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ISOLATING THE CORPORATE REPUTATIONAL RISK IN ENVIRONMENTAL OIL SPILL DISASTERS

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Abstract

This paper isolate the corporate reputational risk incurred by Oil and Gas companies, listed in the NYSE, derived from recent medium sized and large oil spill disasters occurred from 2005 to 2011 in the US. For this purpose, we conduct a standard short-horizon daily event study analysis to calibrate the potential impact of such environmental episodes on the market value of the firms analyzed. Since the accidental spillages are proved to have a negative effect on the cumulative abnormal returns (henceforth, CAR) of the firm's stock, reputational risk can be identified by adjusting abnormal returns by a certain Loss Ratio, in order to capture the difference between the plummeted firm's market value and the operational loss incurred by the company. The new magnitude, CAR (Rep), is then introduced to disentangle operational losses from reputational damage.

JEL classification: G14; L71; Q51.

Keywords: Corporate Reputational Risk; abnormal returns; sevent study; oil spills

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1. Introduction

In the last few years, due to the current financial crisis, reputation and reputational risk have emerged as significant issues in corporate studies. The growing importance of corporate reputation translates into competitive advantage, which is closely linked to profits and shareholder value. In a broad sense, reputation is defined as the observers' collective judgments of a corporation based on the assessments of the financial, social, and environmental impacts attributed to the corporation over time (Barnett et al. 2006). Reputational risk arises when a negative publicity, triggered by certain business events, whether accurate or not, compromises the company's reputation giving rise to an economic loss for the firm. Triggering events usually occur within the company and affect the quality or safety of business products and services. The concept of reputation is too wide depending of the discipline: from the strategic management point of view reputation is considered a resource whereas sociologically reputation is defined as an outcome of shared socially constructed impressions of a firm (Fombrun and Van Riel, 1997). Fombrun (1996) describes reputation as a strategic asset that produce tangible benefits: premium prices for products, lower costs for capital and labor, improved loyalty from employees, greater latitude in decision making, and a cushion of goodwill when crises hit. As such, reputation is viewed as an intangible asset with the potential for value creation (Little and Little, 2000; Roberts and Dowling, 2002).

Scott and Walsham (2005) point out that reputation takes time to be built up, it cannot be brought and it is easily damaged. In addition, reputation depends on the context: that is, different organizations will have different reputation characteristics depending on the details of their situation (Deephouse and Carter, 2005). Reputation, therefore, while being an intuitively appealing concept is a complex organizational characteristic and this affects how it can be formally studied. Fombrun et al. (2000) contend that reputational capital is at risk in everyday interactions between organizations and their stakeholders with risks having many sources such as strategic, operational, compliance and financial.

In the financial field, operational losses suffered by bank industry often imply reputational consequences which are observed directly in the stock markets. Although operational risk is explicitly defined by the Basel Committee on Banking Supervision (2006) as the risk of losses resulting from inadequate or failed internal processes, people and systems or from external events, this definition exclude strategic risk and reputational risk[1]. It is in 2009, when the Committee includes a definition of reputational risk as the risk arising from negative perception on the part of customers, counterparties, shareholders, investors, debt-holders, market analysts, other relevant parties or regulators that can adversely affect a bank´s ability to maintain existing, or establish new, business relationships and continued access to resources of funding. Moreover, the Committee states that reputational risk is multidimensional and reflects the perception of the market participants (Basel Committee, 2009). Surprisingly, while Basel II accord obliges financial institutions to quantify operational risk and estimating

[1] The preliminary approach of reputational risk is described as "the risk of significant negative public opinion that results in a critical loss of funding or customers" (Basel Committee, 1998).

capital charges for covering it, they are not obliged to hold capital requirements for reputational risk. In the recent financial literature, there are empirical studies which address reputational risk as a consequence of operational losses. De Fontnouvelle and Perry (2005) analyzed operational loss announcements within the bank industry. They found significant and negative impact on the prices, even much larger when the operational loss is due to internal fraud. A loss in market value appears to be up to six times larger than the actual loss amount when the internal fraud event takes place in a country with strong shareholders rights. Cummins et al. (2006) carried out an event study to test the impact of the announcement of operational losses, suffered by US bank and insurance companies, on the stock market. The event study analysis reveals a significant negative stock reactions to operational events for both banks and insurers The loss experienced in terms of market value beats the operational loss itself, indicating a negative effect on firm's reputation. Miccoci et al. (2009) conducted an event study analysis on stock prices to calibrate the announcement of operational losses due to internal fraud within the financial sector, introducing the concept of Value at Risk for measuring the reputational effect. Gillet et al. (2010) used a sample of European and US financial firms to test the negative impact of operational losses announcements. Reputational damage arises since the decrease in the market value is higher than the operational loss announced, particularly for internal fraud events. Sturm (2010) also focussed on the European financial companies to study the market reaction to the announcement of operational losses. The reputational damage is confirmed, particularly for firms with high liabilities to assets ratio than companies with more equity. More specifically, Ruspantini and Sordi (2011) assessed the reputational risk impact of internal fraud events within the Unicredit Group Italian retail branches, from the customer's point of view. Fiordelisi et al. (2013) examine the main determinants of reputational risk in the banking sector derived from operational events.

In the case of nonfinancial firms, most of the existing literature focuses on the stock market reaction to internal fraud (Dyck et al., 2010) or single catastrophic events, but little attention has been paid to the reputational risk quantification. Bowen et al. (1983) examined electric utility share price reaction to the Three Mile Island (TMI) accident in 1979, obtaining statistically significant negative price reactions for nuclear-dependent utility stocks. Kalra et al. (1993) analyzed US stock market reaction to the Chernobyl nuclear accident in 1986, finding negative price reactions to the explosion for nuclear and non-nuclear utilities. Blacconiere and Pattem (1994) focused on the Bhopal toxic chemical leak caused by Union Carbide in 1984. The Bhopal accident was followed by legislative proposal to tighten regulation and negative intra-industry market returns in the chemical industry. Hamilton (1995) found negative statistically significant abnormal returns for firms reporting emissions under the first Toxic Release Inventory (TRI), published in 1989. White (1996) studied the investor responses to the Exxon Valdez oils spill in 1989, giving rise to significant cumulative and lasting negative abnormal returns for the company after the accident. Magness (2010) examined share prices behavior following the environmental accident at a Placer Dome mine in the Philippines in 1996, demonstrating the contagion effect in the capital market. Capelle-Blancard and Laguna (2010) focused on the stock market reaction to industrial disasters such as explosions in petrochemical industry. They showed that the stock market reacts negatively and instantaneously after the accident. Heflin and Wallace (2011) investigated the impact of the BP oil spill in 2010 on the shareholder wealth of oil and gas firms. Their results suggested no shareholder wealth changes for the whole industry, but only for firms with offshore operations in the US waters experienced a significant decline in wealth. Ferstl et al. (2012) applied the event study methodology to evaluate the impact of the Japanese Fukusima-Daiichi nuclear disaster on the stock prices of an international nuclear and alternative energy firms. They obtained significant abnormal returns for Japanese, French and German nuclear utilities firms except for US companies analysed.

In this paper, we attempt to quantify the reputational risk incurred by non financial firms, particularly Oil and Gas producers, after suffering from an environmental disaster such as an oil spill. Catastrophic spillages like the British Petroleum disaster in the Gulf of Mexico (2010), among others, provide with scandalous news headlines, offering disheartening pictures of oil coated shorelines and dead or oiled birds and sea animals. Considered one of the worst oil spill in history and a massive ecological disaster, the BP's Deepwater Horizon rig provides with the most visible example of reputational risk due to operational failures when extracting crude oil. Apart from the environmental impact, oil spillages are perceived by investors as a very serious matter turning into financial implications in capital markets. Event study methodology which relies on Efficient Market Theory (Fama, 1970) is applied to examine the US stock market reaction to the most recent biggest oil spill events from 2005 to 2011. Since the drop in market value of the firm penalized is much higher that the economic compensation for restoring the ecological damage, then reputational risk can be identified and even quantified. For this purpose, we transpose from the banking industry some measures for capturing the reputational damage: the Loss Ratio (de Fontnouvelle and Perry, 2005) and the Reputational Abnormal Return (Gillet and Roland, 2010).

The remainder of this paper is organised as follows: section 2 describes the sample and data used; sections 3 provides a theoretical background of the event study methodology; section 4 explains the design of our research; section 5 presents the main findings and results and section 6 points out the conclusions.

2. Data and sample

For conducting our analysis, we have selected the recent oil spill disasters in the US, suffered from Oil and Gas companies, listed on the NYSE, from 2005 to 2011. In particular, we focus on the British Petroleum (BP), Chevron (CVR), ExxonMobil (XOM), Murphy Oil (MUR) and Valero Energy (VLO) as table 1 illustrates:

Table 1. Sample of Oil and Gas Producers

	Ticker	Company	Total Revenue*
	MUR	Murphy Oil USA	27,745,549
	CVX	Chevron Corporation	253,706,000
	BP	BP Corporation	375,517,000
	VLO	Valero Energy	125,987,000
Companies	XOM	ExxonMobil Corporation	486,429,000

(*) at December, 31 (2011)

The companies above are responsible for the following oil spill events in the US within the period analyzed, as table 2 summarizes:

Table 2. Sample of Oil Spill Events.

Event Code	Event Date	Location	Company	Tones*	Event Description
OS-1	August 30, 2005	Louisiana	MUR	3,409.09	*A tank leaked at Murphy's refinery in Meraux, southeast of New Orleans, spilled after being rocked by floodwaters provoked by Hurricane Katrina.*
OS-2	February 13, 2006	New Jersey	CVX	100.65	*The oil was discharged from a leak in a pipeline at the Chevron Perth Amboy facility in the areas of New York/New Jersey Harbor in the area of the Arthur Kill and Raritan Bay.*
OS-3	March 2, 2006	Alaska	BP	689.13	*The crude leaked was caused by internal corrosion in the transit pipeline at the state's northern tip. The spill was detected on 2 March and plugged.*
OS-4	June 1, 2006	Texas	VLO	463.64	*Heavy rains caused portions of the refinery to flood and spill oil into the Port of Corpus Christi.*
OS-5	April 20, 2010	Gulf of Mexico	BP	8,000,000	*A natural gas blowout on the Deepwater Horizon oil rig traveled back up its wellbore and ignited, causing a fire that burned for two days before the rig sank. The explosion killed 11 workers and spilled millions of barrels of crude oil into the gulf.*
OS-6	June 11, 2010	Utah	CVX	109.09	*The June 11-12 spill unleashed soaking Red Butte Creek, the Liberty Park pond and parts of the Jordan River. The pipeline leaked crude oil for more than ten hours before Chevron received notification of the failure from the fire department.*
OS-7	July 1, 2011	Montana	XOM	204.55	*A pipeline ruptured and leaked hundreds of barrels of oil into the waterway, causing a 25 mile plume that fouled the riverbank and forced municipalities and irrigation districts downstream to close intakes.*

(*) in thousands

We also perform an Exploratory Data Analysis[2] (EDA) of the operational losses incurred by the companies in our sample as well as their market value at the event date. The descriptive statistics are given in the Table 3:

[2] Hoaglin et al. (1983)

Table 3. Summary statistics for the operational losses

Event Code	Operational Loss
OS-1	67,000
OS-2	1,045
OS-3	20,000
OS-4	1,950
OS-5	1,000,000
OS-6	80,429
OS-7	1,600
Mean	167,432
Median	20,000
Std Dev.	368,585.35
Min	1,045
Max	1,000,000

sample

(*) in thousands USD

According to the International Tanker Owners Pollution Federation Limited[3] (ITOPF, 2011) the number of large spills (over 700 tones) has decreased significantly during the last 42 years. The average number of major spills for the previous decade (2000-2009) is just over three, approximately eight times less than for the 1970s. A decline can also be observed with medium sized spills (from 7 to 700 tones). Here, the average number of spills in the 2000s was close to 15, whereas in the 1990s the average number of spills was almost double this number. The vast majority of spills are small (below 7 tones) and data on numbers and amounts is incomplete due to the underreporting.

In order to ensure sufficient reputational impact in the media, we select medium sized and large oil spills exceeding 100 tones. We have used Thomson Reuters Data Stream for obtaining the daily stock prices, the market value of each firm, and the S&P 500 market index quotes. Other complementary information regarding the size of the operational loss, the name and country of the company, as well as a detailed description

[3] See www.itopf.com

of the event have been collected from Reuters and others press releases verified via LexisNexis® Academic[4]. The operational losses of each company are published in a range of half a year to year and a half after the announcement of the spill; press releases emerged shortly after the event day is usually a first estimation of the loss. Thus, we choose the amount payable to the company imposed by the Courts months after the spill referred to cleanup and restoration of the area, violation of the Clean Water Act (1972) and future environment projects. The amount payable varies between companies based on the number of barrels of fuel spilled, and the existence of negligence by the company. Future possible payments after the year and a half are rejected in order to filter as well as costs incurred by the company related to damage to installations.

3. Methodological Background

Event study methodology was first applied by Ball and Brown (1968) and Fama et al. (1969), Dodd and Warner (1983), Brown and Warner (1985), and MacKinlay (1997) provides with a wide explanation of such methodology. Focusing in finance, event study technique is considered as a powerful tool whose contribution is twofold (Binder, 1998); testing market efficiency and examining the impact of an event on shareholder wealth.

The event study methodology relies on the Efficient Market Theory (Fama, 1970) which holds that the publicly traded share prices include current and expected firm financial performance in the market valuation, based on publicly available information. Therefore, a change in a stock return following an environmental event implies that the market imputes a change in net present value of the firm as a result of this event

[4] See www.lexis-nexis.com

(Klassen and McLaughlin 1996). Conceptually, event study technique differentiates between the expected returns obtained in the case the event would not have taken place – normal returns– and the returns emerged from the respective event –abnormal returns– . The abnormal returns AR_{it} are defined as the difference between the actual return (R_{it}) of a stock and the normal return (NR_{it}) in case the event has no occurred:

$$AR_{it} = R_{it} - NR_{it} \tag{1}$$

The determination of the normal returns is performed using the estimation of some parameters within the estimation window (250 trading days). A benchmark model is necessary for predicting the normal returns around the event date. Peterson (1989) suggests that there are three kinds of techniques: mean-adjusted models, market models and market –adjusted models. The market model (Sharpe, 1963) is commonly used in the literature to estimate the expected returns as in Brown and Warner (1985), Curran and Moran (2007), Sturm (2010) and Ruspantini and Sordi (2011), Fiordelisi et al. (2013). The market model relates the return of any stock to the return of the market portfolio:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it} \tag{2}$$

where,

R_{it} is the return of stock *i* on day "*t*".

R_{mt} is the return of the market index on day "*t*".

α_i is the constant term.

β_i is a measure of the sensitivity between R_i with respect to R_m.

ε_{it} is the random disturbance term.

The normal or expected returns of stock "i" on day "t" are estimated from the market model by Ordinary Least Squares (OLS) as follows:

$$NR_{it} = \widehat{\alpha_i} + \widehat{\beta_i} R_{mt} \tag{3}$$

where,

NR_{it} the normal return of a stock "i" is at time "t".

R_{mt} is the market index;

$\widehat{\alpha_i}$ and $\widehat{\beta_i}$ are the parameters estimated by OLS.

As checked from previous equations (2) and (3), the abnormal returns can be interpreted as the residuals or prediction errors of the benchmark model. Assuming there are N firms in the sample, we can define a matrix of abnormal returns, Σ , as:

$$\Sigma = \begin{pmatrix} AR_{1,T_1} & \cdots & AR_{N,T_1} \\ \vdots & & \vdots \\ AR_{1,0} & \cdots & AR_{N,0} \\ \vdots & & \vdots \\ AR_{1,T_2} & \cdots & AR_{N,T_2} \end{pmatrix} \tag{4}$$

Each column of this matrix is a time series of abnormal returns for firm "i", whereas each row is a cross section of abnormal returns for each time point within the event window (T_1, T_2). In order to examine the stock reactions around events, each firm's return data could be analyzed separately. Such analysis is usually improved by averaging the information over the whit is not very ole sample. The unweighted cross-sectional average of abnormal returns in period *t* can be defined as:

$$\overline{AR_{it}} = \frac{1}{N}\sum_{i=1}^{N} AR_{it} \tag{5}$$

Moreover, it is also interesting to study the cumulative abnormal returns, calculated within the event window, by aggregating AR_{it} from T_1 to T_2:

$$CAR_i = \sum_{t=T_1}^{T_2} AR_{it} \tag{6}$$

Finally, in event studies, CAR_i's are usually aggregated over the cross-section of events giving raise to the cumulative average abnormal returns:

$$\overline{CAR} = \frac{1}{N}\sum_{i=1}^{N} CAR_i \tag{7}$$

Another way to obtain $\overline{CAR}$ consists of summing up the $\overline{AR}$'s over time, that is:

$$\overline{CAR} = \sum_{t-t_1}^{t_2} \overline{AR_t} \tag{8}$$

In summary, abnormal returns are obtained from event studies as an outcome; which are averaged ($\overline{AR}$), cumulated over time (CAR) and then averaged again ($\overline{CAR}$). The last step in the event study methodology is to test the statistical significance by verifying that the changes in stock prices are not random.

4. Research Design

For designing our research, a standard short-horizon daily event study is performed. We follow Fama et al. (1969), Mackinlay (1997) and Kothari and Warner (2006) as an initial approach. In particular, we assess the US market reaction to oil spill announcements occurred from 2005 to 2011, detailed in section 2. Our main hypothesis is to test whether oil spill disasters affect negatively firm's reputation. In order to isolate the pure reputational effect of the operational losses provoked by the oil spills, we follow a similar approach suggested by Fiordelisi et al. (2013) and Gillet and Roland (2010), based on De Fontnouvelle and Perry (2005) Loss Ratio. In short, we adjust the abnormal returns by adding a modified Loss Ratio, defined as the operational loss divided by the decrease in market value experienced by the firm. Reputational abnormal returns $AR(Rep)$ are then calculated as follows:

$$AR_{i0}(Rep) = AR_{i0} + \left| {Loss_i}/{\Delta\nabla Market\ Cap_i} \right| \tag{9}$$

Where AR_{i0} is the abnormal return for firm "*i*" at day 0 (event day), $Loss_i$ is the operational loss amount suffered from the firm "*i*" and $Market\ Cap_i$ is the market capitalization of the firm "*i*". In case that the loss is unknown on the considered date, it takes the absolute value of a known loss announced latter.

According to Dyckman et al. (1984), we use the market model as the benchmark for estimating the expected or normal returns (see equations 2 and 3). Our estimation window comprises 250 trading days for each particular event as in Gillet et al. (2010), Magness (2010) and Micocci et al. (2009). Martin and Moran (2007) suggest defining the event window in such a way that captures any leak of information prior to the event date as well as changes in share prices due to latecomers to the announcement. Three event windows, including the event date (t=0), have been designed: E_1(-5, +5), E_2(-10, +10) and E_3(-20, +20), that is, from 5, 10 and 20 days prior to the event date to 5, 10 and 20 post-event days, respectively. It should be noted that the event windows are not included in the estimation window in order to avoid overlapping.

In order to calculate the daily stock's returns and S&P 500 (market index) returns we apply the natural logarithm equation[5]:

$$R_{it} = ln\left(\frac{P_{it}}{P_{it-1}}\right)$$

(10)

Where,

P_{it} is the price of the firm's stock *i* at day *t*.

P_{it-1} is the price of the firm's stock *i* at the previous day.

[5] See Strong (1992) and Wells (2004).

The first step in our study is to estimate the expected returns by OLS regression (see equation 2) within the estimation window. The stock's abnormal returns AR_{it} are calculated by difference between the actual and expected returns (see equation 1). In an event study, rather than the abnormal returns of each particular firm, it is even more interesting to analyze the average abnormal returns for the sample (see equation 5). Assuming the Central Limit Theorem, normality tends to increase as the sample does (Brown and Warner, 1985). There are numerous ways of conducting a normality test such as the Anderson-Darling (A-D) or the Kolmogorov-Smirnov (K-S) tests. For sample sizes below 200, Anderson-Darling test is suggested[6]. We have conducted the A-D test on the average abnormal returns for each event windows E_1, E_2 and E_3 (see Appendix 2) proving the normality assumption.

Having checked the normality assumption, it is time to test the significance of the cumulative abnormal returns (see equation 6). Now, the null hypothesis is that the expected cumulative return is equal to zero, that is:

$$H_0 = E(CAR_{it}) = 0 \tag{11}$$

For testing this hypothesis, apart from the previous parametric t-test, we also carry out two nonparametric tests. According to Campbell and Wasley (1993) the inclusion of nonparametric test provides a check of the robustness of conclusions based on the parametric test. In particular, we use the Sign test[7] (see Mackinlay, 1997) and Wilcoxon test[8]. Since the adjusted abnormal returns $AR(Rep)$ (see equation 9) potentially capture

[6] Stephens (1974)
[7] The sign test is a simple binomial test of whether the frequency of positive abnormal residuals equals 50%.
[8] See Wilcoxon (1945) and Siegel (1956).

more precisely the damage to reputation of the firm responsible for the oil spill, we apply the same rationale to the raw CAR , given raise to the $CAR(Rep)$.

5. Main findings and results

The following table summarizes the results obtained from the parametric t-test conducted on cumulative abnormal returns for the three event windows proposed above; E_1 (-5, 5), E_2 (-10, 10) and E_3(-20, 20).

Table 7. Parametric t-test on CAR's

Variable	Mean	t-value	*p-value*	99% CI	95% CI	90% CI
CAR (-5,5)	-0.00141	-0.69	0.506	(-0.00788 , 0.00506)	(-0.00596 , 0.00314)	(-0.00511 , 0.00229)
CAR (-10,10)	-0.02076	-6.41	0.000	(-0.02997 , -0.01155)	(-0.02751 , -0.01401)	(-0.02634 , -0.01518)
CAR (-20,20)	-0.03666	-9.41	0.000	(-0.04720 , -0.02612)	(-0.04454 ,-0.02879)	(-0.04322 , -0.03010)

For event window E_1 (-5, 5), as the p-value is greater than to our choice of significance (0.01, 0.05, 0.1), the null hypothesis (see equation 11) is accepted. On the contrary, for event windows E_2 (-10,10) and E_3 (-20, 20) the p-value is greater than the α-level, so we fail to reject the null hypothesis; in other words, the expected cumulated abnormal returns are significantly different from cero providing evidence of abnormal returns around the event date.

We also have applied two common non-parametric tests used in event studies, such as the Sign test and Wilcoxon test, in order to assess the robustness of the parametric t-test. The following tables illustrate both test results:

Table 8. Sign test on CAR's

Variable	Median	Achieved Confidence	Confidence Interval Lower	Upper
CAR (-5,5)	-0.0003	0.9346	-0.00689	0.00331
		0.95	-0.00734	0.00333
		0.9883	-0.0123	0.00358
CAR (-10,10)	-0.01627	0.9216	-0.02433	-0.01316
		0.95	-0.02579	-0.01288
		0.9734	-0.02879	-0.01231
CAR (-20,20)	-0.03064	0.9404	-0.0452	-0.02632
		0.95	-0.04755	-0.02543
		0.972	-0.05821	-0.02142

Table 9. Wilcoxon test on CAR's

Variable	Estimated Median	Achieved Confidence	Confidence Interval Lower	Upper
CAR (-5,5)	-0.00031	95.5	-0.00631	0.00309
CAR (-10,10)	-0.0189	94.8	-0.0285	-0.0133
CAR (-20,20)	-0.0368	95	-0.0451	-0.0275

From the tables above, we can infer that both the Sign test (Table 8) and Wilcoxon test (Table 9) provides with similar results to that obtained by the parametric t-test: the null hypothesis is accepted in event window E_1 (-5, 5) whereas in E_2 (-10, 10) and E_3 (-20, 20) is rejected. CAR´s are proved to be statistically significant in windows E_2 (-10, 10) and E_3 (-20, 20). In other words, the hypothesis concerning the existence of abnormal returns at event day (t=0) as well as the surrounding days, is confirmed for event windows E_2 (-10, 10) and E_3 (-20, 20) at three α-levels (0.1, 0.05, 0.01).

In order to isolate the reputational effect on the sample, we compute reputational cumulative abnormal returns $CAR(Rep)$. *CAR (Rep)* is obtained by adding the Loss

Ratio to abnormal returns at day 0 (see equation 9). The Loss Ratio for each event is presented bellow in table 10.

Table 10. Event Loss Ratios for event windows E_2 and E_3.

Event Code	Loss Ratio	
	E-2	E-3
OS-1	8.29%	9.08%
OS-2	0.01%	0.01%
OS-3	0.40%	0.49%
OS-4	0.28%	0.27%
OS-5	3.94%	2.55%
OS-6	1.05%	0.68%
OS-7	0.01%	0.01%

This time we focus on windows E_2 (-10, 10) and E_3 (-20, 20) exclusively, because of being significant in the previous analysis. Similarly, we first test the statistical significance $CAR(Rep)$ values by using a parametric t-test. The t-test confirms that $CAR(Rep)$ values are significant for the selected event windows (E_2, E_3) at the 10%, 5% and 1% confidence levels; p-values are (0.006) for E_1 and (0.00) for E_2 and E_3, respectively. Moreover, results obtained by non-parametric tests are in accordance with the t-test; as the following tables illustrates:

Table 11. Parametric t-test on $\mathbf{AR's(Rep)}$

Variable	Mean	t-value	*p-value*	99% CI	95% CI	90% CI
CAR Rep. (-10,10)	-0.01126	-5.02	0.000	(-0,01764, -0,00488)	(-0,01594, -0,00658)	(-0,01513, -0,00739)
CAR Rep. (-20,20)	-0.02748	-9.85	0.000	(-0,03503, -0,01994)	(-0,03312, -0,02185)	(-0,03218, -0,02279)

Table 12. Sign test on $\mathbf{CAR's(Rep)}$

Variable	Estimated Median	Achieved Confidence	Confidence Interval Lower	Upper
CAR (Rep) (-10, 10)	-0.01165	0.9734	-0.01399	-0.00493
CAR (Rep) (-20, 20)	-0.02632	0.9725	-0.03064	-0.01524

Table 13. Wilconxon test on $\mathbf{CAR's(Rep)}$

Variable	Median	Achieved Confidence	Confidence Interval Lower	Upper
CAR Rep. (-10,10)	-0.01084	90	0.008	0.407
		89.8	-0.01471	-0.00668
		90	-0.0324	-0.0218
CAR Rep. (-20,20)	-0.0276	98.9	0.002	0.413
		99	-0.0185	-0.0047
		99	-0.0355	-0.0181

Being proved the statistical significance of $CAR's(Rep)$ for event windows E_2 and E_3, those results are also plot against raw $CAR's$. The following charts illustrate the impact of the operational losses separately from their effect on fim's reputation for both E_2 and E_3 event windows.

In particular, the blue line in figure 1 reflects the strong market reaction to the oil spill announcements in the media by displaying the average value of the cumulative abnormal returns ($CAR's$) from ten days before (-10) to ten days after (+10) the disaster occurred. In contrast, the red line represents the reputational effect in isolation by adjusting $CAR's$ with the *Loss Ratio* at day zero; that is, the average *CAR (Rep)* is figured out for the following ten days after the oil spill disaster. $CAR's$ show a sharply negative trend to reach -5% at day (+10). The drop is not recovered until ten days after the announcement. Similarly, figure 2 shows cumulative abnormal returns behavior for event window E_3 (-20, +20). The mean cumulative abnormal returns are represented by the blue line indicating a decrease on stock market capitalization along the 20 days after the event day. As deducted from both figures, the $CAR's$ experience a more pronounced decrease for E_3 (-20, +20) than for E_2 (-10, +10); for instance, $CAR's$ are approximately (-1.8%) for E_2 and (-3.1%) for E_3 at day 0. The reputational effect is even much striking for E_3; the reputational effect appears on day 0 as even more negatively than -1% whereas for E_2 there is not reputational impact until the following 2 days. Then, *CAR (Rep)* are higher for E_3 (-20, +20) than E_2 (-10, +10).

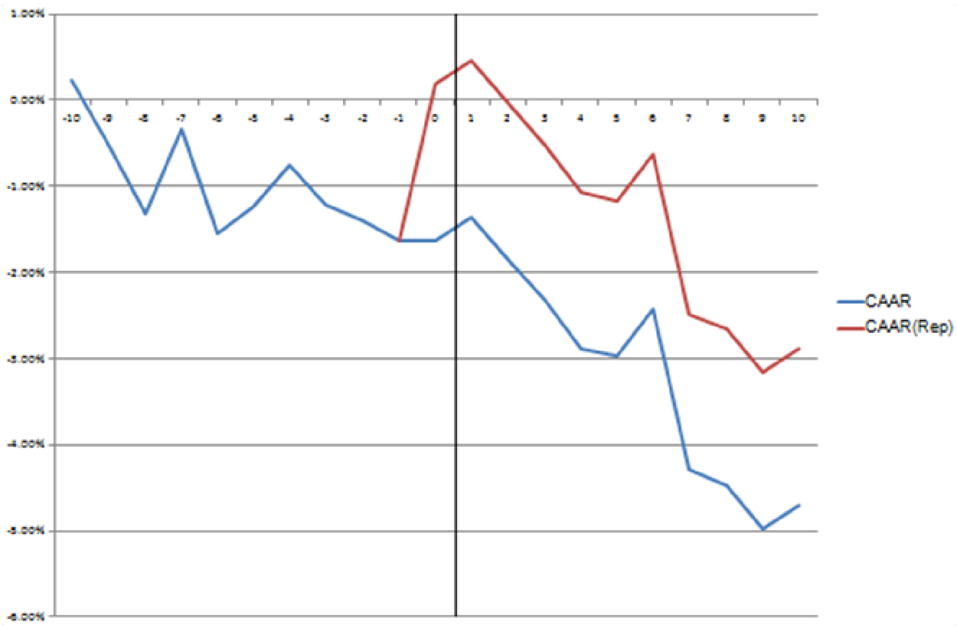

Fig. 1. CAR´s adjusted for reputation around event day within window E_2

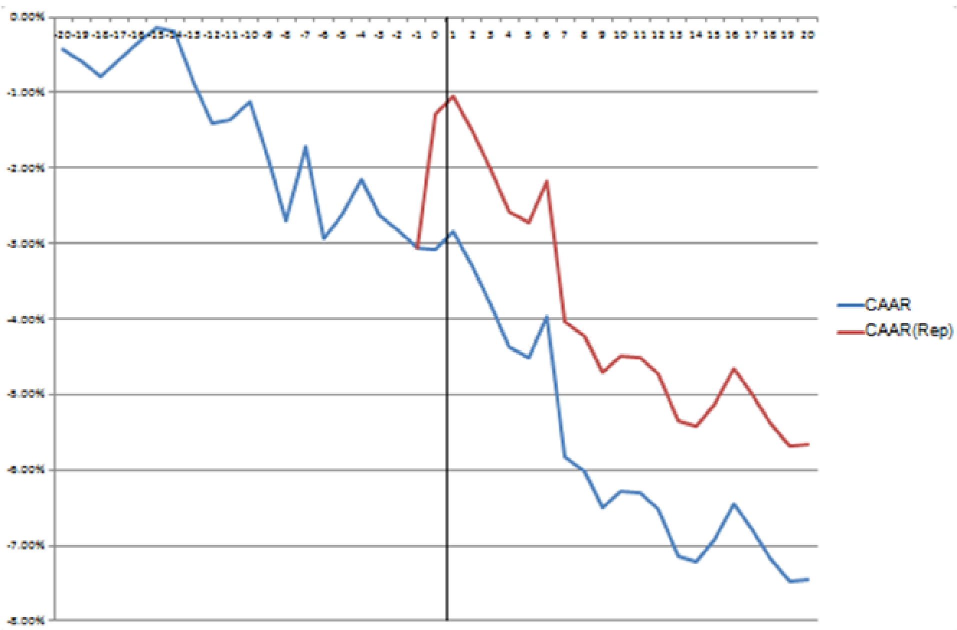

Fig. 2. CAR´s adjusted for reputation around the event day in window E_3

6. Conclusions

This study examines the impact of recent medium sized and large oil spills on the reputation of Oil and Gas companies, listed on NYSE. The research is carried out by using a standard short-horizon event study technique within three different temporary windows around the date of the announcement in media. We highlight the negative stock market reaction to an oil spill disaster even though details on the loss amount may still be unknown. More specifically, our results reveal a significant negative impact on the stock prices of the companies analysed; we also observe significant negative cumulative abnormal returns around the event date, especially for event windows composed by 21 and 41 days. Moreover, we observe that the negative effect continue along the post event 10 days and 20. A recovery is not appreciated in these time intervals. However, for the smallest event window of 11 days, the existence of abnormal returns is not observed as in the biggest ones. This implies the long persistence of reputational effects along time.

On the other hand, by using an approximation to the refined Loss Ratio, we not only identify the reputational risk but also isolate the pure reputation effect from the loss event on market returns. Results provide with strong evidence about the damage of firm´s reputation as a consequence of an oil spill event. The effect is even more pronounced in the analysis regarding the longest window (41 days); mean cumulative abnormal returns (CAR´s) are more negative than others. Similarly, the reputational effect is also more pronounced for the analysis of the longest event window from the selected.

This study provides several contributions; extending knowledge to the stream of literature regarding the assessment of semi-strong Efficient Market Theory. Concretely, regarding the stock price effects of an unfavourable environmental event for firms; we provide a study using an updated sample concerning oil spills from 2005 to 2011. Moreover, the research provides knowledge to reputational risk previous literature; understanding the appearance of reputational risk depending on is related to the investors' perception that the company may incur losses in the future as a result of a possible negligent concerning an environmental disaster.

7. References

Ball, R., Brown, P., (1968), "An empirical evaluation of accounting income numbers", Journal of Accounting Research 6, 159–178.

Barnett, M., Jermier, J. and Lafferty, B., (2006), "Corporate Reputation: The Definitional Landscape," Corporate Reputation Review, Vol. 9, No. 1, pp. 26-38

Basel Committee on Banking Supervision, 2009a, "Proposed enhancements to the Basel II framework", Consultative Document, January.

Basel Committee on Banking Supervision, 2009b, “Results from the 2008 Loss Data Collection Exercise for Operational Risk”, July.

Basel Committee on Banking Supervision, 2006, “International convergence of capital measurement and capital standards”, A revised framework. Comprehensive Version, June.

Basel Committee on Banking Supervision, (1998), “Risk Management for Electronic Banking and Electronic Money Activities”, March.

Binder, J. (1998), “The event study methodology since 1969”, Review of Quantitative Finance and Accounting, 11(2), 111-137.

Blacconiere W. and Pattem D. (1994), “Environmental Disclosures, regulatory costs, and changes in firms Value”, Journal of Accounting and Economic, 18: 357-477

Bowen, R., Castanias, R. and Daley, L., (1983), “Intra-Industry Effects of the Accident at Three Mile Island”, Journal of Financial and Quantitative Analysis, 18:87-108.

Brown, S.J., Warner, J.B., (1985), “Using daily stock returns: the case of event studies”, Journal of Financial Economics 14, 3–31.

Campbell, C. and Wasley C.(1996), “Measuring abnormal trading volume for samples of NYSE/ASE and NASDAQ securities using parametric and non-parametric test statistics”, Review of Quantitative Finance and Accounting, 6, 309–326.

Cannas, G., Masala, G., & Micocci, M. (2009), “Quantifying reputational effects for publicly traded financial institutions”, Journal of Financial Transformation, 27, 76-81.

Capelle-Blancard, G. and Laguna, M. (2010), “How Does the Stock Market Respond to Chemical Disasters?”, Journal of Environmental Economics and Management, 59(2), 192–205.

Cummins, J. David, Christopher M. Lewis, and Ran Wei, 2006: “The market value impact of operational loss events for US banks and insurers”, Journal of Banking and Finance 30, 2605-2634.

De Fontnouvelle, P., and Perry J., (2005): “Measuring reputational risk: The market reaction to operational loss announcements”, Working Paper, Federal Reserve Bank of Boston.

Deephouse, D.L. and Carter, S.M. (2005), “An examination of differences between organizational legitimacy and organizational reputation”, Journal of Management Studies, Vol. 42 No. 2, pp. 329-60.

Dodd, P., Warner, J.B., (1983). “On corporate governance: a study of proxy contests”. Journal of Financial Economics 11, 401–438.

Dyck, A., Morse, A., Zingales, L., (2010). “Who blows the whistle on corporate fraud?”. Journal of Finance 65 (6), pp. 2213–2253.

Dyckman, T.; Philbrick, D. y Stephan, J. (1984), “A Comparison of Event Study Methodologies Using Daily Stock Returns: A Simulation Approach”, Journal of Accounting Research, Vol.22, 1-33.

Fama, E., (1970), “Efficient capital markets: a review of theory and empirical work”, Journal of Finance
25, 383-417.

Fama, E., (1969),“The adjustment of stock prices to new information”, International Economic Review 10, pp. 1–21.

Ferstl, Robert, Utz, Sebastian and Wimmer, Maximilian, (2012), "The Effect of the Japan 2011 Disaster on Nuclear and Alternative Energy Stocks Worldwide: An Event Study", BuR Business Research Journal, Vol. 5, No. 1, pp. 25-41, May.

Fiordelisi, F., Soana, M.G. and Schwizer, P. (2013),"The determinants of reputational risk in the banking sector, Journal of Banking and Finance, 37, pp. 1359-1371.

Fombrun, C. (1996), "Reputation: Realizing Value from the Corporate Image", Harvard Business School Press, Boston, MA.

Fombrun, C. and Van Riel, C. (1997), "The reputational landscape", Corporate Reputation Review, Vol. 1 Nos 1-2, pp. 5-13.

Fombrun, C.J., Gardberg, N.A. and Barnett, M.L. (2000), "Opportunity platforms and safety nets: corporate citizenship and reputational risk", Business and Society Review, Vol. 105 No. 1, pp. 85-106.

Gillet, R., Hübner, G., and Plunus, S. (2010), "Operational risk and reputation in the financial industry", Journal of Banking and Finance 34, 224-235.

Hamilton J. (1995), "Pollution as news: media and stock markets reactions to the Toxic Release Inventory Data", Journal of Environmental Economics and Management Review, 28: 98-113.

Heflin, F. and Wallace, D. (2011), "The BP Oil Spill: Shareholder Wealth Effects and Environmental Disclosures". Working paper series, available at SSRN: http://ssrn.com/abstract=1933531

Hoaglin, D., Mosteller, F., and Tukey, J., (1983), "Understanding robust and exploratory data analysis" Wiley New York.

Kalra, R., Henderson, G. and Raines, G., (1993), "Effects of the Chernobyl Nuclear Accident on Utility Share Prices", Quarterly Journal of Business and Economics, 32(2):52-77.

Klassen, R., McLaughlin, C., (1996), "The impact of environmental management on firm performance". Management Science 42, 1199–1214.

Kothari, S., & Warner, J. (2006), "Econometrics of event studies". Chapter 1 in eckbo, BE. 2006. Handbook of corporate finance: Empirical corporate finance. Handbooks in Finance Series. Elsevier/ North-Holland.

Little, P.L. and Little, B.L. (2000), "Do perceptions of corporate social responsibility contribute to explaining differences in corporate price-earnings ratios? A research note". Corporate Reputation Review, Vol. 3 No. 2, pp. 137-42.

MacKinlay, C., (1997), "Event studies in economics and finance". Journal of Economic Literature 35, 13–39.

Magness, V. (2010), "Environmental disclosure in the mining industry: A signaling paradox?". Martin Freedman, Bikki Jaggi, in (ed.) Sustainability, Environmental Performance and Disclosures (Advances in Environmental Accounting & Management, Volume 4), Emerald Group Publishing Limited, pp. 55 – 81

Martin Curran, M., & Moran, D. (2007), "Impact of the FTSE4Good index on firm price: An event study". Journal of Environmental Management, 82(4), 529-537.

Peterson, P., (1989), "Event studies: A Review of Issues and Methodology", University of Nebraska-Lincoln, p.36-57

Roberts, P.W. and Dowling, G.R. (2002), "Corporate reputation and sustained superior financial performance", Strategic Management Journal, Vol. 23 No. 12, pp. 1077-93.

Ruspantini, D. and Sordi, A. (2011), "The reputational risk impact of internal frauds on bank customers: a case study on UniCredit Group ", No. 15, May.

Scott, S.V. and Walsham, G. (2005), "Reconceptualizing and managing reputation risk in the knowledge economy: towards reputable action", Organizational Science, Vol. 16 No. 3, pp. 308-22.

Sharpe, W. (1963), "A simplified model for portfolio analysis", Management Science 9, pp. 277-293.

Siegel, S. (1956), "Non-parametric statistics for the behavioral sciences", New York: McGraw-Hill. pp. 75–83.

Strong, N., (1992), "Modelling abnormal return: a review article", Journal of Business, Financing & Accounting, Vol. 09, Issue 4, 533-553.

Strurm, P. (2010), "Operational and Reputational Risk in the European Banking Industry: The Market Reaction to Operational Risk Events", Discussion Paper Series in Economics and Management, No. 10-15.

Wells, W., (2004), "A Beginner's Guide To Event Studies", Journal of Insurance Regulation, Summer, Vol. 22, Issue 4, p. 61-70.

White, M. (1996), "Investor response to the Exxon Valdez oil spill", Working Paper, University of Virginia.

Wilcoxon, F. (1945), "Individual comparisons by ranking methods", Biometrics Bulletin 1 (6): 80–83.

Websites:

http://www.itopf.com/information-services/data-and-statistics/statistics/index.html
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http://www.exxonmobil.com Last visit July 2013

http://www.murphyoilcorp.com Last visit July 2013

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