on cross-border industry peers, with contagion effects overweighting competitive effects (Ding et al., 2021). Looking at the Chernobyl nuclear accident, negative market reactions were obtained for all nuclear utilities (Kalra et al., 1993).

Regarding the Deepwater Horizon existing research, there are also mixed conclusions regarding spillover effects. On one side, the financial performance of not only BP but the entire Oil and Gas industry remained unaffected in the medium to long term (McGuire et al., 2022). These findings are not supported by the rest of the literature, which find significant negative intra-industry effects (Kollias et al., 2012; Hsu et al., 2012; Sabet et al., 2012). Even though this disaster led to a market cap loss of $259.1 billion, about $183.7 billion were from unrelated Oil and Gas firms, showing a strong contagion effect (Lee & Garza-Gomez, 2012).

Other studies highlight the importance of studying the Deepwater Horizon spill through a multi-event approach, which might help identify clear spillover effects. On the one hand, given that the information was assimilated by the market over a long period of time, investors differentiated between firms directly involved in the oil spill and the ones not involved (Humphrey & Simkins, 2015). On the other hand, strong evidence of negative abnormal returns was found around the moratorium date. These effects were not only felt by the companies directly involved in the rig activities, but also other Oil and Gas like drilling and service firms (Hunsader et al., 2012).

Despite unclear conclusions on whether environmental disasters generate spillover effects, there is stronger literature arguing for the existence of contagion. Hence:

H_2: The oil spill causes significant negative intra-industry effects.

To the best of my knowledge, this dissertation is the first to study the cross-industry impact of an environmental disaster. Nonetheless, given that the event also generated increased awareness and discussion for greater use of alternative energy sources, a positive cross-industry effect could also be expected.

H_3: The oil spill causes significant positive cross-industry effects, particularly to alternative sources of energy.

2.3. Exposure Effects

Taking into account that the spill lasted for months around the Gulf of Mexico, it is reasonable to expect that the more exposed firms to this region would suffer more. In comparison to the Exxon Valdez accident, the market discriminated between Oil and Gas firms based on the exposure to the Trans-Alaska pipeline (Mansur et al., 1991). Hence:

H_4: Exposure to the Gulf of Mexico increases the magnitude of abnormal returns.

3. Research Design

3.1. Timeline of the Spill

The Macondo Well is an oil and gas prospect located in the Gulf of Mexico, off the coast of Louisiana. Initially, the well had one main rig: Deepwater Horizon, which was owned by Transocean, the world's largest offshore drilling contractor. At the time of the explosion, there were 3 main partners involved in the operation of the rig beside Transocean: BP, Anadarko and Halliburton. BP was the main operator of Macondo Well, owning around 65% of it. Anadarko had a minor participation on the well (25%), whereas Halliburton was a contractor for BP, responsible for cementing and engineering services of the well (Lee & Garza-Gomez, 2012).

Table 1

Major Group: main partners involved in the operations of the Deepwater Horizon rig

Firms	**Roles Played in the Operations**
Transocean	The provider of the drilling rig Deepwater Horizon
BP	Operator and Co-owner of the oil well (65%)
Anadarko Petroleum	Co-owner of the oil well (25%)
Halliburton	The provider of engineering and pumping for cementing operations

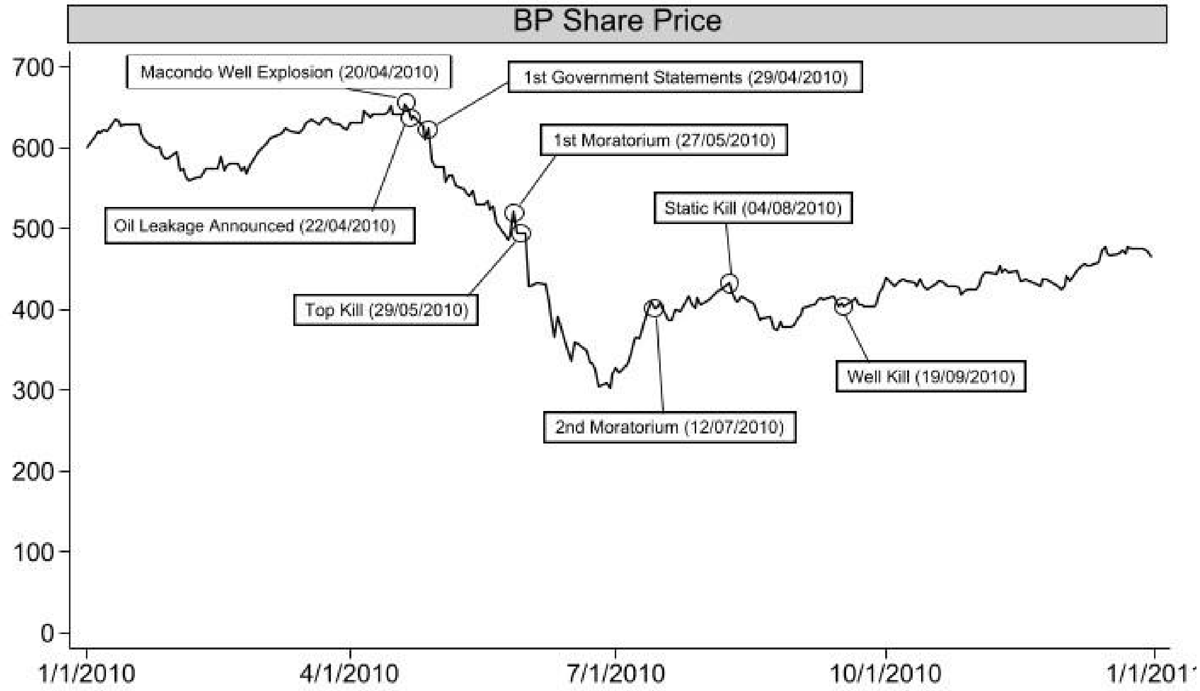
This table reports the major group of companies responsible for the Deepwater Horizon rig.

In the evening of April 20th, 2010, a surge of natural gas erupted through a concrete core that had been previously installed by Halliburton. This forced the natural gas to travel up to the platform, where it ignited. Two days later, on the morning of April 22nd, 2010, the rig fell apart and officially sank. On the evening of the same day, oil started to leak into the water causing unimaginable damage to the environment. One week later, on April 29th, President Obama and its administration made their first statements about the oil spill and the state of Louisiana declared state of emergency (Humphrey & Simkins, 2015). This date was considered of great importance for the markets, as the largest hits in stock prices and peaks of stocks and options volume and implied volatility were recorded (Fodor & Stowe, 2012).

On May 27th, 2010, the Obama administration, more specifically the Department of Interior, issued a six-month moratorium on all offshore drilling below 500ft of water, which affected the activities of several Oil and Gas companies directly exposed to the Gulf of Mexico.

On May 29th, 2010, shortly after the announcement of the 6-month moratorium, BP announced that their attempts to stop the leakage of oil to the Gulf of Mexico had officially failed. This procedure was widely known as *Top Kill*.

Figure 1
BP Share Price Evolution



This figure shows the BP Plc share price evolution in 2010. The most relevant events of the oil spill are illustrated throughout the graph to show how the main operator of the Macondo Well was impacted.

On July 12th, 2010, the Department of Interior issued a new moratorium on offshore drilling. This time, Secretary of the Interior Ken Salazar wanted to assure that adequate safety measures were being implemented by Oil and Gas firms, to reduce the risks of future drilling operations.

On August 4th, 2010, BP announced that a new procedure (*Static Kill*) was a success, finally showing to investors that their efforts to contain further oil leakages to the Gulf of Mexico were yielding promising results.

On September 19th, 2010, Admiral Allen announced that the Macondo well was finally sealed, as BP managed to set up a relief well in order to pump in cement to seal the leakage.

3.2. Data

In this dissertation, the main goal is to study the abnormal returns of US and European firms, in order to assess the impact of the Deepwater Horizon spill. Hence, the first step was to determine the relevant firms for the event. Regarding the selection of firms for the final sample, all available stocks were extracted from the Datastream Worldscope lists from the United States and 24 different European countries[1]. From those, the sample was reduced by using the FTSE Russell Industry Classification Benchmark (ICB), by filtering the sample with the relevant ICB sector codes: 6010 (Oil and Gas) and 6020 (Alternative Energy). ICB subsector codes were also extracted to further segment each group into smaller subgroups. The different Oil and Gas subgroups are Integrated Oil and Gas, Crude Producers, Offshore Drilling, Refining and Marketing, Equipment and Services, and Pipelines, whereas Alternative Fuels and Renewable Energy Equipment constitute the subgroups of the Alternative Energy sector. Lastly, through the Datastream database, a manual cross-check was conducted to confirm whether the selected firms were active between January 1st, 2008, and December 31st, 2010, in order to assure that the companies had relevant data to be analyzed.

After defining the final sample of firms, daily returns were extracted from Datastream through the cross-sectional daily percentual change of the variable RI (Return Index)[2] from January 1st, 2008, to December 31st, 2010. For the market data, the same formula was used to extract daily returns for the S&P 500 and the Stoxx Europe 600. These indexes are the ones considered as proxies for the US and European equity benchmarks, respectively, due to their high correlation with market performance and broad market and sectorial coverage in both geographies. In order to conduct robustness checks, additional factor data – Market Risk Premium (MRP), Small-Minus-Big (SMB), High-Minus-Low (HML) and Momentum (MOM) – was extracted from the Kenneth R. French Data Library for the US and European markets.

As an additional analysis, this dissertation aims at understanding what are the main drivers of abnormal returns. As previously hypothesized, exposure to the Gulf of Mexico is expected to be the main driver of negative abnormal returns. To construct the "Exposure" variable, a manual cross-check of the 10-k filings in the 2009 financial year (FY) of the US Oil and Gas industry was conducted. If a company had any operating rig in the Gulf of Mexico at the end of 2009, it would take the value of 1, otherwise it would be zero. The remaining explanatory variables were extracted from Datastream at the end of FY 2009. Total Assets and ROA are the chosen proxies for Size and Profitability, respectively. Since we are dealing only with publicly traded firms (i.e., bigger firms), "Total Assets" seem to be the most relevant proxy measure of Size (Wakil, 2020). On the other hand, "Return on Assets (ROA)" seems to be most robust proxy

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[1] The countries which constitute the European sample are Austria, Belgium, Croatia, Cyprus, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Italy, Luxembourg, Netherlands, Norway, Poland, Portugal, Romania, Slovenia, Spain, Sweden, Ukraine and United Kingdom.

[2] The formula used was "PCH#(X(RI),1D)/100".

for Profitability (Yousaf and Dey, 2022). For "Leverage", Total Debt was additionally extracted and divided by Total Assets to obtain the Debt/Assets ratio. Market to Book ratio (M/B) was also extracted. Table 2 provides a brief description of the explanatory variables.

Table 2
Description of variables

Variable	Description
Exposure	Binary Variable, equals 1 if the firm was exposed to the Gulf of Mexico at the end of FY 2009, 0 otherwise
Size	Total Assets at the end of FY 2009, in thousands of dollars
Profitability	Return on Assets (ROA) at the end of FY 2009, in percentage
Leverage	Total Debt to Total Assets ratio at the end of FY 2009, in percentage
M/B	Market to Book ratio at the end of the year prior to the spill

3.3. Methodology

3.3.1. Event Study

The event study methodology is one of the most used to assess the impact of a specific event (in this case, a disastrous oil spill) in the value of firms, assuming that stock price variation will reflect the relevant information from the event (MacKinlay, 1997). The idea is to compute cross-sectional abnormal returns around the event date, by comparing each firm's actual return with its expected return, in the case of no event (Fama et al., 1969).

The market model is the selected method to estimate the cross-sectional expected returns during the estimation window. The defined estimation window consists of 256 trading days, ending 30 trading days prior to the event. Assuming the first day of the estimation window to be t_1 and the last day to be t_2, the estimation window is $(t_1, t_2) = (-285, -30)$. The market model was estimated by using the following equation:

$$R_{i,t} = \alpha_i + \beta_i * R_{m,t} + \varepsilon_{i,t} \quad (1)$$

where $R_{i,t}$ is the daily return of firm i in event day t, $R_{m,t}$ is the return of the market portfolio in event day t and $\varepsilon_{i,t}$ is the zero mean disturbance term.

From equation (1), it is possible to obtain estimates for α and β for each firm i. These will then be used to compute the cross-sectional abnormal returns (AR) as follows:

$$AR_{i,t} = R_{i,t} - (\hat{\alpha}_i + \beta_i * R_{m,t}) \quad (2)$$

Given a specific event window, cumulative abnormal returns (CAR) are computed to further understand firms' performance around the event date. Assuming t_3 as the first day of a specific event window and t_4 the last day of that event window, the CAR of a given window (t_3,t_4) is:

$$CAR_i = \sum_{i=t_3}^{t_4} AR_{i,t} \tag{3}$$

Table 3 represents the six different event periods that were defined in order to better segment and characterize the oil spill's different impact over time, as previously discussed in section 3.1 (Timeline of the Spill).

Table 3
Key Event Windows

Event Date	Event Window	Description
April 21	1st Week [0;+1]	In the evening of April 20th, the Deepwater Horizon oil rig ignited and exploded due to a surge of natural gas. April 21st was considered to be t=0 in this event window because it was the first trading day after the rig explosion.
April 23-30	1st Week [+2;+7]	Several reports from the Coast Guard were issued reporting that approximately 5000 barrels of oil were leaking to the Gulf of Mexico. Moreover, the Obama administration made the first public statement addressing the oil spill. This window constitutes a set of negative news in the aftermath of the rig explosion.
May 27	1st Moratorium [-1;+1]	US Department of Interior issued a six-month moratorium on all offshore drilling below 500ft of water along the Gulf of Mexico.
May 29	Top Kill [-1;+1]	BP officially announces the failure of the Top Kill procedure. This was an approach to stop the oil leakage, which consisted of pumping heavy liquids into the well shaft.
July 12	2nd Moratorium [-1;+1]	Secretary of Interior Ken Salazar issued a new moratorium, which was focused on promoting adequate safety measure of drilling activities.
August 4	Static Kill [-1;+1]	BP announces the first successful approach to contain oil leakage, the Static Kill procedure.
September 19	Well Kill [-1;+1]	Official announcement that the Macondo well was sealed. This event marks the end of the oil spill.

This table reports the key event dates of the oil spill, and a brief description of each event.

For the first event window (*1st Week*), day 0 is the initial day because no news of leakage of information about the malfunction of the Deepwater Horizon rig was found previous to the rig explosion. The second event window (*1st Week*) incorporates a more extensive timeframe to account for the initial news about oil leakage and the first statements by the Obama administration. For the remaining event periods, the initial event day is t = –1 to include any possible leakages of information to investors, and the final event day is t = 1 to assess the short-term impact of that specific event.

Even though reporting cross-sectional cumulative abnormal returns might be informative, it is crucial to understand the statistical significance of these figures. In order to do so, hypothesis tests are designed to understand whether the cumulative abnormal returns for a given event window are significantly different from zero (de Jong, 2007). Hence, the defined hypotheses are:

$$H_0 : CAR_i = 0 \tag{4}$$

$$H_a : CAR_i \neq 0 \tag{5}$$

In case of no significant impact from the event, the expectation is that the cumulative abnormal returns would be equal to 0. The rejection of H_0 means that the cumulative abnormal returns for a specific group are significantly different from 0, meaning it was significantly impacted by the Deepwater Horizon Oil Spill. Instead of testing the significance for every firm in the cross-section, this test could be done as a one period abnormal return (de Jong, 2007), by aggregating the cross-section:

$$CAAR = \frac{1}{N}\sum_{i=1}^{N} CAR_i \tag{6}$$

where CAAR is the cumulative average abnormal return and N is the number of firms. The N changes according to the group that is being studied.

By applying the Central Limit Theorem, assuming that cumulative abnormal returns are independent and mutually uncorrelated and that σ is unknown, the t-stat converges to a standard normal random variable for a large enough sample size, which usually means a N greater than 30 (Kwak and Kim, 2017):

$$t - stat = \sqrt{N}\frac{CAAR}{s} \approx N(0,1) \tag{7}$$

$$s = \sqrt{\frac{1}{N-1}\sum_{i=1}^{N}(CAR_i - CAAR)^2} \quad (8)$$

where s is the standard deviation.

For the studied subgroups which sample size is lower than 30 (will be discussed in the following section), the t-stat is assumed to follow a Student-t distribution with N – 1 degrees of freedom.

Two robustness tests were also conducted to assess the strength of the obtained results. The first is changing the estimation method of the abnormal returns to a four factor model, the Carhart model (4FF). The Carhart model is considered to be more sophisticated than the market model and than the three factor model, providing clear improvements in the quality of prediction of stock returns (Bello, 2008). While the market model uses the market portfolio to estimate the relevant parameters, the 4FF model (3FF + MOM) considers a more comprehensive analysis of stock returns based on several sources of risk. The Carhart model utilizes proxies for systematic risk (R_m), size (SMB), value (HML) and momentum (MOM) in order to estimate the relevant parameters:

$$R_{i,t} = \alpha_i + \beta_{1i} * R_{m,t} + \beta_{2i} * SMB_t + \beta_{3i} * HML_t + \beta_{4i} * MOM_t + \varepsilon_{i,t} \quad (9)$$

The estimated parameters (α, β_1, β_2, β_3 and β_4) are used to estimate cross-sectional returns during the event period:

$$AR_{i,t} = R_{i,t} - (\hat{\alpha}_i + \beta_{1i} * R_{m,t} + \beta_{2i} * SMB_t + \beta_{3i} * HML_t + \beta_{4i} * MOM_t) \quad (10)$$

The second robustness check involves changing the event windows within each event period. For the *1st Week*, the initial event window is now (-1,+1) to assess whether there was any significant information leakage to the market, while the second event window is now (+2,+5), excluding the Obama administration statements and focusing only on news about the oil leakage. The remaining event periods go from an event window of (-1,+1) to (-1,+5), to check whether the short-term sentiment persisted through an extended time period.

3.3.2. Exposure Effect

After investigating the effect of the Deepwater Horizon spill on firm value, this study aims at understanding what drove those variations on firm value, more specifically in the US Oil and

Gas industry. In order to investigate these determinants, the hypothesis which was formulated is that firms with higher exposure to the Gulf of Mexico, where the spill occurred, have significantly negative cumulative abnormal returns.

By using an Ordinary Least Squares (OLS) linear regression, this study aims to answer this question by studying the relationship of cross-sectional cumulative abnormal returns with the corresponding exposure. The main dependent variable is each firm's cumulative abnormal return for a given event window (t_3,t_4), whereas the key independent variable will be a dummy variable for exposure to the Gulf of Mexico:

$$CAR_i = \alpha + \beta_1 * Exposure_i + \varepsilon_i \quad (11)$$

In a second regression specification, some control variables will be added:

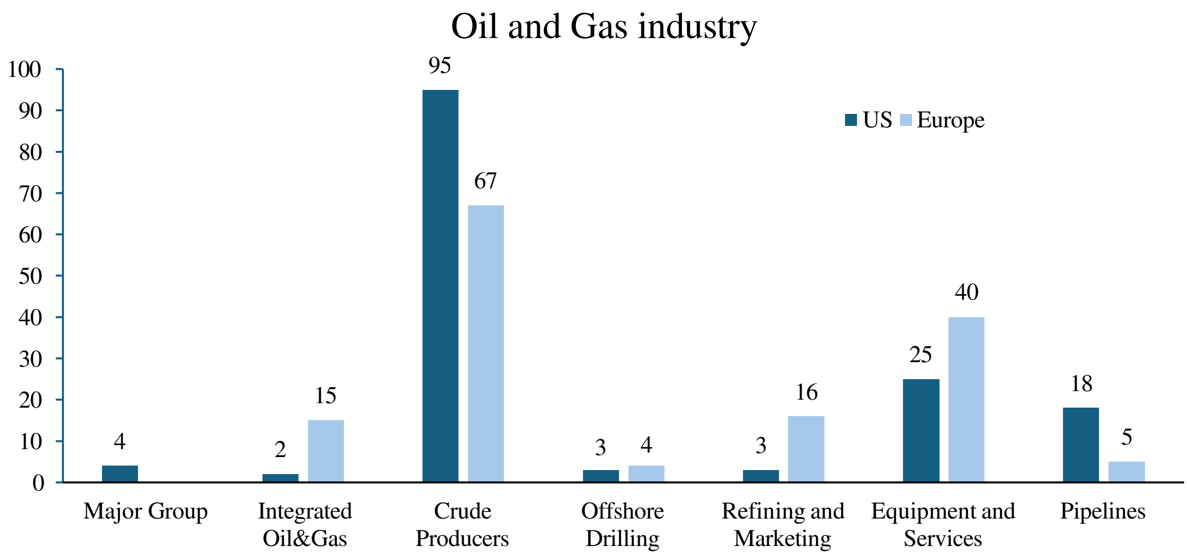
$$CAR_i = \alpha + \beta_1 * Exposure_i + \beta_2 * Size_i + \beta_3 * Prof_i + \beta_4 * Lev_i + \beta_5 * {M/B}_i + \varepsilon_i \quad (12)$$

where $Size_i$ is the Total Assets in dollars of firm i, $Prof_i$ is the ROA of firm i, Lev_i is the Total Debt to Total Assets ratio of firm i and M/B_i is the Market-to-Book ratio of firm i.

3.4. Descriptive Statistics

This section provides a summary of the descriptive statistics of the sample and control variables used in the regression.

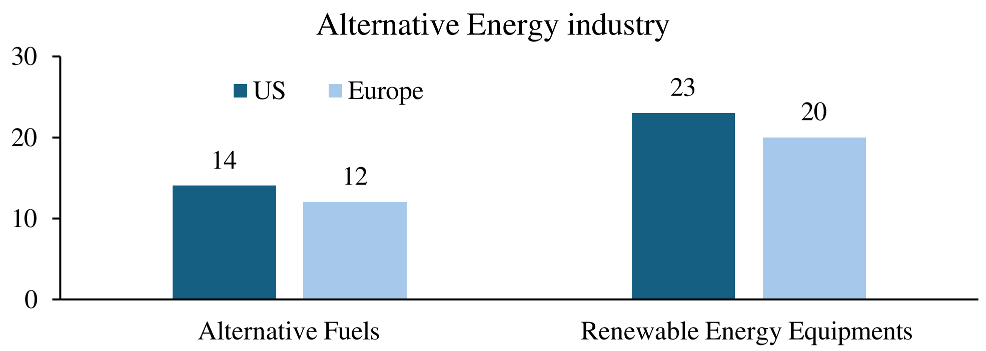
Figure 2
Sample Distribution of Oil and Gas industry



This figure reports the sample distribution of the Oil and Gas industry, broken down by geography (US and Europe) and the different sub-industry classifications.

Figure 2 illustrates the sample distribution of the Oil and Gas industry, for both geographies (US and Europe) and sub-industry classifications. According to the FTSE Russell ICB, the majority of sub-industry classifications don't have a significant enough sample size (n < 30) in the studied period, apart from Crude Producers and European Equipment and Services. This will influence the way main results will be reported, as will be explained in section 4.1. Major Group is constituted by the 4 main rig operators: BP, Transocean, Anadarko and Halliburton, as defined in table 1.

Figure 3
Sample Distribution of Alternative Energy industry



This figure reports the sample distribution of the Alternative Energy industry, broken down by geography (US and Europe) and the different sub-industry classifications.

Figure 3 provides an overview of the sample distribution of the Alternative Energy industry for both geographies (US and Europe) and for different sub-industry classifications. The majority of firms are considered to operate within the Renewable Energy Equipments field. Nonetheless, it is important to note the lack of significant sample size for each of the sub-industry classifications, which might distort some of the obtained results.

Table 4
Descriptive Statistics of US Oil and Gas industry

Variable	Size (Thousands of $)	Profitability (%)	Leverage (%)	M/B (%)
Mean	8 469 165,11	-8,62	25,27	3,20
Median	900 171,50	2,80	24,57	1,76
St Dev	32 441 619,50	56,46	20,55	8,01
Minimum	377,00	-554,45	0,00	-9,19
Maximum	298 983 000,00	93,18	87,28	70,86

This table reports the descriptive statistics for some of the explanatory variables used in the regression analysis for the US Oil and Gas industry, which comprises 150 companies.

Table 4 represents an overview of the summary statistics for the control variables of US Oil and Gas sample. Given that the other groups (Alternative Energy industries and Europe Oil and

Gas) are not significantly exposed to the Gulf of Mexico, they will not be studied in section 4.3 (Regression Results). Thus, financial data for these groups was not retrieved.

Despite US Oil and Gas firms being quite big on average, with a mean size of $8.47 billion, they don't have many leverage, with the average firm having 25.27% Debt/Assets ratio. It is also interesting to understand how big the variation is in firm profitability, with some extreme outliers like -554.45% (minimum) and 93.18% (maximum) and a considerable standard deviation in comparison to its mean. To handle this issue, Table A1 (in the Appendix) illustrates the summary statistics for the winsorized data at the 95% level.

4. Main Results

4.1. Event Study Results

4.1.1. Oil and Gas Industry

This section reports the results of the event study for the Oil and Gas industry, in order to assess whether the oil spill generated abnormal returns. Through the statistical analysis of cumulative abnormal returns over the cross-section, it is expected that the Oil and Gas industry presents negative significant abnormal returns, especially when negative news are announced.

Table 5 represents the main output for the most relevant event periods and sub-industry classifications throughout the duration of the oil spill. Despite the initial explosion of the oil rig in the evening of April 20^{th}, the US Oil and Gas market did not seem to react immediately to the disaster, with no significant CAAR during the (0,+1) window in the *1^{st} Week*, even for the Major Group (BP, Transocean, Anadarko and Halliburton). On the other hand, the European market seems to be quicker in efficiently incorporating the negative information, with not only BP (at 10%) but also the Crude Producers sub-industry classification and the whole Oil and Gas industry (at 1%) presenting significant negative CAAR. When additional news about the oil leakage went public on the evening of April 22^{nd}, the US market seems to suffer a lot more than in the initial days. In the (+2,+7) window, the Major Group and the US Oil and Gas industry presented negative CAAR at a significance level of 1%, whereas the Crude Producers presented negative CAAR at the significance level of 5%. In contrast, Europe did not react nearly as bad, with no significant CAAR for the Oil and Gas industry and for Crude Producers. As expected, BP presents a significant -8.81% CAAR over this event window, as they were considered the main responsible for the explosion and consequent oil leakage to the Gulf of Mexico.

When the 1^{st} *Moratorium* was announced by the Department of Interior, the US market did have contrary reactions. While investors seemed to think of the Major Group as the main responsible for this new tight regulation and ended up penalizing them, leading to a significant negative CAAR at the 10% level, both the Crude Producers and Total Group performed positively in this event window, with significant positive CAAR at the 1% level. On the other hand, Europe was not significantly impacted by this event. This was quite expected given that this regulation was imposed in the United States, more specifically for drilling activities conducted in the Gulf of Mexico.

Table 5
CAAR of Oil and Gas industry for different event periods

CAAR Windows		1st Week		1st Moratorium	Top Kill	Static Kill
		21/04/2010		27/05/2010	29/05/2010	04/08/2010
		(0,+1)	(+2,+7)	(-1,+1)	(-1,+1)	(-1,+1)
US	Major Group	-0,0102	-0,1305***	-0,0179*	-0,2279***	0,0496**
	(N = 4)	*(0,1349)*	*(0,0000)*	*(0,0671)*	*(0,0000)*	*(0,0474)*
	Crude Producers	0,0046	-0,0282**	0,0281***	-0,0613***	0,0058
	(N = 95)	*(0,5465)*	*(0,0374)*	*(0,0094)*	*(0,0000)*	*(0,6271)*
	Total Group	0,0077	-0,0247***	0,0269***	-0,0744***	-0,0029
	(N=150)	*(0,1330)*	*(0,0067)*	*(0,0002)*	*(0,0000)*	*(0,7175)*
Europe	BP	-0,0170*	-0,0881***	-0,0149	-0,1809*	0,0191*
	(N = 1)	*(0,0896)*	*(0,0000)*	*(0,7399)*	*(0,0703)*	*(0,0957)*
	Crude Producers	-0,0212***	0,0126	0,0046	-0,0199**	-0,0034
	(N = 67)	*(0,0004)*	*(0,6370)*	*(0,7828)*	*(0,0386)*	*(0,7326)*
	Total Group	-0,0100***	0,0038	0,0089	-0,0204***	0,0130
	(N = 147)	*(0,0033)*	*(0,7660)*	*(0,2720)*	*(0,0001)*	*(0,1968)*

This table reports the cumulative average abnormal return (CAAR) of the US and European Oil and Gas firms for relevant event windows and sub-industry classifications. Some of the sub-industry classifications are not reported here due to a lack of significant sample size, which might distort the obtained results. "Major Group" and "BP" are exceptions due to their relevance in the spill. The dates below each event refer to the day 0 of that specific event, as explained in section 3.1. The p-values are reported in parentheses. The superscripts *, ** and *** correspond to statistical significance at the 10%, 5% and 1% level.

A couple of days later, when BP announced the failure of *Top Kill*, the whole market reacted negatively. Significant negative CAAR were observed throughout the whole US and European sample. The Major Group and more specifically BP were the most affected ones again, with CAAR of -22.79% and -18.09% over the *Top Kill* event window, respectively. The whole US and European Oil and Gas industry also took very significant hits, with CAAR of -7.44% and -2.04%, respectively. This is a clear sign on how investors did not differentiate between any of the parties involved in the rig operations and other firms in the industry, i.e., the existence of contagion effects.

A couple of months later, when BP finally announced the success of the *Static Kill* procedure, only BP and the Major Group seem to have been significantly impacted by the event. Over this event window, BP presented a significant CAAR of 1.91% at a 10% significance, whereas the Major Group reported a significant CAAR of 4.96% at a 5% significance.

There are a couple of interesting takeaways from these last two events. While in *Top Kill* (very negative news) investors penalized severely not only the main responsibles for the Deepwater Horizon rig but also the whole industry, in *Static Kill* (very positive news) this did not happen, with the only affected parties being BP and its rig partners. It is interesting to understand how bad news affected the whole industry on a far greater magnitude than positive news did, with the existence of intra-industry and cross-border contagion effects in the presence of bad news rather than good news. All in all, there seems to be enough evidence of significant negative market reaction of not only BP and its rig operating partners (H_1), confirming Fodor and Stowe (2012) and Hill and Schneeweis (1983), but also of other firms in the Oil and Gas Industry (H_2), corroborating Hunsader et al. (2012) and Lee and Garza-Gomez (2012).

Table A2, reported in the Appendix, reports the CAAR of the remaining sub-industry classifications for the most relevant event windows. Given that the sample size of most groups is not greater than 30, the Central Limit Theorem can't be applied. This might lead to some distortions of the obtained results, as some sub-industry classifications might be heavily influenced by outliers.

The ambiguity of these results is clearly seen in every event window. In the *1st Week* after the oil spill, no clear pattern can be observed, with a mix of significant and insignificant CAAR over different sub-industry classifications for both US and Europe, and with contrary signs. For the *1st Moratorium*, these results seem to confirm that investor did not penalize the remaining US Oil and Gas sub-industry classifications for more restrictive regulation, with positive CAAR for every classification, and even some significant values. For Europe, the lack of significance continued to be a pattern except for "Integrated Oil and Gas", showing how this regulation did not affect the European market. Regarding the *Top Kill* window, significant negative abnormal CAAR are observed throughout both US and European samples, with the exception for the European Pipelines. This is another strong confirmation of the intra-industry and cross-border contagion effects for the presence of negative news, as discussed above. When it comes to the *Static Kill* window analysis, the ambiguity of results is once again observed, with no clear pattern regarding the sign or significance of CAAR.

Table A3, reported in the Appendix, reports the output of the US and European Oil and Gas industry for the remaining event periods. The *2nd Moratorium* imposed by Secretary of Interior Ken Salazar was considered a reformulation of the *1st Moratorium*. Hence, the market did not view it as such a big change in comparison to the first one. Regarding the *Well Kill* event window, investors were already expecting this news sooner or later after the announcement of the success of the *Static Kill* procedure. Given that both of these news were not considered as big surprises to the market, they are not considered to be as relevant as the ones presented in Tables 5 and A2.

As it can be observed in Table A3, neither of the events represent a clear pattern for both the US and European Oil and Gas firms. Ambiguity of sign and significance characterizes the results from the *2nd Moratorium* window. Regarding the *Well Kill* period, we can observe fairly consistent negative CAAR, despite the lack of significance over the majority of subgroup classifications. It is particularly interesting to observe how the European Oil and Gas market reacted negatively to the positive news of the Macondo well finally being sealed, reflecting how positive news in one specific geography can lead to worse returns for other geography.

4.1.2. Alternative Energy Industry

This section reports the results of the event study for the Alternative Energy industry. Positive abnormal returns are expected for the Alternative Energy industry, as the spill generated some debate in the market whether these energy sources should be more used instead of fossil fuels.

Table 6 reports the CAAR of the US and European Alternative Energy industry and sub-industry classifications for relevant event periods. As it can be observed, the Alternative Energy industry had insignificant results throughout all the event windows. For the exception of the US Alternative Energy industry in the *Top Kill* window which reported a significant 4.97% CAAR, the Alternative Energy industry was not affected by the Deepwater Horizon spill. Hence, there seems to be enough evidence to not accept the hypothesis of existence of significant cross-industry effects (H_3). This insignificance of results might be due to some factors. The small sample size may dilute measurable effects on stock prices. On the other hand, the oil spill's market reaction might have been more focused on penalizing the oil sector rather than being seen as an immediate reason for investment shifts toward alternative energy. This might have occurred in the long rather than in the short-term.

Table 6
CAAR of Alternative Energy industry for different event periods

CAAR Windows		1st Week 21/04/2010 (0,+1)	1st Week 21/04/2010 (+2,+7)	1st Moratorium 27/05/2010 (-1,+1)	Top Kill 29/05/2010 (-1,+1)	Static Kill 04/08/2010 (-1,+1)
US	Alternative Fuels	0,0543	0,0264	0,0057	0,0364	-0,0100
	(N = 14)	*(0,2736)*	*(0,7248)*	*(0,9137)*	*(0,1339)*	*(0,8181)*
	Renewable Energy	-0,0048	0,0209	0,0278	0,0578	0,0270
	(N = 23)	*(0,8513)*	*(0,5011)*	*(0,1597)*	*(0,1716)*	*(0,8141)*
	Total Group	0,0176	0,0230	0,0195	0,0497*	0,0130
	(N = 37)	*(0,4754)*	*(0,4954)*	*(0,3986)*	*(0,0719)*	*(0,8580)*
Europe	Alternative Fuels	0,0385	-0,0352	0,0215	-0,0147**	-0,0122
	(N = 12)	*(0,3626)*	*(0,2833)*	*(0,4069)*	*(0,0177)*	*(0,1522)*
	Renewable Energy	-0,0065	0,0153	0,0089	0,0039	0,0034
	(N = 20)	*(0,4693)*	*(0,2088)*	*(0,3991)*	*(0,7315)*	*(0,6984)*
	Total Group	0,0104	-0,0036	0,0136	-0,0031	-0,0025
	(N = 32)	*(0,5382)*	*(0,8063)*	*(0,2378)*	*(0,6805)*	*(0,6979)*

This table reports the cumulative average abnormal return (CAAR) of the Alternative Energy firms for relevant event windows and sub-industry classifications. The dates below each event refer to the day 0 of that specific event, as explained in section 3.1. The p-values are reported in parentheses. The superscripts *, ** and *** correspond to statistical significance at the 10%, 5% and 1% level.

Table A4 (in the Appendix) reports the CAAR of US and European Alternative Energy industry for the remaining event windows. Generally, the Alternative Energy presents inconsistent and ambiguous results regarding the sign and significance of CAAR in both event windows. Just as in table 6, the Alternative Energy industry does not seem to be significantly impacted by these event windows in terms of stock performance.

4.2. Robustness Tests

As explained in section 3.3.1. (Event Study), two main robustness tests were conducted. The first is using a different method to estimate abnormal returns. The chosen method was the Carhart 4FF (3FF + Momentum). The second test is using different event windows for each event. All in all, both tests yield very similar results in comparison to the ones obtained previously, which reinforces the conclusions from the previous section.

4.2.1. Main Responsibles for Macondo Well

Table A5 (in the Appendix) presents the CAAR for US and European Oil and Gas firms, with the Carhart 4FF model, while Table A7 (in the Appendix) presents the CAAR for US and European Oil and Gas firms, for different event windows. Despite some small inconsistencies, i.e., some values losing significance while others gaining, both robustness tests still convey the idea that BP and its main operating partners (Major Group) experienced significant negative abnormal returns, especially in the context of bad news (*Top Kill*), confirming once again H_1.

4.2.2. Spillover Effects

Looking once again at Tables A5 and A7, there is further evidence of significant negative intra-industry effects, confirming H_2. For both US and Europe, negative abnormal returns were experienced mainly in the 1st Week after the announcement and in the presence of very negative news (*Top Kill* and *2nd Moratorium*).

When looking at the cross-industry reactions, Table A6 (in the Appendix) reports the CAAR for US and European Alternative Energy firms, with the Carhart 4FF model, while Table A8 (in the Appendix) presents the CAAR for US and European Alternative Energy firms, for different event windows. The insignificance of results for the Alternative Energy industry persists throughout both robustness tests, providing enough evidence to reject H_3 once again.

4.3. Regression Results

In order to understand how the exposure to the Gulf of Mexico influenced firms involved in the event, some Ordinary Least Squares (OLS) multivariate regressions will be employed for the most relevant windows, as described in section 3.3.2. It is expected that firms which are exposed to the Gulf of Mexico would have significantly lower cumulative abnormal returns over the event windows, due to increased regulations, negative investor sentiment and restricted activities in this area.

Table 7 presents the main findings for the US Oil and Gas industry. Due to lack of variation in exposure data in the Alternative Energy industry and the European Oil and Gas industry, this section will only focus on the US Oil and Gas industry. From the 150 US Oil and Gas firms, 79 (52.67%) were exposed to the Gulf of Mexico, while 71 (47.33%) constitute the non-exposed group. The first specification of each event window represents the raw effect of exposure on the cross-sectional CAR, as specified in equation (10), whereas the second specification includes control variables, as specified in equation (11).

Table 7

Regression results

	1st Week CAR (0, +1)		1st Week CAR (+2, +7)		1st Moratorium CAR (-1, +1)		Top Kill (-1, +1)		Static Kill (-1, +1)	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Constant	0,0033	0,0203*	-0,0260**	-0,0239	0,0014	0,0013	-0,0550***	-0,0504***	0,0005	0,0085
	(0,6660)	*(0,0584)*	*(0,0496)*	*(0,2005)*	*(0,6729)*	*(0,7804)*	*(0,0000)*	*(0,0003)*	*(0,9682)*	*(0,6000)*
Exposure	0,0067	0,0053	0,0031	0,0110	-0,0093**	-0,0083*	-0,0368***	-0,0291**	-0,0063	-0,0085
	(0,5256)	*(0,6348)*	*(0,8680)*	*(0,5708)*	*(0,0371)*	*(0,0802)*	*(0,0075)*	*(0,0435)*	*(0,6919)*	*(0,6149)*
Size (Total Assets)		0,0000		0,0000		0,0000		0,0000		0,0000
		(0,9498)		*(0,9776)*		*(0,5475)*		*(0,7753)*		*(0,8133)*
Profitability (ROA)		0,0001		-0,0001		0,0000		-0,0002		0,0001
		(0,5919)		*(0,4095)*		*(0,7704)*		*(0,1153)*		*(0,3346)*
Leverage		-0,0550**		-0,0499		-0,0015		-0,0426		-0,0336
		(0,0370)		*(0,2739)*		*(0,8925)*		*(0,2068)*		*(0,3964)*
M/B		-0,0006		0,0015		0,0001		0,0003		0,0007
		(0,3561)		*(0,2124)*		*(0,8228)*		*(0,7397)*		*(0,4744)*
Observations	150	150	150	150	150	150	150	150	150	150
R^2	0,0027	0,0393	0,0002	0,0270	0,0290	0,0326	0,0473	0,0752	0,0011	0,0177
Adjusted R^2	-0,0040	0,0059	-0,0066	-0,0067	0,0225	-0,0009	0,0408	0,0431	-0,0057	-0,0164

This table reports regression results (OLS) for US Oil and Gas companies. The dependent variable represents the cumulative abnormal returns of the firms for relevant event periods. Robust standard errors (HC3) are applied due to heteroscedasticity problems. The p-values are reported in parentheses. The superscripts *, ** and *** correspond to statistical significance at the 10%, 5% and 1% levels, respectively. The description of the variables can be found in Table 2.

Regarding the *1st Week*, for both the (0,+1) window which represents the rig explosion and the (+2,+7) window which illustrates the first news of oil leakage and the first statements of the Obama administration, exposed firms had on average a higher CAR than non-exposed firms, due to the positivity of the exposure coefficient. Nonetheless, due to its lack of significance, exposure was not a determining factor to explain *1st Week* stock performance of the US Oil and Gas industry.

When it comes to the *1st Moratorium*, exposure seems to be a relevant factor. In the first specification, exposed firms had on average lower cumulative abnormal returns than non-exposed firms by 0.93 percentage points (pp) at a 5% significance level. Even when control variables are included, significance still holds (now at 10%). Keeping everything else constant, exposed firms had on average lower cumulative abnormal returns by 0.83 pp.

The coefficient of exposure keeps being negative and significant when the *Top Kill* period is analysed. Now at the 1% level, exposed firms at on average lower cumulative abnormal returns than non-exposed firms by a considerable 3.68 pp. When controlling for Size, Profitability, Leverage and M/B, exposed firms still significantly underperform the non-exposed group, with CARs lower by 2.91 pp on average. This specification holds the most explanatory power over all the regressions, with an Adjusted R^2 of 4.31%.

Similarly to the *1st Week*, exposure doesn't seem to influence cross-sectional cumulative abnormal returns variation in the *Static Kill* event period. Despite the negativity of the exposure coefficient, they aren't significant. Curiously, exposure is a significant factor to explain stock performance in a setting of negative news (*Top Kill*), but it doesn't seem to have much explanatory power when it comes to good news (*Static Kill*).

When comparing to the formulated hypothesis (H_4), it is plausible to assume that exposure was a main driver of abnormal returns, especially in the setting of negative news like *1st Moratorium* and *Top Kill*, confirming Mansur et al. (1991).

5. Limitations & Further Research

This dissertation provides interesting findings to the existing research of the Deepwater Horizon oil spill. Nonetheless, it is important to recognize some flaws of this study and how they could have impacted the obtained results.

Regarding specific options of variables of this thesis, it is important to acknowledge the way some variables were constructed. Exposure could have been constructed in a more meticulous way, by dividing the number of rigs that a firm had in the Gulf of Mexico in comparison to their total number of rigs. This would yield a more accurate perspective of exposure, by distinguishing firms by their level of exposure. For other company specific variables, different proxies could have been used to estimate firm size like revenues or profitability like return on equity (ROE). Regarding the sample size issue, this was a consequence of how the firm selection process was conducted. The choice of another industry classification benchmark like the SIC code could have given a different sample and possibly solved some of the sample size issues in sub-industry classifications. The way variables were constructed could have also significantly impacted the obtained results.

On the other hand, this dissertation considers only publicly traded companies in 2010 in order to obtain relevant stock price data for the event study. By definition, private companies are not traded, hence they don't have relevant stock price data available. Besides this, due to a lack of information about these firms, the results obtained in this dissertation are not extensible to private firms in the Oil and Gas and Alternative Energy industries, especially when it comes to the assessment of further spillover effects to private companies in these industries.

As further research, new regions could be considered to assess not only the impact of the oil spill on the European market, but also to other prominent markets like Asia, South America, Africa or Australia. Another interesting future contribution lies in the medium to long term impacts of the oil spill. Did smaller Oil and Gas companies experience financial distress or possibly bankruptcy due to increased regulation and restrictive deepwater drilling policies? Did M&A transactions increase in the Oil and Gas industry, with bigger firms diversifying their activities to spread risk? These topics could be studied to add further knowledge about the oil spill and to better understand not only its short-term impact, but also the medium to long term effects.

6. Main Conclusions

This dissertation focused on studying the intra-industry and cross-industry financial impact of the Deepwater Horizon oil spill on US and Europe Energy sectors. The main goal was to understand whether there was a significant market reaction to the spill, and what were the main drivers of these reactions. More specifically, the main contributions of this thesis rely on clearly understanding whether there were any spillover effects and at what point in time, and to understand if exposure to the Gulf of Mexico was a main driver of stock performance.

Investors seemed to severely penalize the main responsibles for the Deepwater rig explosion. In the relevant event windows, BP and the Major Group reacted very negatively to bad news, like the first news of oil leakage to the Gulf of Mexico, *1st Moratorium* and *Top Kill*. On the other hand, good news (*Static Kill*) did in fact lead to significant positive CAAR, but on a far lower magnitude in comparison to bad news. Hence, there seems to be enough evidence to confirm that BP and its operating partners experienced a significant negative market reaction (H_1).

On the other hand, intra-industry spillover effects seem to exist, affecting not only the remaining US Oil and Gas firms but also the European Oil and Gas industry, confirming H_2. In the *1st Week*, the European market immediately absorbed the negative information of the rig explosion, while the US market experienced significant negative abnormal returns when the news of oil leakage started to come out. The *Top Kill* window is the most evident when it comes to intra-industry contagion, with an all-around significant negative CAAR for both the US and European Oil and Gas market. Only in the *1st Moratorium* period there seems to exist a competitive effect, where the market penalized only the Major Group, with the remaining US Oil and Gas industry experiencing significant positive CAAR. Conversely, there isn't enough evidence to confirm H_3, i.e., cross-industry effects do not seem to exist. By analysing the Alternative Energy industry, no pattern of significant abnormal returns was found.

Finally, there is enough evidence to confirm that exposure is a key driver of stock performance within this event, especially for the presence of bad news like the *1st Moratorium* and *Top Kill*. By conducting a regression analysis of the effect of exposure on cumulative abnormal returns, this thesis concludes that exposure to the Gulf of Mexico negatively impacts abnormal returns in these two event windows, which are representative of negative news.

Besides the analysis of the stated hypothesis, another interesting takeaway is how the market tends to overreact to bad news and underestimate the impact of positive news in the context of environmental disasters. Investors should keep in mind these findings when addressing future environmental disasters, specially of how contagion effects tend to be of greater magnitude in the setting of negative news.

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Appendix

Table A1

Descriptive Statistics (Winsorized)

Variable	Size (Thousands of $)	Profitability (%)	Leverage (%)	M/B (%)
Mean	3 949 701,43	-2,66	0,28	2,28
Median	900 171,50	2,80	0,29	1,76
Stdev	8 013 801,84	19,34	0,17	2,18
Minimum	1 039,00	-105,81	0,00	-0,80
Maximum	51 559 000,00	18,91	0,71	15,84

This table reports the winsorized descriptive statistics at the 95% level for some of the explanatory variables of the regressions.This resulted in the exclusion of 8 outliers.

Table A2

CAAR of Oil&Gas industry for remaining sub-industry classifications

CAAR Windows		1st Week		1st Moratorium	Top Kill	Static Kill
		21/04/2010		27/05/2010	29/05/2010	04/08/2010
		(0,+1)	(+2,+7)	(-1,+1)	(-1,+1)	(-1,+1)
US	Integrated Oil&Gas	-0,0081***	0,0087**	0,0099***	-0,0401***	0,0049***
	(N = 2)	*(0,0000)*	*(0,0321)*	*(0,0024)*	*(0,0000)*	*(0,0041)*
	Offshore Drilling	0,0029	0,0172	0,0339	-0,0861***	-0,0327
	(N = 3)	*(0,8224)*	*(0,3480)*	*(0,4083)*	*(0,0000)*	*(0,1795)*
	Refining and Marketing	-0,0187	-0,0027	0,0567***	-0,0274	-0,0200
	(N = 3)	*(0,1771)*	*(0,7408)*	*(0,0000)*	*(0,2699)*	*(0,2353)*
	Equipment and Services	0,0254***	-0,0123	0,0135	-0,1213***	-0,0377***
	(N = 25)	*(0,0004)*	*(0,3954)*	*(0,2625)*	*(0,0000)*	*(0,0001)*
	Pipelines	0,0105	-0,0147	0,0449***	-0,0540***	-0,0046
	(N = 18)	*(0,1913)*	*(0,1238)*	*(0,0000)*	*(0,0000)*	*(0,5420)*
Europe	Integrated Oil&Gas	-0,0051	0,0103	0,0234**	-0,0185	0,0102**
	(N = 15)	*(0,4151)*	*(0,3878)*	*(0,0213)*	*(0,1350)*	*(0,0459)*
	Offshore Drilling	-0,0126**	-0,0618	0,0279	-0,0407**	-0,0007
	(N = 4)	*(0,0204)*	*(0,1451)*	*(0,1004)*	*(0,0487)*	*(0,9763)*
	Refining and Marketing	-0,0134**	0,0048	0,0030	-0,0081	0,0069
	(N = 16)	*(0,0495)*	*(0,7462)*	*(0,7669)*	*(0,4162)*	*(0,3810)*
	Equipment and Services	0,0109**	-0,0046	0,0086	-0,0289***	0,0461
	(N = 40)	*(0,0250)*	*(0,6830)*	*(0,3036)*	*(0,0006)*	*(0,1561)*
	Pipelines	-0,0280	-0,0168*	0,0305	0,0104*	0,0084
	(N = 5)	*(0,1142)*	*(0,0783)*	*(0,3655)*	*(0,0627)*	*(0,3664)*

This table reports the cumulative average abnormal return (CAAR) of the US and European Oil and Gas firms for relevant event windows and remaining sub-industry classifications. The dates below each event refer to the day 0 of that specific event, as explained in section 3.1. The p-values are reported in parentheses. The superscripts *, ** and *** correspond to statistical significance at the 10%, 5% and 1% level.

Table A3

CAAR of Oil&Gas industry for remaining event periods

CAAR Windows	2nd Moratorium 12/07/2010 (-1,+1)		Well Kill 19/09/2010 (-1,+1)	
	US	**Europe**	**US**	**Europe**
Major Group	0,0221		0,0046	
	(0,4130)		*(0,4679)*	
BP		0,0887		0,0123
		(0,2030)		*(0,3990)*
Integrated Oil&Gas	0,0199	0,0020	0,0049***	-0,0061
	(0,1332)	*(0,8074)*	*(0,0041)*	*(0,2618)*
Crude Producers	-0,0144	-0,0263**	-0,0154	-0,0197
	(0,1669)	*(0,0244)*	*(0,2442)*	*(0,1055)*
Offshore Drilling	-0,0361**	0,0325	-0,0094	0,0120
	(0,0456)	*(0,4169)*	*(0,6819)*	*(0,5822)*
Refining and Marketing	-0,0162	-0,0060	-0,0348	-0,0170*
	(0,1582)	*(0,6923)*	*(0,1645)*	*(0,0790)*
Equipment and Services	0,0143**	0,0008	0,0119	-0,0007
	(0,0382)	*(0,9553)*	*(0,1886)*	*(0,8712)*
Pipelines	0,0149***	-0,0091	-0,0034	-0,0048
	(0,0000)	*(0,2166)*	*(0,4890)*	*(0,7150)*
Total Group	-0,0051	-0,0116*	-0,0089	-0,0115**
	(0,4527)	*(0,0957)*	*(0,3004)*	*(0,0497)*

This table reports the cumulative average abnormal return (CAAR) of the US and European Oil and Gas firms for the remaining studied event windows. The dates below each event refer to the day 0 of that specific event, as explained in section 3.1. The p-values are reported in parentheses. The superscripts *, ** and *** correspond to statistical significance at the 10%, 5% and 1% level.

Table A4

CAAR of Alternative Energy industry for remaining event periods

CAAR Windows	2nd Moratorium 12/07/2010 (-1,+1)		Well Kill 19/09/2010 (-1,+1)	
	US	**Europe**	**US**	**Europe**
Alternative Fuels	-0,0493*	0,0173	0,0779	0,0049
	(0,0585)	*(0,5014)*	*(0,2854)*	*(0,8719)*
Renewable Energy	0,0296	0,0065	0,0217	-0,0169**
	(0,2392)	*(0,6980)*	*(0,3998)*	*(0,0161)*
Total Group	-0,0003	0,0106	0,0430	-0,0087
	(0,9888)	*(0,4515)*	*(0,1741)*	*(0,4656)*

This table reports the cumulative average abnormal return (CAAR) of the Alternative Energy firms for the remaining windows and sub-industry classifications. The dates below each event refer to the day 0 of that specific event, as explained in section 3.1. The p-values are reported in parentheses. The superscripts *, ** and *** correspond to statistical significance at the 10%, 5% and 1% level.

Table A5
CAAR of Oil&Gas industry (Robustness: 4FF)

CAAR Windows		1st Week		1st Moratorium	Top Kill	2nd Moratorium	Static Kill	Well Kill
		21/04/2010		27/05/2010	29/05/2010	12/07/2010	04/08/2010	19/09/2010
		(0,+1)	(+2,+7)	(-1,+1)	(-1,+1)	(-1,+1)	(-1,+1)	(-1,+1)
US	Major Group	-0,0135**	-0,1305***	-0,0152	-0,1758***	-0,0015	0,0478**	-0,0084
		(0,0243)	*(0,0000)*	*(0,1218)*	*(0,0000)*	*(0,9578)*	*(0,0306)*	*(0,1551)*
	Integrated Oil&Gas	-0,0087***	0,0084**	0,0102***	-0,0081	0,0044	0,0045**	-0,0031
		(0,0000)	*(0,0197)*	*(0,0000)*	*(0,2121)*	*(0,6945)*	*(0,0306)*	*(0,2579)*
	Crude Producers	-0,0014	-0,0210	0,0323***	-0,0126	-0,0331***	0,0039	-0,0272**
		(0,8629)	*(0,1892)*	*(0,0027)*	*(0,1323)*	*(0,0031)*	*(0,7465)*	*(0,0373)*
	Offshore Drilling	-0,0043	0,0189	0,0399	-0,0215*	-0,0658***	-0,0387	-0,0251
		(0,6717)	*(0,4106)*	*(0,4116)*	*(0,0502)*	*(0,0005)*	*(0,1530)*	*(0,2325)*
	Refining and Marketing	-0,0116	-0,0109*	0,0466***	-0,0091	-0,0250***	-0,0130	-0,0419*
		(0,3338)	*(0,0545)*	*(0,0014)*	*(0,4356)*	*(0,0001)*	*(0,4416)*	*(0,0639)*
	Equipment and Services	0,0215***	-0,0133	0,0159	-0,0519***	-0,0177**	-0,0402***	-0,0058
		(0,0021)	*(0,3640)*	*(0,1920)*	*(0,0002)*	*(0,0163)*	*(0,0001)*	*(0,5167)*
	Pipelines	0,0059	-0,0153*	0,0401***	-0,0173***	-0,0050	-0,0012	-0,0150***
		(0,3711)	*(0,0927)*	*(0,0000)*	*(0,0014)*	*(0,4040)*	*(0,8784)*	*(0,0073)*
	US Oil&Gas Group	0,0025	-0,0207*	0,0295***	-0,0241***	-0,0264***	-0,0041	-0,0213**
		(0,6566)	*(0,0501)*	*(0,0000)*	*(0,0001)*	*(0,0003)*	*(0,6080)*	*(0,0117)*
Europe	BP	-0,0128	-0,0874***	-0,0104	-0,1824***	0,0815***	0,0210	0,0147
		(0,6513)	*(0,0020)*	*(0,7121)*	*(0,0000)*	*(0,0039)*	*(0,4578)*	*(0,6037)*
	Integrated Oil&Gas	-0,0053	0,0113	0,0250**	-0,0166	-0,0045	0,0098*	-0,0053
		(0,3903)	*(0,3465)*	*(0,0159)*	*(0,1829)*	*(0,5364)*	*(0,0596)*	*(0,3474)*
	Crude Producers	-0,0250***	0,0139	0,0044	-0,0149	-0,0151	-0,0056	-0,0200*
		(0,0000)	*(0,6027)*	*(0,7959)*	*(0,1354)*	*(0,2012)*	*(0,5757)*	*(0,0960)*
	Offshore Drilling	-0,0062**	-0,0451	0,0708*	-0,0179	0,0578*	0,0018	0,0301
		(0,0483)	*(0,2921)*	*(0,0640)*	*(0,6171)*	*(0,0744)*	*(0,9364)*	*(0,3849)*
	Refining and Marketing	-0,0118*	0,0117	-0,0023	-0,0032	0,0022	0,0048	-0,0183*
		(0,0714)	*(0,3421)*	*(0,8337)*	*(0,7268)*	*(0,8763)*	*(0,5436)*	*(0,0759)*
	Equipment and Services	0,0101**	-0,0015	0,0118	-0,0183**	0,0040	0,0408	-0,0026
		(0,0304)	*(0,8941)*	*(0,1482)*	*(0,0121)*	*(0,7557)*	*(0,2057)*	*(0,5579)*
	Pipelines	-0,0302*	-0,0177*	0,0293	0,0101*	-0,0059	0,0076	-0,0061
		(0,0842)	*(0,0825)*	*(0,3706)*	*(0,0654)*	*(0,2490)*	*(0,3906)*	*(0,6449)*
	Europe Oil&Gas Group	-0,0117***	0,0065	0,0104	-0,0140***	-0,0037	0,0103	-0,0117**
		(0,0006)	*(0,6076)*	*(0,2147)*	*(0,0083)*	*(0,5801)*	*(0,3048)*	*(0,0447)*

This table reports the cumulative average abnormal return (CAAR) of the US and European Oil and Gas firms for relevant event windows and sub-industry classifications, when using a different estimation method: the Carhart 4FF model. The dates below each event refer to the day 0 of that specific event, as explained in section 3.1. The p-values are reported in parentheses. The superscripts *, ** and *** correspond to statistical significance at the 10%, 5% and 1% level.

Table A6

CAAR of Alternative Energy industry (Robustness: 4FF)

	CAAR Windows	1st Week 21/04/2010 (0,+1)	1st Week 21/04/2010 (+2,+7)	1st Moratorium 27/05/2010 (-1,+1)	Top Kill 29/05/2010 (-1,+1)	2nd Moratorium 12/07/2010 (-1,+1)	Static Kill 04/08/2010 (-1,+1)	Well Kill 19/09/2010 (-1,+1)
US	Alternative Fuels	0,0419	-0,0223	-0,0186	0,0364	-0,0723**	-0,0364	0,0633
		(0,4155)	*(0,7784)*	*(0,7157)*	*(0,1339)*	*(0,0196)*	*(0,3918)*	*(0,3983)*
	Renewable Energy Equipment	-0,0192	-0,0049	0,0233	0,0578	0,0232	0,0128	0,0126
		(0,4255)	*(0,8671)*	*(0,2374)*	*(0,1716)*	*(0,3749)*	*(0,9105)*	*(0,6342)*
	US Alternative Energy Group	0,0039	-0,0115	0,0075	0,0234	-0,0130	-0,0058	0,0317
		(0,8743)	*(0,7388)*	*(0,7428)*	*(0,3603)*	*(0,5410)*	*(0,9359)*	*(0,3268)*
Europe	Alternative Fuels	0,0365	-0,0322	0,0267	-0,0084	0,0285	-0,0139	0,0068
		(0,3998)	*(0,3152)*	*(0,2595)*	*(0,1864)*	*(0,2903)*	*(0,1063)*	*(0,8269)*
	Renewable Energy Equipment	-0,0095	0,0189	0,0146	0,0118	0,0210	0,0010	-0,0148**
		(0,3050)	*(0,1212)*	*(0,1533)*	*(0,3021)*	*(0,2084)*	*(0,9053)*	*(0,0286)*
	Europe Alternative Energy Group	0,0078	-0,0003	0,0191*	0,0042	0,0238*	-0,0046	-0,0067
		(0,6529)	*(0,9859)*	*(0,0754)*	*(0,5800)*	*(0,0954)*	*(0,4777)*	*(0,5872)*

This table reports the cumulative average abnormal return (CAAR) of the US and European Alternative Energy firms for relevant event windows and sub-industry classifications, when using a different estimation method: the Carhart 4FF model. The dates below each event refer to the day 0 of that specific event, as explained in section 3.1. The p-values are reported in parentheses. The superscripts *, ** and *** correspond to statistical significance at the 10%, 5% and 1% level.

Table A7
CAAR of Oil&Gas industry (Robustness: Different Event Windows)

	CAAR Windows	1st Week		1st Moratorium	Top Kill	2nd Moratorium	Static Kill	Well Kill
		21/04/2010		27/05/2010	29/05/2010	12/07/2010	04/08/2010	19/09/2010
		(-1,+1)	(+2,+5)	(-1,+5)	(-1,+5)	(-1,+5)	(-1,+5)	(-1,+5)
US	Major Group	0,0096	-0,0329***	-0,0958***	-0,1883***	-0,0058	-0,0183	0,0317***
		(0,5529)	*(0,0061)*	*(0,0000)*	*(0,0000)*	*(0,8447)*	*(0,4561)*	*(0,0002)*
	Integrated Oil&Gas	-0,0051***	0,0038	0,0288***	-0,0362***	0,0138	-0,0112	0,0138*
		(0,0033)	*(0,7320)*	*(0,0000)*	*(0,0000)*	*(0,2547)*	*(0,1134)*	*(0,0815)*
	Crude Producers	0,0028	-0,0224**	0,0526***	-0,0308***	-0,0546***	0,0502***	-0,0073
		(0,7482)	*(0,0321)*	*(0,0004)*	*(0,0099)*	*(0,0000)*	*(0,0005)*	*(0,6646)*
	Offshore Drilling	0,0239*	0,0124	0,0197	-0,1037***	-0,1003**	-0,0903***	0,0263
		(0,0897)	*(0,5807)*	*(0,5940)*	*(0,0000)*	*(0,0222)*	*(0,0002)*	*(0,2142)*
	Refining and Marketing	0,0034	-0,0108***	0,0877***	-0,0101**	-0,0408	-0,0664***	-0,0323
		(0,8416)	*(0,0000)*	*(0,0077)*	*(0,0495)*	*(0,2378)*	*(0,0011)*	*(0,4438)*
	Equipment and Services	0,0351***	-0,0059	0,0040	-0,1240***	-0,0016	-0,1100***	-0,0024
		(0,0003)	*(0,4702)*	*(0,8428)*	*(0,0000)*	*(0,9193)*	*(0,0000)*	*(0,8838)*
	Pipelines	0,0182**	-0,0179***	0,0575***	-0,0464***	0,0031	-0,0586***	-0,0125
		(0,0255)	*(0,0042)*	*(0,0000)*	*(0,0012)*	*(0,7442)*	*(0,0000)*	*(0,1816)*
	US Oil&Gas Group	0,0105*	-0,0181***	0,0409***	-0,0535***	-0,0373***	-0,0609***	-0,0056
		(0,0761)	*(0,5997)*	*(0,0001)*	*(0,0000)*	*(0,0000)*	*(0,0000)*	*(0,6123)*
Europe	BP	-0,0041	-0,0881	-0,1428*	-0,1684**	0,0548	0,0084	-0,0088
		(0,8602)	*(0,3071)*	*(0,0657)*	*(0,0381)*	*(0,5628)*	*(0,4017)*	*(0,6854)*
	Integrated Oil&Gas	-0,0009	0,0103	0,0132	-0,0119	0,0078	0,0124*	-0,0134
		(0,8965)	*(0,3878)*	*(0,3777)*	*(0,3677)*	*(0,2398)*	*(0,0590)*	*(0,1191)*
	Crude Producers	-0,0247***	0,0126	-0,0231	-0,0297*	-0,0223*	-0,0024	0,0185
		(0,0000)	*(0,6370)*	*(0,1919)*	*(0,0510)*	*(0,0581)*	*(0,8372)*	*(0,3655)*
	Offshore Drilling	-0,0134	-0,0618	-0,0111	-0,0754**	0,0648	-0,0306*	0,0353
		(0,5729)	*(0,1451)*	*(0,5351)*	*(0,0428)*	*(0,2508)*	*(0,0768)*	*(0,2712)*
	Refining and Marketing	-0,0160	0,0048	-0,0245**	-0,0220*	0,0084	-0,0044	-0,0050
		(0,1285)	*(0,7462)*	*(0,0407)*	*(0,0525)*	*(0,5856)*	*(0,7396)*	*(0,7702)*
	Equipment and Services	0,0126**	-0,0046	-0,0077	-0,0349**	0,0011	0,0401	-0,0120
		(0,0544)	*(0,6830)*	*(0,4980)*	*(0,0153)*	*(0,9366)*	*(0,2104)*	*(0,3677)*
	Pipelines	-0,0224	-0,0168*	0,0486	0,0000	0,0008	-0,0008	-0,0215
		(0,2823)	*(0,0783)*	*(0,4292)*	*(0,9987)*	*(0,9356)*	*(0,9634)*	*(0,1489)*
	Europe Oil&Gas Group	-0,0108***	0,0038	-0,0126	-0,0287***	-0,0064	0,0097	0,0100
		(0,0045)	*(0,7660)*	*(0,1672)*	*(0,0005)*	*(0,3594)*	*(0,3512)*	*(0,3279)*

This table reports the cumulative average abnormal return (CAAR) of the US and European Oil and Gas firms for relevant event windows and sub-industry classifications, when using different event windows. The dates below each event refer to the day 0 of that specific event, as explained in section 3.1. The p-values are reported in parentheses. The superscripts *, ** and *** correspond to statistical significance at the 10%, 5% and 1% level.

Table A8

CAAR of Alternative Energy industry (Robustness: Different Event Windows)

	CAAR Windows	1st Week		1st Moratorium	Top Kill	2nd Moratorium	Static Kill	Well Kill
		21/04/2010		27/05/2010	29/05/2010	12/07/2010	04/08/2010	19/09/2010
		(0,+1)	(+2,+7)	(-1,+1)	(-1,+1)	(-1,+1)	(-1,+1)	(-1,+1)
US	Alternative Fuels	0,0391	0,0164	-0,0418	-0,0213	-0,0485	-0,0051	0,0739
		(0,1289)	*(0,8306)*	*(0,3842)*	*(0,6443)*	*(0,1864)*	*(0,9440)*	*(0,1535)*
	Renewable Energy Equipment	-0,0274	-0,0091	-0,0026	0,0260	-0,0088	0,0709	0,0500
		(0,5239)	*(0,7693)*	*(0,9562)*	*(0,5313)*	*(0,8090)*	*(0,6843)*	*(0,6075)*
	US Alternative Energy Group	0,0223	-0,0162	-0,0265	0,0011	-0,0313	0,0340	0,0489
		(0,5948)	*(0,6431)*	*(0,4317)*	*(0,9699)*	*(0,2168)*	*(0,7590)*	*(0,4375)*
Europe	Alternative Fuels	0,0724	-0,0352	0,0073	-0,0293**	0,0103	-0,0397**	-0,0072
		(0,1925)	*(0,2833)*	*(0,8355)*	*(0,0357)*	*(0,7381)*	*(0,0172)*	*(0,6211)*
	Renewable Energy Equipment	-0,0143	0,0153	0,0105	0,0068	0,0280	-0,0039	-0,0276
		(0,2140)	*(0,2088)*	*(0,5108)*	*(0,6701)*	*(0,2027)*	*(0,7903)*	*(0,1706)*
	Europe Alternative Energy Group	0,0182	-0,0036	0,0093	-0,0067	0,0213	-0,0173	-0,0200
		(0,4245)	*(0,8063)*	*(0,5662)*	*(0,5581)*	*(0,2276)*	*(0,1286)*	*(0,1444)*

This table reports the cumulative average abnormal return (CAAR) of the US and European Alternative Energy firms for relevant event windows and sub-industry classifications, when using different event windows. The dates below each event refer to the day 0 of that specific event, as explained in section 3.1. The p-values are reported in parentheses. The superscripts *, ** and *** correspond to statistical significance at the 10%, 5% and 1% level.