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ABSTRACT

The Deepwater Horizon explosion had considerable environmental, economic, and regulatory impacts. We examine oil companies' cumulative abnormal returns related to the date of the rig explosion, as well as announcements regarding insurance liability, insurance premiums for offshore drilling, and deepwater drilling moratorium events. We find no statistically significant stock response to the rig explosion itself – mostly likely given the incompleteness of information at the spill's beginning. We do find firms directly involved with the Deepwater Horizon show negative responses to the moratorium on drilling in the Gulf of Mexico along with evidence that firms emphasizing drilling and service to existing oil wells also react negatively. Our results further show negative impacts from the possibility of increased financial assurance and insurance costs for firms involved in the pipeline and bulk station and terminal areas. Finally, firms with a weaker financial position (higher leverage) tend to have lower returns. In all, results support contagion more than competitive effects.

INTRODUCTION

The British Petroleum (BP) Deepwater Horizon April 2010 oil spill was a catastrophic event with both economic and environmental consequences. While oil exploration is an extremely risky endeavor, a disastrous event such as this spill creates more consideration about oil exploration and production safety. The rig explosion and its aftermath brought great uncertainty related to the magnitude of the spill, its legal ramifications, political pressure on the oil industry, and the impact for all parties involved.

This study examines oil company stock price responses to the disaster's key events. Specifically, we examine: the rig explosion itself, announcements related to possible changes in insurance liability and premiums for offshore drilling, and announcements related to the moratorium on deepwater drilling.

Overall, the results provide evidence that the various events related to insurance caps and moratoria impact oil firms. Specifically, the moratoria banning drilling negatively impact the value of exploration and equipment companies, while the insurance announcements negatively affect the pipeline and bulk station industries. Additional analysis which separates the firms by Gulf of Mexico (GOM) exposure and leverage indicate that GOM-exposed firms suffer greater negative wealth effects while results related to leverage are mixed, but generally show higher-leveraged firms have lower returns.

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BACKGROUND

The April 20, 2010 explosion of the BP-operated Deepwater Horizon oil rig in the Gulf of Mexico and the subsequent leakage of millions of barrels of oil before the July 2010 capping of the well seem to have been market-changing events in the oil industry. Following the explosion, Congress proposed to increase environmental liability coverage from $75 million to $10 billion to ensure that responsible parties pay the full cost associated with oil spills (Pearson, 2010). Also, Congress debated increasing the requirements of the Oil Pollution Act of 1990 which mandates companies with offshore facilities maintain evidence of $150 million of financial responsibility. Simultaneously, oil companies and their insurers reassessed deep water drilling risks. Energy insurance proponents argued that removing the $75 million liability cap could lead more companies to self-insure (Carmel & Yekrangi, 2010). Others suggested that increasing the liability limits could drive offshore drilling companies out of U.S. waters (Postal, 2010). The proposed House bill stalled in the Senate, but there was considerable debate regarding the cost of operating offshore rigs. For example, insurance premiums increased 15% - 50% in the month after the April explosion (Holm, 2010).

On May 28, 2010, the Obama administration issued a six-month moratorium on all offshore deepwater drilling (Favole, Power, & Chazan, 2010). The purpose of the moratorium was to improve safety and provide environmental protection to reduce the risk of events such as the BP oil spill (Department of Interior, 2010a). In addition to calling for new operating standards for offshore oil companies, the Secretary of the Interior, Ken Salazar, canceled lease sales in the Gulf of Mexico and off the coast of Virginia and suspended proposed Arctic drilling.

The moratorium was expected to have a large economic impact with one estimate suggesting losses of $2.1 billion in output, as many as 8,000 jobs, more than $487 million in wages, and $98 million in state tax revenues in the Gulf states of Texas, Louisiana, Mississippi, Alabama, and Florida (Mason, 2011). Clouding the issue, several companies that service offshore oil rigs sued the U.S. government in an effort to overturn the drilling ban (Associated Press, 2010). The lawsuit claimed that the Department of the Interior had no proof that the 33 projects affected by the ban posed an imminent threat. The judge agreed with the plaintiffs and lifted the ban on offshore drilling on June 22, 2010 (Power, 2010). The Obama Administration appealed the decision and issued a new moratorium on July 12, 2010 suspending activities based on drilling configurations and technologies rather than water depth (Department of Interior, 2010b).

The moratorium's negative impact fell short of the dire predictions. Unemployment claims from the oil industry on the Gulf Coast were lower than anticipated. Furthermore, only two deepwater rigs in the Gulf that were impacted by the ban actually left the area (Broder & Krauss, 2010). Instead, many oil companies used the time to upgrade and service equipment while moving some operations to onshore sites, which helped to prevent worker lay-offs.

Although scheduled to be lifted on November 30, 2010, the ban was raised October 12, 2010. Still, the government granted no deepwater drilling permits until February 28, 2011 (Carey, 2011). In fact, the Department of Interior's Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE) authorized only 37 shallow-water and two deep-water wells between April 20, 2010 and March 16, 2011. For comparison, the BOEMRE's approval rate before April 2010 was slightly above seven wells per month (Stilley,

2011). The impact on oil companies can be seen with the February 2011 Chapter 11 bankruptcy filing by Seahawk Drilling, a Houston-based company, which blamed the BOEMRE's slow permit application review process (Stilley, 2011).

HYPOTHESES

We use the events described above to delineate dates and firm-specific qualities to explore the stock price reaction of oil-related firms to the explosion. While the rig explosion itself was an unexpected event – a necessity for an event study – the true nature of the spill and the events related to it played out over several months. Thus, it is quite possible that any stock price reactions will evolve over longer periods than event-study methodology may capture. As such, we believe any statistically significant results we find will truly point toward expected economic impacts. We enumerate our hypotheses in their null form and explain our ex ante expectations as to results following each hypothesis.

Hypothesis 1a: Oil industry firms' stock returns will have no response to the BP oil rig explosion.

Given that the explosion can only be considered catastrophic, we naturally expect a negative response. However, we realize it is quite possible not to find one. First, the extent of the explosion and the rate of oil leakage from it took considerable time to assess – in fact, the oil leakage amount may never be known with much certainty. Second, responses may differ based on if the markets consider reactions within a "contagion" or "competitive" framework.

We use the term "contagion" in the sense that oil industry firm stock returns could be positively correlated to each other. Thus, what is bad for one is bad for all. However, the stock market may view the firms in a competitive situation where any losses expected from the most directly involved firms (e.g. BP and TransOcean) would be a competitors' gain. In that case, returns would have a negative correlation such that the net position would be closer to zero and show no significant returns.

Hypothesis 1b: Oil industry firms' stock returns will have no response to the increase in insurance costs.

Given that all the differing announcements about insurance costs would lead to higher operating costs for the oil companies, we expect a negative response. We could find no significant abnormal returns if the insurance announcements are not a surprise since the market could anticipate much of the content from them.

Hypothesis 1c: Oil industry firms' stock returns will have no response to the moratorium or the court ordered lifting of the moratorium.

If the contagion setting discussed above holds, we expect a negative response to the moratorium announcement and a positive response to the court order ending the drilling ban. Since the moratorium halts all deepwater drilling, it limits oil production. The ban can affect business for all areas of the oil industry. We consider six distinct SIC classification groups within the oil industry: SIC 131 (exploration), SIC 138 (drilling), SIC 291 (refining), SIC 353 (machinery and equipment), SIC 461 (pipelines), and SIC 517 (bulk stations and terminals). Of course, many of the largest firms are involved in many if not all SIC classifications which will bias our tests toward finding no difference between groups. Just as the moratorium would limit oil industry production and lead to negative returns, the court's overturning the moratorium should lead to positive returns given higher output.

However, if the competitive view holds, it would not be surprising to find a lack of significance since a decrease in Gulf of Mexico oil production could lead to increases in oil prices and/or production from other areas. Our estimation model will control for the price of oil. Thus, the competitive view leads to the likelihood of no statistically significant abnormal return for the whole industry in response to the moratorium and the court order lifting the ban.

Hypothesis 2a: The stock returns of oil industry firms with Gulf of Mexico exposure will have no reaction to the moratorium or the court order ending the moratorium.

Hypothesis 2b: The stock returns of oil industry firms with Gulf of Mexico exposure will not differ from the stock returns of oil industry firms with little or no Gulf of Mexico exposure in relation to the moratorium or its court-ordered lifting.

Since SIC 131 and SIC 138 firms are involved in exploration and drilling, we examine these two groups by firms which have operations in the Gulf of Mexico (GOM) and those which do not. We expect companies operating in the GOM should experience a greater negative impact because of the explosion's location and the moratorium's targeted area. Firms outside the GOM may benefit from other companies' problems within the GOM. On the other hand, if a contagion effect dominates, firms which operate outside the GOM may suffer as well.

Hypothesis 3a: Oil industry firms' stock returns will not differ based on financial condition with the announcement of increases in financial assurance (and insurance).

Hypothesis 3b: Oil industry firm's stock returns will not differ based on financial condition with the moratorium announcement.

We expect the drilling moratorium to have a greater impact on firms in more precarious financial conditions. We examine four different measures of financial condition: working capital, current ratio, return on equity, and leverage. We compare companies that are above or below $150 million in working capital as an approximate measure of the Oil Pollution Act of 1990's $150 million financial assurance requirement for offshore facilities. For the current ratio, return on equity, and leverage (measured as long term debt to total assets), we compare abnormal returns across groups based on the median value of the financial variable for the industry.

DATA and METHODOLOGY

We use fiscal year 2009 data from Research Insight (Compustat) and stock returns data from CRSP for the appropriate date range around the 2010 announcements (See Table 1 for announcement dates) and calculate the cumulative abnormal returns (CARs) for a 3-day event window defined as days (-1 to 1) for each announcement date using 121 days prior to the first date listed in Table 1 and 121 days after the last date listed in Table 1 to estimate market parameters in line with Bhargava & Fraser (1998) and Saunders & Smirlock (1987). For the rig explosion, we use a two-day event window (0, +1) as there would be no information leakage in day -1 for such an event. We investigate the impact of the explosion, insurance announcements, and moratorium events for firms in the Oil and Gas Industry (three-digit SIC codes 131, 138, 291, 353, 461, and 517). See Table 2 for descriptive statistics.

Table 1: Event Days Related to the Deepwater Horizon Rig Explosion

Event Code	**Date**	**Event**
Day 1 (γ_1)	April 20, 2010	BP Deepwater Horizon Explosion. Source: *The Wall Street Journal* Online
Day 2 (γ_2)	May 5, 2010	Congress introduces HR5214: "Big Oil Bailout Prevention Act of 2010" Calls to increase environmental liability cap from $75 million to $10 billion. Later stalls in the Senate and is never enacted into law. Source*: GovTrack.us*
Day 3 (γ_3)	May 25, 2010	Insurance for drilling in the Gulf has risen 15%-50%.

		Source: *The Wall Street Journal*
Day 4 (γ_4)	May 28, 2010	First Six-Month Moratorium on deepwater drilling. Source: Department of Interior press release, *Bloomberg*
Day 5 (γ_5)	June 23, 2010	U.S. District Court Judge Martin Feldman lifts moratorium. Source: *The Wall Street Journal*
Day 6 (γ_6)	July 12, 2010	Second Six-month Moratorium on deepwater drilling. Source: Department of Interior press release, *New York Times*

Much of the data in Table 2 are as we expect. Means for total assets and working capital are greater than medians for each group. This relationship indicates large firms which skew averages. The largest firms are in SIC 291 (refining) given the infrastructure requirements for that segment. SIC 517 (bulk stations and terminals) has the smallest firms.

The long term debt-to-total assets ratio (leverage) shows a wide range for almost all firm types. The median for SIC 353 (machinery and equipment) is 3.01% while the highest median is for SIC 461 (pipelines) with 39.02%. Finally, return on assets (ROA) ranges from a median of

-3.78% for SIC 131 (exploration) to 5.84% for SIC 353 (machinery and equipment).

Table 2: Summary Statistics for Oil and Gas Industry Companies

Total Assets and Working Capital are in millions ($). Current Ratio is (Current Assets)/(Current Liabilities). ROA is (Net Income before Extraordinary Items)/(Total Assets). Leverage is (Long Term Debt)/(Total Assets).

	N	Mean	Median	Standard Deviation	Min	Max
SIC 131 (Exploration)						

Total Assets	96	5,177.00	1,057.88	10,394.33	9.44	50,123.00
Working Capital	96	178.12	8.61	758.10	-491.35	5,835.06
Current Ratio	96	2.08	1.22	3.72	0.34	34.74
ROA (%)	96	-8.99	-3.78	18.36	-103.86	16.49
Leverage (%)	96	30.64	30.80	18.37	0.00	111.32
SIC 138 (Drilling)						
Total Assets	34	4,831.21	1,556.52	8,418.31	23.57	36,436.00
Working Capital	34	716.20	226.34	1,419.37	-1.47	6,391.00
Current Ratio	34	2.51	2.36	0.96	0.86	4.96
ROA (%)	34	1.97	4.36	20.65	-24.38	21.97
Leverage (%)	34	22.69	23.07	13.27	0.00	45.77
SIC 291 (Refining)						
Total Assets	25	87,573.70	47,052.00	91,927.53	2,132.79	292,181.00
Working Capital	25	1,499.31	498.19	7,268.71	-16,428.46	21,998.19
Current Ratio	25	1.23	1.17	0.38	0.64	2.17
ROA (%)	25	3.11	3.72	5.19	-12.41	9.36
Leverage (%)	25	17.08	16.34	10.91	0.18	43.42
SIC 353 (Machinery and Equipment)						
Total Assets	12	5,633.83	1,374.82	7,667.19	186.87	21,532.00
Working Capital	12	1,505.57	529.92	1,943.56	40.30	5,424.00
Current Ratio	12	3.27	3.39	1.26	1.33	5.90
ROA (%)	12	5.43	5.84	3.73	-1.19	12.87
Leverage (%)	12	7.50	3.01	9.55	0.00	30.99

SIC 461 (Pipelines)						
Total Assets	6	1775.63	1575.77	1347.67	515.54	3255.65
Working Capital	6	47.89	2.25	82.06	-7.67	195.99
Current Ratio	6	1.14	1.12	0.27	0.75	1.47
ROA (%)	6	4.55	4.17	1.73	2.32	7.49
Leverage (%)	6	32.42	39.02	27.10	0.00	63.36
SIC 517 (Bulk Stations and Terminals)						
Total Assets	7	785.82	685.94	580.40	30.12	1741.23
Working Capital	7	129.86	38.37	200.00	-11.77	516.24
Current Ratio	7	1.21	1.23	0.32	0.61	1.54
ROA (%)	7	2.76	3.24	5.89	-7.77	11.47
Leverage (%)	7	17.54	16.21	18.16	0.00	44.37

We employ a multivariate regression model (MVRM) to examine the stock price reactions to the event dates following Yildirim, Kwag, & Collins (2006) and Bhargava & Fraser (1998). The MVRM corrects for heteroscedasticity biases that arise when common event periods produce individual asset returns that may be contemporaneously correlated such that residuals across the various firm type portfolios will not be identically and independently distributed. The dummy variable for each event will help judge the impact of that event on stock returns and on any shift in overall systematic risk. Following Bhargava & Fraser (1998), we include a time lag variable to control for non-synchronous trading (based on studies by Scholes & Williams (1977) and Dimson (1979)) and divide firms into six portfolios based on SIC codes to use a system of Seemingly Unrelated Regressions (SUR) (Zellner (1962)). For tests not involving the competitive effect, we also include a variable to control for stock price reaction to changes in crude oil prices. The model specification for the current study is:

$$r_{it} = \alpha_i + D_t\,\alpha\rho_i + \beta 1_i r_{mt} + \beta 1_{li} r_{m(t-1)} + \beta 2_i r_{oil} + \Sigma^{6}_{k=1}\,\gamma_i D_0 + \beta 1\rho_i D_t r_{mt} + \beta 1\rho_{li} D_t r_{m(t-1)} + \varepsilon_{it} \quad (1)$$

where r_{it} = the return for portfolio i on day t,

α_i = intercept coefficient for portfolio i,

D_t = dummy which is 1.0 after the last event date; else 0.0,

$\alpha\rho_i$ = shift intercept coefficient for portfolio i,

$\beta 1_i$ = systematic risk coefficient on market return for portfolio i (i.e. market beta),

r_{mt} = the return on the value weighted market portfolio on day t,

$\beta 1_{li}$ = systematic risk coefficient on the lagged market return for portfolio i,

$\beta 2_i$ = systematic risk coefficient on oil return for portfolio i (i.e. oil beta),

r_{oil} = the return on the front month NYMEX WTI contract (U.S. Government Energy Information Administration),

γ_i = the wealth effect of the announcement on portfolio i for event k = 1 through 6,

D_0 = dummy which is 1.0 in the event window of the k^{th} announcement; 0.0 otherwise (= 1 for the event window of day -1 through day +1 except for the rig explosion when it is = 1 for the event window of day 0 through day +1),

$\beta 1\rho_i$ = shift in market systematic risk for portfolio i,

$\beta 1\rho_{li}$ = shift in market systematic risk for portfolio i on the lagged return, and

ε_{it} = error term.

To reiterate, we estimate cumulative abnormal returns by estimating the model parameters using 121-day trading periods before the first event and after the last event in Table 1.

RESULTS

Table 3 reports the results from estimating equation (1). The "Deepwater Horizon Firms" (DH) column utilizes the five firms (Anadarko, BP, Cameron, Halliburton, and Transocean) which were involved with operations at the Deepwater Horizon rig. The remaining six columns examine the six SIC code classifications excluding the five above firms. All regressions are significant at better than the 0.0001 level with the expected positive relationships – significant at the 0.0001 level or better - between company returns and the market portfolio ($\beta 1$). Interestingly, the DH firms show no relationship between oil prices and stock returns while all other SIC groups show a positive relationship – significant at the 0.05 level or better - to oil prices ($\beta 2$). This result supports the competitive effect as the other companies seem to be able to benefit from changing oil prices, while the DH firms do not.

The DH firms show no relationship between their stock returns and the rig explosion (γ_1). This relationship is not too surprising given the uncertain extent of the event in the beginning. Stock prices for SIC 138 (drilling) companies show a positive reaction to the explosion. Since the drilling firms were not directly responsible for the explosion, the results could indicate, in keeping with the competitive effect, the market's expectation that these firms would be able to capitalize on the problems of the DH firms.

Table 3: Results from Deepwater Horizon Rig Event Tests

This table presents the results from estimating the following model for the oil industry: $r_{it} = \alpha_i + D_t\, \alpha\rho_i + \beta 1_i r_{mt} + \beta 1_{li} r_{m(t-1)} + \beta 2_i r_{oil} + \Sigma^6_{k=1}\, \gamma_i D_0 + \beta 1 \rho_i D_t r_{mt} + \beta 1 \rho_{li} D_t r_{m(t-1)} + \varepsilon_{it}$ where r_{it} = the return for portfolio i on day t, α_i = intercept coefficient for portfolio i, D_t = dummy which is 1.0 after the last event date; else 0.0, $\alpha\rho_i$ = shift intercept coefficient for portfolio i, $\beta 1_i$ = systematic risk coefficient on market return for portfolio i (i.e. market beta), r_{mt} = the return on the value weighted market portfolio on day t, $\beta 1_{li}$ = systematic risk coefficient on the lagged market return for portfolio i, $\beta 2_i$ = systematic risk coefficient on oil return for portfolio i (i.e. oil beta), r_{oil} = the return on the front month NYMEX WTI contract, γ_i = the wealth effect of the announcement on portfolio i for event k = 1 through 6, D_0 = dummy which is 1.0 in the event window of the k^{th} announcement; 0.0 otherwise (= 1 for the event window of day -1 through day +1), $\beta 1 \rho_i$ = shift in market systematic risk for portfolio i, $\beta 1 \rho_{li}$ = shift in market systematic risk for portfolio i on the lagged return, and ε_{it} = error term. The Deepwater Horizon column separates the five firms directly related to the rig explosion: British Petroleum, Halliburton, Transocean, Cameron, and Anadarko. We consider oil industry SIC Codes 131 (exploration), 138 (drilling), 291 (refining), 353 (machinery and equipment), 461 (pipelines), and 517 (bulk stations and terminals). P-values are in parentheses. ***, **, and * signify significance at the 0.01, 0.05, and 0.10 level, respectively.

SIC	Deepwater Horizon Firms	131 Exploration	138 Drilling	291 Refining	353 Machinery & Equipment	461 Pipelines	517 Bulk Stations & Terminals
Intercept	-0.000	0.000	-0.001	-0.001*	0.001	0.001**	0.000
	(-0.65)	(0.92)	(0.12)	(0.08)	(0.44)	(0.04)	(0.59)
$\alpha\rho_i$	0.000	0.001	0.002**	0.001**	0.001	-0.000	0.001
	(0.95)	(0.37)	(0.03)	(0.04)	(0.31)	(0.75)	(0.32)
$\beta 1_i$	0.027***	1.242***	1.552***	1.037***	1.542***	0.535***	0.542***
	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)
$\beta 1_{li}$	0.002	0.142***	0.102**	0.015	0.110**	0.137***	0.167***
	(0.28)	(0.002)	(0.05)	(0.62)	(0.03)	(0.001)	(0.00)

$\beta 2_i$	0.001	0.197***	0.213***	0.154***	0.136***	0.065**	0.124***
	(0.52)	(<0.0001)	(<0.0001)	(<0.0001)	(0.00)	(0.04)	(0.00)
γ_1	0.000	-0.002	0.011*	0.000	0.006	0.002	0.003
	(0.81)	(0.68)	(0.08)	(0.92)	(0.26)	(0.67)	(0.65)
γ_2	0.000**	-0.001	0.005	-0.001	0.004	-0.018***	-0.013***
	(0.04)	(0.74)	(0.34)	(0.74)	(0.47)	(<0.0001)	(0.01)
γ_3	0.000	0.004	0.001	-0.005*	0.004	0.009**	0.008
	(0.83)	(0.31)	(0.87)	(0.08)	(0.42)	(0.03)	(0.11)
γ_4	-0.001***	-0.002	-0.021***	0.003	-0.033***	-0.002	-0.000
	(<0.0001)	(0.57)	(<0.0001)	(0.32)	(<0.0001)	(0.68)	(0.96)
γ_5	-0.000	-0.004	-0.006	0.005	0.002	0.006	0.004
	(0.35)	(0.94)	(0.25)	(0.08)*	(0.65)	(0.19)	(0.46)
γ_6	-0.000	-0.005	-0.000	-0.002	-0.011** (0.02)	0.002	-0.000
	(0.89)	(0.23)	(0.93)	(0.45)		(0.59)	(0.99)
$\beta 1\rho_i$	-0.003	-0.223***	-0.287***	-0.018	-0.104	-0.251***	-0.190**
	(0.32)	(0.01)	(0.005)	(0.74)	(0.28)	(0.002)	(0.05)
$\beta 1\rho_{li}$	0.000	-0.107	-0.103	-0.006	-0.269***	-0.111	-0.081 (0.40)
	(0.98)	(0.21)	(0.30)	(0.91)	(0.01)	(0.17)	
Adj. R^2	0.57	0.82	0.84	0.89	0.84	0.49	0.45
F-test	34.28***	113.52***	128.35***	198.14***	129.53***	24.87***	21.15***
	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)

The DH firms, as well as SIC 461 (pipelines) and SIC 517 (bulk stations and terminals) show significant stock price reactions to the announcement that the bill to increase environmental liability caps was passed by the House (γ_2). While it seems unlikely that the market would interpret the legislation as directly helpful to the DH firms, it is possible that the proposed legislation was deemed less potentially harmful to the DH firms than expected, thus, generating the positive response. Given the relatively small firm sizes in SIC 461 and SIC 517 (see Table 2), the negative reaction may arise given financial distress if the firms were not able to afford insurance or if they were unable to self-insure. We examine this issue later in the study.

With regards to the announcement that insurance premiums increased as much as 15%-50% for offshore drilling (γ_3), SIC 291 (refining) firms have a negative stock price response, while SIC 461 (pipelines) firms have a positive response. While SIC 291 shows the expected negative relationship, the positive finding for SIC 461 (pipelines) could mean that the insurance costs might not have increased as much as originally expected. That explanation seems a bit strained given no other grouping has a significant relationship to the reported increases.

DH firms as well as SIC 138 (drilling) and SIC 353 (machinery and equipment) have negative reactions to the first drilling moratorium in the Gulf of Mexico (γ_4) indicating that the market seems to interpret the halted drilling as a loss for these companies. SIC 291 (refining) shows a positive response to the court ordered lifting of the moratorium (γ_5). The lack of a response by the other groups may be attributed to the expectation that the DOI would appeal the judge's ruling. SIC 353 (machinery and equipment) has a negative reaction to the second moratorium (γ_6) in keeping with its reaction to the original ban (γ_4).

Table 4 reports the combined tests for significance of CARs for combined like-event dates. We separate the CARs tests for announcement related to insurance costs ($\gamma_2 + \gamma_3$) and drilling moratorium announcements ($\gamma_4 + \gamma_6$). The tests reveal no significant difference for the combined insurance days. However, the drilling moratorium days show negative reactions for the five DH firms, SIC 138 (drilling), and SIC 353 (machinery and equipment) firms indicating that banning drilling - the primary business of these groups - is related to a decline in those companies' values. These results support the contagion effect for these firm types. We also estimated equation (1) without the control for oil prices and find the Table 4 type results to be virtually the same. These results are available upon request.

Table 5 presents results of tests examining contagion and competitive effects. In these tests, we re-estimate Equation (1), but omit the variable to control for oil prices. The basic idea for this omission is that firms directly tied to the rig explosion would likely see any court-ordered cost change directly with the price of oil. However, firms not tied to the rig explosion would likely benefit (lose) from increases (decreases) in oil prices. Thus, the CARs will more likely show if there is a difference (supporting competitive effect) or similarity (supporting contagion effect) between the tested groups when we omit the price of oil from the model.

Table 4: Cumulative Abnormal Returns for Related Events

This table presents the Cumulative Abnormal Returns (CARs) from estimating the following model for the oil industry: $r_{it} = \alpha_i + D_t\, \alpha\rho_i + \beta 1_i r_{mt} + \beta 1_{li} r_{m(t-1)} + \beta 2_i r_{oil} + \Sigma^{6}_{k=1}\, \gamma_i D_0 + \beta 1 \rho_i D_t r_{mt} + \beta 1 \rho_{li} D_t r_{m(t-1)} + \varepsilon_{it}$ where r_{it} = the return for portfolio i on day t, α_i = intercept coefficient for portfolio i, D_t = dummy which is 1.0 after the last event date; else 0.0, $\alpha\rho_i$ = shift intercept coefficient for portfolio i, $\beta 1_i$ = systematic risk coefficient on market return for portfolio i (i.e. market beta), r_{mt} = the return on the value weighted market portfolio on day t, $\beta 1_{li}$ = systematic risk coefficient on the lagged market return for portfolio i, $\beta 2_i$ = systematic risk coefficient on oil return for portfolio i (i.e. oil beta), r_{oil} = the return on the front month NYMEX WTI contract, γ_i = the wealth effect of the announcement on portfolio i for event k = 1 through 6, D_0 = dummy which is 1.0 in the event window of the k^{th} announcement; 0.0 otherwise (= 1 for the event window of day -1 through day +1), $\beta 1 \rho_i$ = shift in market systematic risk for portfolio i, $\beta 1 \rho_{li}$ = shift in market systematic risk for portfolio i on the lagged return, and ε_{it} = error term. We combine like events: insurance costs (γ_2 and γ_3) and drilling moratoria ($\gamma_4 + \gamma_6$). The Deepwater Horizon column separates the five firms directly related to the rig explosion: British Petroleum, Halliburton, Transocean, Cameron, and Anadarko. We consider oil industry SIC Codes 131 (exploration), 138 (drilling), 291 (refining), 353 (machinery and equipment), 461 (pipelines), and 517 (bulk stations and terminals). F-test values are in parentheses. ***, **, and * signify significance at the 0.01, 0.05, and 0.10 level, respectively.

Firm Category	Insurance Days $\gamma_2 + \gamma_3$	Moratorium Days $\gamma_4 + \gamma_6$
Deepwater Horizon Firms	0.137%	-0.589%**
	(2.61)	(20.55)
SIC 131 (exploration)	0.302%	-0.785%
	(0.22)	(1.53)
SIC 138 (drilling)	0.588%	-2.094%***
	(0.61)	(8.14)
SIC 291 (refining)	0.604%	0.068%
	(2.06)	(0.03)
SIC 353 (machinery and equipment)	0.776%	-4.400%***
	(1.15)	(38.44)
SIC 461 (pipelines)	-0.849%	0.053%
	(1.98)	(0.01)

SIC 517 (bulk stations and terminals)	-0.516% (0.49)	-0.022% (0.00)

Panel A of Table 5 compares the CARs from re-estimating Equation (1) without the oil price beta for the three firms directly tied to the Deepwater Horizon (DHF) and all other firms in SIC 131 (exploration) and SIC 138 (drilling). Again, these firms show no significant reaction to insurance changes or to the court order to end the moratorium on drilling. However, they do continue to show the negative reaction to the moratorium announcements and, interestingly, the SIC 131 and SIC 138 firms' stock reactions are worse than those for the DH firms. These results support a contagion effect, but also that the moratoria are even more harmful to firms not directly tied to the rig explosion.

Panel B of Table 5 examines SIC 131 (exploration) firms dividing them based on whether the firms have Gulf of Mexico (GOM) exposure or not. To gauge Gulf of Mexico exposure, we examine the Business Summary portion for each company in Yahoo! Finance. We code any firm which has reference to Gulf of Mexico operations as 1.0 and we code all other firms as 0.0. Panel C repeats the GOM exposure process for SIC 138 (drilling) firms. In both cases, we find only GOM-exposed firms have negative stock reactions to the first moratorium (γ_4) and both moratoria combined ($\gamma_4 + \gamma_6$), but the differences between GOM- and non-GOM-exposed firms is only significant for SIC 138 firms. Hence, there does appear to be evidence for the competitive effect for SIC 138 firms. We also compare the CARs from the Deepwater Horizon firms with all other firms in our sample when estimating Equation (1) without the oil price control variable. The results are very similar to those shown in Panel A of Table 5 only with the difference between the two groups CARs significant at the 0.10 level as opposed to the 0.05 level.

Table 5: Cumulative Abnormal Returns based on Gulf of Mexico Exposure

This table presents the Cumulative Abnormal Returns (CARs) from estimating the following model for the oil industry (that does not include the oil beta): $r_{it} = \alpha_i + D_t\, \alpha\rho_i + \beta 1_i r_{mt} + \beta 1_{li} r_{m(t-1)} + \Sigma^6_{k=1}\, \gamma_i D_0 + \beta 1\rho_i D_t r_{mt} + \beta 1\rho_{li} D_t r_{m(t-1)} + \varepsilon_{it}$ where r_{it} = the return for portfolio i on day t, α_i = intercept coefficient for portfolio i, D_t = dummy which is 1.0 after the last event date; else 0.0, $\alpha\rho_i$ = shift intercept coefficient for portfolio i, $\beta 1_i$ = systematic risk coefficient on market return for portfolio i (i.e. market beta), r_{mt} = the return on the value weighted market portfolio on day t, $\beta 1_{li}$ = systematic risk coefficient on the lagged market return for portfolio i, γ_i = the wealth effect of the announcement on portfolio i for event k = 1 through 6, D_0 = dummy which is 1.0 in the event window of the k^{th} announcement; 0.0 otherwise (= 1 for the event window of day -1 through day +1), $\beta 1\rho_i$ = shift in market systematic risk for portfolio i, $\beta 1\rho_{li}$ = shift in market systematic risk for portfolio i on the lagged return, and ε_{it} = error term. We examine and compare firms with and without Gulf of Mexico (GOM) exposure alongside the Deepwater Horizon Firms (DHF): Halliburton, Transocean, and Anadarko for SIC Codes 131 (exploration) and 138 (drilling). ***, **,* signify significance at the 0.01, 0.05, and 0.10 level, respectively.

Panel A: Deepwater Horizon and other Gulf of Mexico Firms

	Event Date	DHF	SIC 131 (exploration) & SIC 138 (drilling)	Difference (DHF-non DHF)	F-value
Insurance	γ_2	0.127%	-0.083%	0.044%	0.01
	γ_3	0.010%	0.760%	-0.750%	2.67
	$\gamma_2 + \gamma_3$	0.137%	0.843%	-0.706%	1.12
Moratorium	γ_4	-0.530%***	-2.088%***	1.558%***	11.52
	γ_6	-0.058%	-0.659%	0.601%	1.71
	$\gamma_4 + \gamma_6$	-0.588%***	-2.747%***	2.169%***	10.87
Court Order	γ_5	-0.096%	-0.344%	0.248%	0.29

Panel B: SIC 131 (Exploration)

	Event Date	No GOM	GOM	Difference (G-NG)	F-value
Insurance	γ_2	-0.374%	-0.045%	0.329%	0.85
	γ_3	0.553%	0.158%	-0.395%	1.29
	$\gamma_2 + \gamma_3$	0.179%	0.113%	-0.066%	0.02
Moratorium	γ_4	0.052%	-0.215%**	-0.267%	0.59
	γ_6	-0.418%	-0.128%	0.290%	0.70
	$\gamma_4 + \gamma_6$	-0.366%	-0.353%**	0.013%	0.00
Court Order	γ_5	0.173%	-0.049%	-0.222%	0.40

Table 5 (Continued)

Panel C: SIC 138 (Drilling)

	Event Date	No GOM	GOM	Difference (G-NG)	F-value
Insurance	γ_2	0.013%	0.213%	0.226%	0.42
	$\gamma_2 + \gamma_3$	-0.053%	0.617%	0.670%	2.38
Moratorium	γ_4	-0.219%	-1.777%***	-1.558%***	27.27
	γ_6	-0.040%	-0.257%	-0.217%	0.53
	$\gamma_4 + \gamma_6$	-0.259%	-2.034%***	-1.775%***	17.40
Court Order	γ_5	-0.200%	-0.209%	-0.009%	0.00

Table 6 examines the non-DH firms within their respective SIC groups after splitting the samples by low-leverage and high-leverage firms. We also compare firms by total assets, current ratio, and a cutoff of $150 million of working capital (as gauge of financial assurance). However, we find no significant differences based on these alternate measures. Low- (High-) leverage firms are companies with leverage values that are less (more) than the median for the entire sample excluding DH firms. The purpose behind these tests is that firms with less financial slack may react more strongly to various study events. For instance, remember that Table 4 reports no significant CARs for the combined moratorium days ($\gamma_4 + \gamma_6$) for the SIC 131 (exploration) group. However, when we split this group by leverage, we find the high-leverage firms show a more negative response to the first moratorium (γ_4) and the combined moratorium days ($\gamma_4 + \gamma_6$). This same pattern shows for SIC 461 (pipeline) firms, but with the high-leverage firms showing lower CARs in relation to insurance dates as well. Thus, as theorized, firms with less financial slack show evidence of worse CARs in relation to event dates of this study for those two SIC groups.

Three groups; SIC 291 (refining), SIC 353 (machinery and equipment), and SIC 517 (bulk stations and equipment) show no significantly different CARs based on leverage. However, we find low-leverage SIC 138 (drilling) firms have lower CARs than high-leverage firms in that category for the second moratorium (γ_6) as well as the combined moratorium dates ($\gamma_4 + \gamma_6$).

Given the unexpected results for SIC 138 firms, we re-examine the unexpected leverage results while controlling for the impact Gulf of Mexico (GOM) exposure. We include SIC 131 (exploration) firms as well to have a more complete picture. The SIC 131 firms CARs again show the pattern reported in Table 6 that high-leveraged firms' CARs are more negative than low-leveraged firms. This result holds for both sub-samples based on GOM exposure.

Note that the SIC 138 (drilling) firms with no GOM exposure show no differences between CARs based on leverage. However, GOM-exposed SIC 138 firms with lower leverage show evidence of lower, that is more negative, CARs than high leverage GOM-exposed firms. Thus, the unexpected result in Table 6 is driven by these GOM-exposed firms. Further examination of this unexpected finding is beyond the current study.

Table 6: Cumulative Abnormal Returns Examining Leverage Differences

This table presents the results from estimating the following model for the oil industry: $r_{it} = \alpha_i + D_t\, \alpha\rho_i + \beta 1_i r_{mt} + \beta 1_{li} r_{m(t-1)} + \beta 2_i r_{oil} + \Sigma^6_{k=1}\, \gamma_i D_0 + \beta 1\rho_i D_t r_{mt} + \beta 1\rho_{li} D_t r_{m(t-1)} + \varepsilon_{it}$ where r_{it} = the return for portfolio i on day t, α_i = intercept coefficient for portfolio i, D_t = dummy which is 1.0 after the last event date; else 0.0, $\alpha\rho_i$ = shift intercept coefficient for portfolio i, $\beta 1_i$ = systematic risk coefficient on market return for portfolio i (i.e. market beta), r_{mt} = the return on the value weighted market portfolio on day t, $\beta 1_{li}$ = systematic risk coefficient on the lagged market return for portfolio i, $\beta 2_i$ = systematic risk coefficient on oil return for portfolio i (i.e. oil beta), r_{oil} = the return on the front month NYMEX WTI contract, γ_i = the wealth effect of the announcement on portfolio i for event k = 1 through 6, D_0 = dummy which is 1.0 in the event window of the k^{th} announcement; 0.0 otherwise (= 1 for the event window of day -1 through day +1), $\beta 1\rho_i$ = shift in market systematic risk for portfolio i, $\beta 1\rho_{li}$ = shift in market systematic risk for portfolio i on the lagged return, and ε_{it} = error term. We exclude the firms directly related to the Deepwater Horizon explosion from these tests. ***, **, and * signify significance at the 0.01, 0.05, and 0.10 level, respectively.

	Event Date	Low Leverage (< median)	High Leverage (> median)	Difference (H-L)	F-value
SIC 131 (Exploration)					
Insurance	γ_2	-0.045%	-0.109%	-0.064%	0.09
	γ_3	0.001%	0.390%	0.389%	2.58
	$\gamma_2 + \gamma_3$	-0.044%	0.281%	0.325%	0.79
Moratorium	γ_4	0.113%	-0.366%	-0.479%**	5.69
	γ_6	-0.168%	-0.364%	-0.196%	0.95
	$\gamma_4 + \gamma_6$	-0.055%	-0.730%	-0.675%**	5.55
Court Order	γ_5	0.000%	-0.044%	-0.044%	0.07

SIC 138 (Drilling)					
Insurance	γ_2	0.171%	0.338%	0.167%	0.56
	γ_3	0.023%	0.055%	0.032%	0.02
	$\gamma_2 + \gamma_3$	0.194%	0.393%	0.199%	0.40
Moratorium	γ_4	-1.078%***	-0.976%***	0.102%	0.22
	γ_6	-0.256%	0.214%	0.470%**	4.77
	$\gamma_4+ \gamma_6$	-1.334%	-0.762%	0.572%*	3.48
Court Order	γ_5	-0.437%*	-0.167%	0.270%	1.52
SIC 291 (Refining)					
Insurance	γ_2	-0.094%	-0.001%	0.093%	0.21
	γ_3	-0.209%	-0.296%	-0.087%	0.21
	$\gamma_2 + \gamma_3$	-0.303%	-0.297%	0.006%	0.00
Moratorium	γ_4	0.185%	0.103%	-0.082%	0.20
	γ_6	-0.124%	-0.093%	0.031%	0.03
	$\gamma_4+ \gamma_6$	0.061%	0.010%	-0.051%	0.04
Court Order	γ_5	0.120%	0.399%**	0.279%	2.11
SIC 353 (Machinery and Equipment)					
Insurance	γ_2	0.232%	0.133%	-0.099%	0.08
	γ_3	0.331%	0.080%	-0.251%	0.56
	$\gamma_2 + \gamma_3$	0.563%	0.213%	-0.350%	0.52
Moratorium	γ_4	-1.391%***	-1.874%***	-0.483%	2.10
	γ_6	-0.641%**	-0.495%	0.146%	0.19
	$\gamma_4+ \gamma_6$	-2.032%***	-2.369%***	-0.337%	0.50
Court Order	γ_5	-0.017%	0.242%	0.259%	0.59

Table 6 (Continued)

	Event Date	Low Leverage (< median)	High Leverage (> median)	Difference (H-L)	F-value
SIC 461 (Pipelines)					
Insurance	γ_2	-0.697%***	-1.085%***	-0.388%*	3.61
	γ_3	0.515%	0.417%*	-0.098%	0.24
	$\gamma_2 + \gamma_3$	-0.182%	-0.668%*	-0.486%*	2.84
Moratorium	γ_4	0.065%	-0.235%	-0.300%	2.31
	γ_6	0.230%	-0.007%	-0.237%	1.45
	$\gamma_4 + \gamma_6$	0.295%	-0.242%	-0.537%*	3.65
Court Order	γ_5	0.335%	0.222%	-0.226%	0.32
SIC 517 (Bulk Stations and Terminals)					
Insurance	γ_2	-0.328%	-0.992%***	-0.664%	2.25
	γ_3	0.367%	0.436%	0.069%	0.03
	$\gamma_2 + \gamma_3$	-0.568%	-1.297%	-0.729%	0.91
Moratorium	γ_4	-0.151%	0.129%	0.280%	0.43
	γ_6	0.000%	-0.006%	-0.006%	0.00
	$\gamma_4 + \gamma_6$	-0.151%	0.123%	0.274%	0.20
Court Order	γ_5	0.012%	0.366%	0.354%	0.67

CONCLUSION

The Deepwater Horizon explosion and the related events which followed during the late spring and summer of 2010 greatly impacted the environment, economy, and oil industry. While we find little stock impact relating to the explosion itself – most likely owing to the slow release of information about the event – we do find that the Obama Administration's moratorium on drilling in the Gulf of Mexico had significant negative wealth impacts on the stock returns of oil firms directly involved with the rig's explosion and for oil firms involved in the drilling and machinery and equipment industries. We also find evidence to support the expectation that firms with greater exposure to operations in

the Gulf of Mexico have significantly lower returns and that oil firms in the pipeline and bulk stations and terminal areas show negative impacts from the increased costs due to financial assurance and insurance. Finally, in general, firms with a weaker financial position (higher leverage) tend to have lower returns, although this result is not uniform. In all, the results provide more support for contagion effects over competitive effects that the explosion was bad for all oil firms as opposed to an opportunity for those firms not directly involved to gain at the expense of Deepwater Horizon firms.

REFERENCES

Associated Press (2010). "Companies Sue over Drilling Moratorium." *Mississippi Business Journal*, June 11, 2010. Accessed March 31, 2011.

http://msbusiness.com/blog/2010/06/companies-sue-over-drilling-moratorium/.

Bhargava, R. & Fraser, D.R. (1998). "On the wealth and risk effects of commercial bank expansion into securities underwriting: An analysis of Section 20 subsidiaries." *Journal of Banking and Finance*, 22(4), 447-465.

Broder, J.M. & Krauss, C. (2010). "Job Losses over Drilling Ban Fail to Materialize." New York Times. August 25, 2010. Accessed March 24, 2011. http://www.nytimes.com/2010/08/25/us/25drill.html.

Carey, A. (2011). "Interior Secretary Salazar Cracks Under Pressure and Begins Issuing Gulf of Mexico Drilling Permits." *The Daily Caller*, March 1, 2011. Accessed March 31, 2011. http://dailycaller.com/2011/03/01/interior-secretary-salazar-cracks-under-pressure-and-begins-issuing-gulf-of-mexico-drilling-permits/.

Carmel, R. & Yekrangi, A. (2010). "An Overview of Offshore Oil Drilling Risks, Legislation

and Offshore Physical Damage Insurance Policies." *Coverage* Vol. 20(6), 1, 12-18.

Department of Interior Press Release (2010). "Salazar Calls for New Safety Measures for Offshore Oil and Gas Operations, Orders Six Month Moratorium on Deepwater Drilling." May 28, 2010. Accessed March 24, 2011. http://www.doi.gov/news/pressreleases/Salazar-Calls-for-New-Safety-Measures-for-Offshore-Oil-and-Gas-Operations-Orders-Six-Month-Moratorium-on-Deepwater-Drilling.cfm.

Department of Interior Press Release (2010). "Secretary Salazar Issues New Suspensions to Guide Safe Pause on Deepwater Drilling." July 12, 2010. Accessed March 24, 2011. http://www.doi.gov/news/doinews/Secretary-Salazar-Issues-New-Suspensions-to-Guide-Safe-Pause-on-Deepwater-Drilling.cfm#.

Dimson, E. (1979). "Risk Measurement when Shares are Subject to Infrequent Trading." *Journal of Financial Economics*, Vol. 7, No 2, 197-226.

Favole, J.A., Power, S. & Chazan, G. (2010). "Obama Vows Tougher Stance on Oil Industry." *The Wall Street Journal Online*. May 28, 2010. Accessed April 2, 2011. http://online.wsj.com/article/SB10001424052748704269204575270031411598538.html.

Holm, E. (2010). "Insurance Premiums for Offshore Drilling Soar 15%-50%." *The Wall Street Journal Online*. May 25, 2010. Accessed March 25, 2011. http://online.wsj.com/article/SB10001424052748704167704575258772553997694.html.

House Bill (2010). "H.R. 5214--111th Congress: Big Oil Bailout Prevention Act of 2010." GovTrack.us (database of federal legislation). Accessed April 11, 2011. http://www.govtrack.us/congress/bill.xpd?bill=h111-5214.

Mason, J.R. (2010). "The Economic Cost of a Moratorium on Offshore Oil and Gas Exploration to the Gulf Region." *American Energy Alliance*, 23 pages.

Pearson, N.O. (2010). "Offshore Insurance to Shrink as Providers Flee BP-Like Risk." *Bloomberg*, June 24, 2010. Accessed March 29, 2011. http://www.bloomberg.com/news/2010-06-24/offshore-oil-drilling-insurance-to-shrink-as-providers-flee-bp-like-risk.html.

Postal. A. & MacDonald, C. (2010). "Liability Cap Hike Could Drive Drillers Out of U.S. Waters, Institute Warns*." Property Casualty.com*. June 28, 2010. Accessed March 29, 2011. http://www.propertycasualty360.com/2010/06/28/liability-cap-hike-could-drive-drillers-out-of-us-waters-institute-warns.

Power, S. "Judge Overturns Drilling Ban." *The Wall Street Journal* Online, June 23, 2010. Accessed April 1, 2011. http://online.wsj.com/article/SB10001424052748704853404575322942341022322.html.

Saunders, A. & Smirlock, M. (1987). "Intra- and interindustry effects of bank securities market activities: The case of discount brokerage." *Journal of Financial and Quantitative Analysis*, 22, 467-482.

Scholes, M. & Williams, J. (1977). "Estimating Betas from Non-synchronous Data." *Journal of Financial Economics*, Vol. 10, No 1, 83-105.

Stilley, R. (2011). "How to Kill My Company." *Mobile Press-Register*, March 25, 2011, A12.

Yildirim, H.S., Kwag, S.W., & Collins, M.C. (2006). "An Examination of the Equity Market Response to The Gramm-Leach-Bliley Act Across Commercial Banking, Investment Banking, and Insurance Firms." *Journal of Business Finance & Accounting*, Vol. 33, Nos 9&10, 1629-1649.

Zellner, A. (1962). "An Efficient Method of Estimating Seemingly Unrelated Regressions and Tests for Aggregation Basis." *Journal of American Statistical Association*, Vol 57, 348-368.

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