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Reputational risk and corporate finance: A multi-event model

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Abstract

This paper develops a model for the evaluation of reputational risk and explores if certain characteristics of negative events happening to a company can explain their reputational impacts. To this aim, the paper adopts the share market value as a synthetic measure of a company's ability to create economic value and explores the reaction of the share market to the announcement of negative events (e.g. protests, accidents, corporate misconducts).

The proposed model contributes to prior research in this field with three innovative dimensions. It applies to events that have a limited impact from an operational perspective (e.g. protests, small environmental events) but could have a considerable reputational effect. It applies to different types of events that can potentially affect the stakeholders' expectations and perceptions. It addresses the determinants of reputational risk, exploring which characteristics of an event explain the share market reaction.

The empirical analysis is based on data collected over a timeframe of ten years, concerning a leading multinational company, that competes in the Oil & Gas industry and is listed on NY Stock Exchange. 67 events involving this company in this period of time are analysed through the proposed model, leading to the identification of a sub-set of events which significant reputational events are associated with and to the exploration of different factors that can explain the relevance of the reported reputational impacts.

Key words

Reputational risk, market share value, local regression models, anova

1. INTRODUCTION

Over the last decade, the issue of evaluating reputational risk has become an area of growing research interest due to two related trends: the increasing importance of reputation as a company's asset; the increasing vulnerability of companies to risks that can damage their reputation. In general terms, reputation can be defined as the expression of stakeholders' expectations and perceptions about an organization's ability to create value ([1]). Leveraging on a good reputation, a company can establish better relationships with its stakeholders (e.g. customers, suppliers, employees, policy makers) with positive returns on its financial performance ([2]; [3]). In turn, events that damage a company's reputation may lead to negative financial impacts due to losses of market share, funding, human capital and business partners. Hence, reputation is considered as a critical intangible asset able to provide a company with a significant competitive advantage ([2]; [3]); for this reason, it needs to be maintained and properly managed by paying particular attention to the so-called reputational risk – i.e. the risk of incurring into reputational damages.

This issue has become particularly relevant in the current competitive context, due to two main changes that made companies more exposed to reputational risk. First, the range of stakeholders a company should take into account has broadened: companies have to deal with the expectations of many different subjects (shareholders, customers, partners, local communities, government, public opinion) that are generally interested in different aspects of a company's performance ([4]; [5]). This means that the possible sources of reputational damage have somehow increased compared to the past. Second, the diffusion of ICT technologies, such as the internet, mobile technologies, social media, provides anybody with the possibility of broadcasting information to a large audience in a very short time, again expanding the spectrum of reputational risks and boosting risk dynamics ([6]).

Being object of these pressures, companies are facing challenges to manage reputational risk, partly due to the difficulties they encounter in measuring it and understanding its determinants ([7]). The core components of reputation – stakeholders' expectations and perceptions - are intangible and, thus, they are difficult to evaluate and also not easily manageable through traditional approaches to risk assessment and management, leading to the question that is at the basis of this work: how can we evaluate reputational risk?

With this background, the paper develops a model for the evaluation of reputational risk with two specific objectives:

1. Evaluate the reputational impact of specific events (e.g. protests, accidents, oil spills) on the economic value of a company, based on the share market reaction to the announcement of these events in the news;
2. Analyse if certain characteristics of the events (e.g. type of event, geographical location where the event takes place, pollution) can explain their reputational impact.

Like prior research in the field, this work adopts the share market value as a synthetic measure of a company's ability to create value; but it introduces three innovative dimensions in connection to the model development. First, the proposed approach applies to events that have a limited impact from an operational perspective (e.g. protest, small environmental events) but could have a considerable reputational effect. Prior research in this field mainly focused on reputational impacts related to big operational losses. Second, the proposed approach applies to different types of events that can potentially affect the stakeholders' expectations and perceptions. Prior literature typically focused in specific risk categories (e.g. frauds, negative environmental news). Finally, the proposed approach addresses the determinants of reputational risk, exploring which characteristics of an event could explain the share market reaction. Prior literature focused on the sole estimation of reputational risk.

The empirical analysis is based on data collected over a timeframe of ten years, concerning a leading multinational company, that competes in the Oil & Gas industry and is listed on NY Stock Exchange. This setting appears particularly interesting from a reputational point of view, because the Deepwater Horizon explosion in 2010 made companies operating in this sector subject to growing pressures from the public opinion and media in connection to the potential impact of their activities on the environment and the society.

The next sections include a review of prior research dealing with the evaluation of reputational risk, an outline of the data sets and the research approach followed for data analysis; a review of the results of the analysis; and finally some concluding remarks.

2. CURRENT APPROACHES TO THE EVALUATION OF REPUTATIONAL RISK

The literature concerning the evaluation of reputational risk includes two main streams of research. The first one comprises studies that developed approaches to monitor reputational risk through non-financial indicators ([8]). These works move from the identification of the elements that compose a company's reputation, that are called reputational drivers, and evaluate reputational risk based on a set of indicators that measure these reputational drivers. Rayner (2004) is paradigmatic of this approach ([8]). She identifies seven reputational drivers (financial performance and long term investment value, corporate governance and leadership, corporate responsibility, workplace talent and culture, delivering customer promise, communications and crisis management, regulatory compliance) and relates them to a set of 27 indicators. Examples of the indicators that measure the regulatory compliance driver are the number of non-conformances, the number of litigations, the use of whistleblowing systems. Clearly these approaches allow a company to evaluate the impact of reputational risk on the ability to create economic value only indirectly, since non-financial indicators lead

financial performances, but an analytical relationship between the non-financial and the financial performance is hard to find. Instead, they can serve as an early warning system to signal areas at risk from a reputational point of view ([8]).

The second stream of literature includes studies that developed models to measure reputational risk in financial terms. Most of these studies use the share market value as a synthetic measure of the financial performance of a company and analyse how the share market reacts to the announcement of critical events (e.g. operational losses, corporate misconduct, negative environmental news). The difference between the change in the share market value, that follows the announcement of the event – that is generally a loss – and the amount of the operational costs associated to the event (e.g. operational losses, fines, cleaning costs) provides an evaluation of reputational risk. In particular, if the loss in the share market value exceeds the operational costs, then there is a reputational damage.

This approach has been employed in different business sectors for analysing different risk categories. In particular, in the non-financial sector, there is a rich group of contributions that analyse the share market reaction to illegal allegations. Some of these papers date back to the eighties and the nineties ([9], [10], [11], [12], [13], [14]); whilst other are more recent ([15], [16]) confirming the long-lasting attention of researchers to this specific type of risk. Other papers address the impact of corporate governance press news ([17]) or environmental news ([18], [19], [20]). Comparing the share market loss with the operational costs related to these types of event (like costs of fines, damage awards, remediation costs), these works highlight how the market value losses often exceed the operational costs, hence indicating the existence of a reputational damage.

Similarly, there is a number of papers settled in the financial industry that explore the share market reaction to the announcement of operational losses – i.e. "loss resulting from inadequate or failed internal processes, people and systems or from external events" ([21]) ([22],

[23], [24], [25], [26], [27], [28]). Again, these papers show that, in several cases, the announcement of an operational loss is accompanied by a reputational damage.

However, the applicability of this approach depend on the availability of punctual data on the operational costs. Since these works measure reputational risk as the difference between the share value loss and the related operational loss, the latter should be known. This condition has a relevant implication in terms of the type of events that are studied: most of these works in fact analyse reputational risk associated to big operational losses, for instance greater than 10 million euros, because they are typically recorded more accurately ([23], [24]). Even if there are few papers that address both big (higher than 10 USD millions) and small operational losses, in most cases they set a minimum threshold of 1 million USD ([27], [28]). This means that the prior literature mainly focuses on the analysis of reputational risk associated to 'big issues', with more limited attention to those events that do not lead to a big loss in operational terms, but could still have a reputational impact (like a protest or an accident).

A further gap that emerges from the analysis of prior research is that only few authors have gone beyond the measurement of reputational damage, analyzing its determinants. Furthermore, those works that have addressed this point focus on exploring issues mainly related to the company's characteristics, such as the organization riskiness, level of profitability, level of intangible assets, firm capitalization, firm size, the entity of the operational losses and the business units that suffered from the operational losses ([24], [27], [28]). Instead, less attention has been given to exploring which type of events (e.g. environmental, social, economic) or which characteristics of the event (e.g. location where they happen, link to a specific business unit) lead to a reputational damage. This focus has a relevant implication in connection to the possible use of the analysis from a decision-making perspective, since they do not provide information about which characteristics of an event could determine a reputational damage. This choice limits the potential use of the analysis in

a prospective way and in particular in relation to the possibility of guiding the design of proper risk response strategies that is typically related to the type of risk that is to be managed.

3. METHODS

3.1. Data collection

The empirical work has been carried out in a multinational company operating in the Oil and Gas industry, listed on the NYSE. In this setting, data were collected through two main sources: (1) face to face interviews to achieve an overall understanding of the reputational dynamics in this field and (2) documental analysis to construct the data sets used to perform the quantitative analysis.

In the beginning, face to face interviews were carried out at the premises of the studied organization with twelve key informants from the following areas: Health, Safety, and the Environment; Environmental Management; Continuous Improvement; Quality management; International negotiations; Stakeholders management; Operations; Planning and Control; Reserves and portfolio optimization.

The interviews concerned the reputational drivers of the company and related risk factors, addressing in particular the following issues: key stakeholders and their expectations, key risks that could undermine the relationship with the stakeholders, main problems occurred in the past. This preliminary exploration allowed the researchers to achieve a better understanding of potential sources of reputational risk in the specific context, guiding construction of the data sets, subsequently built through documental analysis.

The first data set, including the events that could potentially damage the company's reputation, was built through the analysis of the news, performed by means of Lexis Nexis. In particular, a keywords search on the All English news database was performed with the keywords reported in Table 1 for the period January 2004 - June 2013. Through this search, we retrieved the news concerning events related to the following categories, involving the case company, and with an operational impact relatively limited (i.e. not exceeding 1 million euros).

[Please insert Table 1 here]

The search results were ordered by relevance, and they were cross-checked based on the article's title and summary, for eliminating the events not related with the analyzed company. For each event, the following information was reported:

- Event date, that indicates the first time when the news about an event appeared on the press;
- Geographical area, that refers to countries and continents, where the event took place.
- Event category, that defines the type of event according to the following classification: oil spill, gas leak, blow out, flaring, sabotage, fire, accident, plant closure, business interruption, project cancellation, business misconduct, complain and protests;
- Pollution, that specifies whether the event involves environmental pollution;
- Involvement of the division responsible for upstream activities.

Finally, the data set was validated by the company's interviewees, in order to double check that the identified events were all related to the organization and their impact in terms of

operational costs was not significant (i.e. not exceeding 1 million euros), the latter condition meaning that a reduction of the market share value could be almost entirely attributed to reputational dynamics. This process lead to a data set comprising 67 "potentially reputational" events.

Compared to prior research, the process of construction of the first data set is more nuanced due to the choice of not focusing on a specific type of risk or big operational losses, where ad hoc databases were already available (e.g. OpVar database, OpVantage First for the financial sector).

The second data set instead consists of a public archive including a list of price sensitive events. It consists of a register of investor communications, that are related to the company's financial performance, and are recognized by the company to have a potential to affect its share market value (e.g. publication of financial reports, dividends distribution, communications related to relevant business choices). This data set was provided by the company itself and updated continuously. We used here the list available at January 2014.

3.2. Model development

This section describes the key elements of the model designed to evaluate the reputational impact of each specific event on the company economic value and to detect the determinants that can explain the impact of each event. In particular, we defined a three-step approach based on linear modeling:

1. First, a family of local regression models (one for each event) is used to estimate - from the analysis of share market value along time - the impact of each reputational event on the company economic value;

2. Second, a family of one-way analyses of variance (one for each potential risk factor) is used to identify the characteristics of events associated with higher impacts;
3. Third, a multi-way analysis of variance (one for the entire analysis) is used to provide managers with a reputational-risk map that pinpoints situations of larger exposure to reputational risk.

As suggested in ([29]), for sake of reproducibility, we are hereby depicting in detail the entire procedure of data analysis.

3.2.1 Analysis of the impact of single events on the company economic value

First, we fit a local linear model for each "potentially reputational event" to estimate the impact of each event on the company economic value following the approach proposed in Omissis (2015). In particular, consistently with previous literature, we assume that in absence of both reputational and price sensitive events: (*i*) the economic value of the company is well approximated by the share market value; (*ii*) the evolution along time of the share market value is influenced by the market and industry performances, that are here assumed to be well approximated by the Dow Jones index and the price of oil per barrel, respectively; (*iii*) the residual dynamics of the share market value is the one imputable to the company; (*iv*) finally, a reputational event could affect the latter dynamics by creating a drop in the share market value (i.e., abnormal return if measured in relative terms).

In detail, in a suitable temporal window of the event, we fit the following model:

$$S_t = \beta_0^i + \beta_{Rep}^i \, 1_{\{t \geq t_i\}}(t) + \beta_{DJ}^i \, DJ_t + \beta_{OIL}^i \, OIL_t + \varepsilon_t \qquad (1)$$

with S_t the share value at NYSE at day *t*; DJ_t the value of the Dow Jones Index at day *t*; OIL_t the price of oil per barrel at NYSE at day *t*; $1_{\{t \geq t_i\}}(t)$ the dummy variable modeling a jump at day t_i (the date of the *i*th reputational event) that is set to zero for $t < t_i$ and to 1 for $t \geq$

t_i; and finally, ε_t is the zero-mean error term. The coefficient β_{Rep}^i models a possible drop of the share after day t_i neither imputable to the market nor to the industry (which are instead taken into account by coefficients β_{DJ}^i and β_{OIL}^i, respectively). Consistently, the abnormal return imputable to the *i*th reputational event is here defined as:

$$AR_i = \frac{\beta_{Rep}^i}{\beta_{DJ}^i DJ_{t_i} + \beta_{OIL}^i OIL_{t_i}} \quad (2)$$

that is the ratio between: (*i*) the difference between the share market value at day t_i if the event had or had not happened (cleansed from the error term); and (*ii*) the share market value at day t_i if the event had not happened (cleansed from the error term).

The estimation of the coefficients β_{Rep}^i, β_{DJ}^i, and β_{OIL}^i requires to take into account the non-stationarity of phenomenon. The effect of the market and industry dynamics on share dynamics is indeed changing through time. We here follow the approach based on the use of local models. We estimate the coefficients by means of ordinary least square regression on the data observed in the time window starting from the last reputational or price sensitive event before the *i*th reputational event and the first reputational or price sensitive event after the *i*th reputational event. Thanks to this approach we are able to evaluate - event by event - the accuracy of the estimation process which is of primary importance for the second and third step of the analysis. We indeed give a confidence interval for the AR_i, whose amplitude is determined by both the window size and the local share volatility. In detail, the variance of the estimate is obtained by Taylor expansion and the confidence level by Chebychev inequality. An overview of the advantages of this approach with respect to other approaches presented in the literature is discussed in Omissis. (2015).

3.2.2 Analysis of the characteristics of the events associated with higher impacts

The second step of the analysis aims at identifying the characteristics of the events associated to higher abnormal returns. This is done - factor by factor - by comparing the average abnormal return between events of different types. The methodology consists in a series of weighted analyses of variances (i.e., Anova) in which the abnormal returns of reputational events (estimated as described above) are used as instances of the response variable and the characteristics that define each event (geographical area, event category, release of pollutant, involvement of the Upstream division, crisis, respectively) as the factor levels. Being the accuracy in the estimation of the abnormal return event-specific, each event contributes to model estimation with a weight inversely proportional to the estimated variance $\sigma^2_{AR_i}$ of the estimate such that more reliable estimates contribute more and less reliable estimates contribute less. One-way anova models assumed that for each factor:

$$AR_i = \mu + \tau_{j(i)} + \delta_i \qquad (3)$$

where $i = 1, \dots, n$ is the reputational event index (with *n* the total number of events) and $j(i)$ is the type (w.r.t. the investigated factor) of the *i*th event, AR_i the abnormal return of the *i*th event, μ is the big-mean (i.e., the expected abnormal return of a generic reputational event), τ_j is the expected effect of the *j*th level of the factor (i.e., $\mu + \tau_j$ is the expected abnormal return of reputational events of type *j*), and finally δ_i are *i.i.d.* zero-mean error terms. If we indicate with $\omega_i = 1/\sigma^2_{AR_i}$ the weight of the *i*th event in the analysis, we have the following estimates for μ and τ_j:

$$\hat{\mu} = \overline{AR} = \frac{\sum_{i=1,\dots,n} \omega_i AR_i}{\sum_{i=1,\dots,n} \omega_i} \qquad (4)$$

$$\hat{\tau}_j = \overline{AR_j} - \overline{AR} = \frac{\sum_{i\ s.t.\ j(i)=j} \omega_i AR_i}{\sum_{i\ s.t.\ j(i)=j} \omega_i} - \frac{\sum_{i=1,\dots,n} \omega_i AR_i}{\sum_{i=1,\dots,n} \omega_i} \qquad (5)$$

We apply model (3) to explore all risk factors (i.e., geographical area, event category, release of pollutant, involvement of the Upstream division, before/after 2008 economic crisis). In detail, in the next section, for each level *j* of the investigated factor we report: (*i*) the expected abnormal return for the event of type *j*; (*ii*) the estimated standard error of the estimate; (*iii*) the *p*-value of the test $H_0: \mu + \tau_j = 0$ vs $H_1: \mu + \tau_j < 0$; and finally the number of events of type *j*. Moreover, through a chromatic scale we highlight situations of greatest exposure to reputational risk: red for event type associated to an expected abnormal return larger than 1.6% (i.e., loss larger than 1 billion euro at the current capitalization of the company) and yellow for event type associated to an expected abnormal return less than 1.6%. We decided not to report (i.e., gray) estimates for all situations which undoubtedly there is no evidence of an impact (i.e., p-value larger than 50%). Note that this absence of evidence can be due to a negligible or absent abnormal return for events of that type but also to a lack of a sufficient number of events of that type to catch the effect or even both. It is thus more proper to identify these situations as not sufficiently explored than safe in terms of exposure to reputational risk.

To overcome the lack of data for exploring some type of events pertaining to the effect of the geographical area and of the event type, we decide to aggregate event types in macro-types (i.e., continents and sustainability pillars, respectively) such to gain statistical power in the analysis.

3.2.3 Construction of a reputational risk map

The third step of the analysis is meant to provide managers with a unique reputational-risk map of the company that points out situations of larger exposure to reputational risk. This differs from the second step. Here we rely on a weighted multi-way analysis of variance in

which all factors are jointly analyzed to look for the factor combinations associated to larger expected abnormal returns. Due the reduced number of events, the latter analysis has been based on the assumption that each factor contributes in additive way to the definition of the expected abnormal return of each event. This simplistic assumption could be overcome only if more events were available. We indeed model the abnormal return AR_i of the *i*th reputational event as:

$$AR_i = \mu + \sum_{f=1}^{F} \tau_{j_f(i)}^{f} + \delta_i \qquad (6)$$

where $i = 1, \dots, n$ is the reputational event index (with *n* the total number of events) and $j_f(i)$ is the type of the *i*th event with respect to the types available for factor *f*. As before, AR_i is the abnormal return of the *i*th event, μ is the big-mean (i.e., the expected abnormal return of a generic reputational event), $\tau_{j_f}^{f}$ is the expected effect of the j_f th level of factor f (i.e., $\mu + \sum_{f=1}^{F} \tau_{j_f}^{f}$ is the expected abnormal return of reputational events of type j_1 with respect to the first factor, of type j_2 with respect to the second factor, ... , of type j_F with respect to the *F*th factor, with *F* the number of investigated risk factors), and finally δ_i are *i.i.d.* zero-mean error terms describing the unpredictable peculiarity of the *i*th event. The big mean μ is estimated as in (6) and consistently the factor specific effects are estimated as:

$$\hat{\tau}_{j_f}^{f} = \overline{AR}_{j_f} - \overline{AR} = \frac{\sum_{i\ s.t.\ j_f(i)=j_f} \omega_i AR_i}{\sum_{i\ s.t.\ j_f(i)=j_f} \omega_i} - \frac{\sum_{i=1,\dots,n} \omega_i AR_i}{\sum_{i=1,\dots,n} \omega_i} \qquad (7)$$

In detail, we jointly analyze five factors: geographical area (at continent level of aggregation), event category (at sustainability level of aggregation), release of pollutant, involvement of the Upstream division, and crisis. Results of this latter analysis are discussed in the next section and synthetically reported in Figure 6. From a risk management perspective in the visual representation of the results we focus on the current and near future

situation. Thus for the crisis factor we report just the estimated expected abnormal return for events that might occur in the future. With respect to the other four factors we report just the levels of each factor that come out as significant in at least one combination with the levels of the other factors and omit the factor levels that never come out as significant. Expected abnormal returns are reported in matrix form with the same color key used in the second step of the analysis.

4. RESULTS

Figure 1 reports along time the confidence intervals of the estimated abnormal returns of 65 reputational events. For two of the 67 events it was indeed not possible to obtain such estimates due to the reduced size of the corresponding local window. Focusing on events having significant impact at 10% level, there is a strong excess of negative events (22%) with respect to an ideal scenario in which reputational events have no impact on share market value. On the contrary, there isn't any significant excess on the number of significantly positive event (8%) which is indeed in line with the expected value we would have observed in a scenario in which reputational events have no impact on share market value. This prominence of significantly negative impacts over the positive ones is an evidence of the existence of a downsize effects of reputational events (at least for some of them).

The dashed vertical lines reported in Figure 1 have been drawn in correspondence of events which were price sensitive for the company. It is clear from the picture that while the temporal frequency of the price sensitive events has remained unchanged along time, on the contrary the frequency of reputational events has grown significantly in the last years. This could be related to the increasing sensitivity of traditional and new information and communication media to the economic, social, and environmental performance of companies

operating in the Oil & Gas industry. This trend points out the fact that in the current situation the presence of neighboring price sensitive and reputational events cannot be neglected in the estimation of the impact of an event ([29]).

[Please insert Figure 1 here]

In Figure 2, we reported the results of the weighted one-way Anovas that explore the following factors: geographical area, event category, pollution, division related to upstream activities, and crisis. In details, the label "Pollution 1/0" indicates events with/without pollution, respectively. "Upstream 1/0" indicates events pertaining to / not pertaining to the division responsible for upstream activities, respectively. "Crisis 1/0" indicates events that took place after October 2008 / before September 2008, respectively. In each matrix, rows correspond to different types of events from the most impacting ones to the less impacting ones. The first column reports the estimated expected abnormal return of a generic event of the type reported in the row. The second column reports the estimated standard deviation of the estimates reported in the first column. The third column reports the *p*-values used for testing a negative expected abnormal return of a generic event of the type reported in the row. Low values support the hypothesis that the corresponding type of events is negatively impacting on the share market value. Finally, the fourth column reports the number of events of the type reported in the row observed in the investigated time frame. We recall that the empty lines (i.e., gray) correspond to type of events that are not relevant in terms of exposure and due to the reduced number of events. Estimates for Oceania and South America were not considered representative of the corresponding continent.

[Please insert Figure 2 here]

Starting from the analysis of the geographical areas, the company resulted to be more exposed in Europe and Asia (Figure 2). Conversely, Africa, which is the area with the largest number of events, appeared to be a less critical continent in terms of reputation. As far as concern the event category, at the aggregated level, the social area is marked by an high impact. Finally, release of pollutants, the financial crisis and the connection with the Upstream division, resulted factors associated to the events with higher losses. This means that events that entail pollutants' releases, events that happened after 2008 and events that concern the Upstream division can be considered particularly sensitive from a reputational point of view.

Finally, Figure 3 reports the results of the weighted multi-way Anova jointly focusing on the following factors: geographical area, event category, pollution, and upstream for events occurred after October 2008. As already mentioned, this analysis is based on the assumption that each factor contributes in additive way to the definition of the impact of each event. Though this assumption could introduce some bias in the estimates, it allows to explore factor scenarios that has never occurred in the explored time frame. As an example, this latter analysis points out that reputational events occurring in Europe of social type with release of pollutant involving the Upstream division represent the area of largest exposure for the company with an estimated abnormal return equal to -5.8579%.

[Please insert Figure 3 here]

5. CONCLUSIONS

This paper develops an approach for the evaluation of reputational risk in quantitative terms; it then explores if certain characteristics of negative events (e.g. event category, geographical location where the event takes place, pollution) can explain their impact. Reputational risk is increasingly recognized as a relevant risk factor that could reduce a company's ability to create economic value. However, dealing with reputational risk and reputational risk management is not easy because, in many cases, they can be hardly separated from the management of risk associated to other organisational processes ([30], [31]). Furthermore, the approaches currently used to measure and manage reputational risk are often based on qualitative data and information, due to the intangible nature of reputation itself ([8]). These circumstances somehow limit the extent to which reputational risk is explicitly integrated in decision-making process.

A few quantitative studies have been carried out, embracing an event study methodology; however, these works generally focus on the identification and quantification of a reputational effect, without entering in the analysis of the factors that determine a reputational impact (e.g. [12], [16], [27], [28]).

The used approach signs three main innovative contributions with respect to the main streams of the literature. First, the estimation of the abnormal return by means of a dummy variable used as regressor in a local model allows to estimate a confidence interval for the abnormal return of each "potentially reputational event" that allows the test its significance. Through the approach used in this paper, decision-makers are provided with a measure of the quality

of the information they are using, which is particularly important considering that this information could be used to support strategic decision-making processes ([32], [33]).

Second, the use of local models based on mobile windows allows to take into explicit consideration the existence of price sensitive events, that is a shortcoming highlighted in connection to prior works ([29]). This possibility appears to be particularly important to achieve a better understanding of what really matters in terms of reputation, given the multiplicity of factors that can influence a company's share price and thus improving again the quality of the information provided to decision-makers.

Third, the proposed approach makes a step further in the comprehension of the reputational risk dynamics exploring the determinants of reputational risk – i.e. the factors that are more likely to influence the impact of an event on the share value. This is particularly important in connection of the possibility of using the model for supporting decision-making processes at company level, for instance when deciding where to invest and on what issues focusing mitigation initiatives.

From this perspective, the model can be used to complement other managerial tools that are used to support decision-making. One example is represented by different approaches and instruments that have been recently proposed to integrate stakeholders' interests in managerial decision-making processes (e.g. [34], [35]). Most of these papers focus on how to take into account stakeholders priorities and interest in company's strategic choices, often on the basis of qualitative methodologies. The quantification of the reputational risk through the approach proposed in this paper and its decomposition in its main drivers could complement these tools providing an outlook of which risk factors are more relevant from a reputational point of view and associating them to different stakeholders categories. Another example is represented by investment analysis techniques (e.g. NPV, IRR, Pay back time) that could be

integrated with an outlook of the risk exposure of certain project depending, for instance, on the geographical location where a company is investing or on the type of business that it is developing.

Finally, we highlight some paths for future research. First, the proposed approach focuses on the market share reaction to an event in a certain day, hence it allows the exploration of the existence of a drop in the share market value, but it does not say anything about if and how the share recovers its value. Hence, future works could explore the reaction dynamics and the form of the responses to a reputational event. Second, in this work, we used as a proxy of the ability of a company to create value the share market value (a measure used widely in prior literature). However, it could be interesting to enlarge the analysis to other proxies to obtain a multi-faceted description of the impact of reputational events. In particular, considering the development that information and communication technologies and social media have had in the last decade, and the impact that these tools have on a company from a reputational perspective, it could be interesting to look at the reactions of social media to reputational events. In this case, the reputational effect would be measured for instance through the excess of (negative) tweets or posts on Facebook.

Finally, a third aspect that deserves further attention is represented by the type of events object of the analysis. This paper focused on downsize reputational risk, hence exploring negative events – i.e. events that could undermine a company's ability to create value. However, future works could expand this perspective, exploring the impacts of positive events – i.e. events that could improve a company's ability to create value by improving its reputation. For instance, Godfrey, et al. (2009) pinpoint that participation in CSR activities targeting a company's secondary stakeholders or the society at large are associated with an "insurance-like" benefit ([36]). In other words, these stakeholders tend to temper their negative judgments and sanctions toward the firm when it is involved in negative events if managers

have put in place some CSR activities, specifically targeting the society. Embracing a complementary perspective, it could be interesting to understand if and how a company's involvement in CSR activities leads to direct benefits from a reputational point of view, exploring not only the existence of a reputational effects, but also its determinants. Again, this analysis could provide managers with a relevant information for orienting their decisions.

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Table 1: List of Keywords

Dimension	Keyword
Environmental	Oil spill, spill
	Gas leak
	Blow out, explosion, fire
Social	Accident, fatality, injury
	Protest, complaint
Economic	Bribery, corruption, scandal
	Sabotage, bunkering, vandalism
	Business interruption
	Project cancellation, plant closure

Figure 1: Confidence intervals of the estimated abnormal returns of reputational events

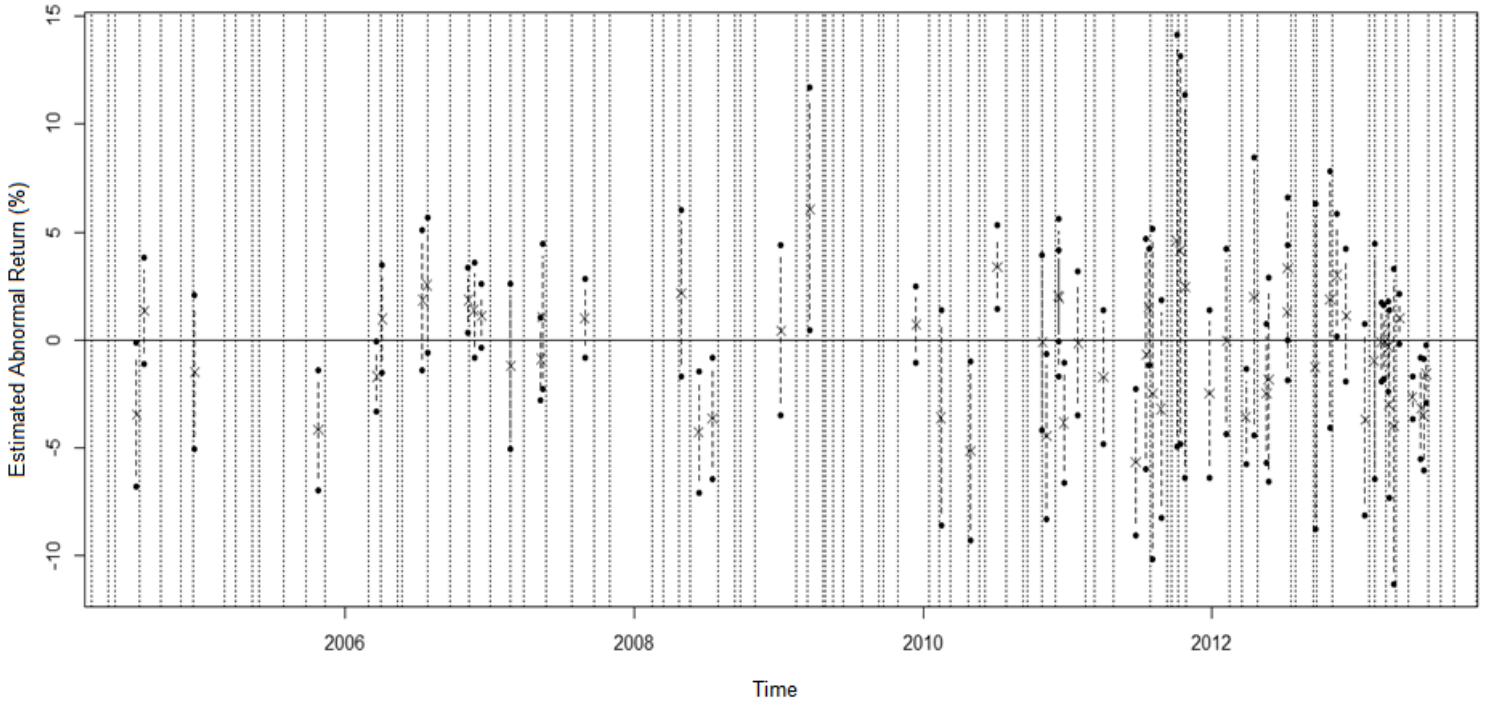

Figure 2: One-way impact matrix

	Estimate	Std. Error	P-value	Sample Size
Europe	-1,8079	0,7616	0,0104	12
Asia	-1,4128	0,7576	0,0336	8
Africa	-0,0285	0,3090	0,4635	43
Oceania	0,7249			1
South America	0,9781			1

	Estimate	Std. Error	P-value	Sample Size
Social	-1,3587	0,5200	0,0056	10
Environmental	-0,4115	0,7073	0,2814	11
Economic	0,0599	0,3368	0,4297	44

	Estimate	Std. Error	P-value	Sample Size
Pollution 0	-0,2354	0,2856	0,2064	51
Pollution 1	-1,3069	0,7648	0,0462	14

	Estimate	Std. Error	P-value	Sample Size
Upstream 0	0,2235	1,1840	0,4255	6
Upstream 1	-0,3991	0,2798	0,0780	59

	Estimate	Std. Error	P-value	Sample Size
Crisis 0	0,1553	0,4878	0,3876	17
Crisis 1	-0,5916	0,3203	0,0347	48

Figure 3: Multi-way impact matrix

		Pollution 1			Pollution 0		
		Europe	Asia	Africa	Europe	Asia	Africa
Upstr. 1	Social	-5,8579	-3,9397	-2,7270	-4,2307	-2,3125	-1,0998
	Economic	-4,7475	-2,8293	-1,6166	-3,1203	-1,2021	0,0106
	Environmenta	-4,1088	-2,1906	-0,9779	-2,4816	-0,5634	0,6493
Upstr. 0	Social	-2,8692	-0,9510	0,2617	-1,2420	0,6762	1,8889
	Economic	-1,7588	0,1594	1,3721	-0,1316	1,7866	2,9993
	Environmenta	-1,1201	0,7981	2,0108	0,5071	2,4253	3,6380

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