# Unexpected Media Coverage and Stock Market Returns: Evidence from Chemical Disasters*

Marie-Aude Laguna†

January 15, 2009

**Abstract**

This paper examines the consequences of news coverage following a chemical disaster on the subsequent drop in stock returns of the firm responsible for the accident. To do this, we build an original dataset of chemical explosions that occurred worldwide from 1990-2005. Because investors and journalists react to the same information, to account for the simultaneity bias we use original instrumental variables, namely a measure of the firm's newsworthiness, and a measure of daily news pressure at the time of disasters. Everything else equals (pollution, fatalities and firm's characteristics), there is clear evidence that extensive news coverage mitigates the market value losses on the short-term, while after a few months, marginally more intense news coverage is costly to firms. This gradual and delayed reaction may be due to the fact that investors are slow to recognize the extent of the loss associated with public concern raised by intense news coverage coverage and pollution.

**Classification code:** G12, G14, G30, M30.

**Keywords:** Media, Efficient Hypothesis, Corporate Finance, Reputation.

---

*Financial support from the French Agency of Environment and Energy (ADEME) is greatly acknowledged. I thank participants at the Paris School of Economics lunch-seminar in applied micro-econometrics, the 2008 European Economic Association Congress in Milan, the 2008 Canadian Economic Association Congress in Vancouver, and the 2008 Société Canadienne Sciences Economiques Congress in Montebello. I would also like to thank Gunther Capelle-Blancard, Thierry Chauveau, Bernard Sinclair-Desgagné, Sandrine Lardic, and Sandrine Spaeter for helpful comments and discussions. The usual disclaimer applies.

†Université Paris I Panthéon-Sorbonne. 106-112, bd de l'hôpital 75013 Paris, +33 144 078 271. E-mail: marie-aude.laguna@malix.univ-paris1.fr.

# 1 Introduction

Over the last two decades, we have witnessed several environmental disasters. The names of large companies are often associated with such events. Union Carbide was responsible for the Bhopal explosion in 1984, Exxon for the Valdez oil spill in 1989, and BP for a large chemical explosion in Texas in 2005. All these events, which provoked either numerous deaths or serious pollution, were followed by enormous news coverage. It is commonly assumed that environmental disasters deteriorate the firm's reputation and its public image. Needless to say, public image is a major concern for all firms. According to various surveys, improving public image is the most cited factor by managers to motivate Corporate Social Responsibility.[1]

In this article, we investigate the intensity of media coverage, its determinants and its marginal effect on stock returns following chemical disasters. The drop in stock returns is used as an unbiased measure of uninsured cost suffered by the firms. In particular, we investigate whether intense news coverage after an environmental disaster represents an additional cost to the firm. This article intends to answer the following questions. What is the mechanism through which media influence stock markets? Do investors respond to intense news coverage after an accident?

It is worth noting that in financial economics, in accordance with the efficient market hypothesis, media are most often treated as a black box and only information content is accounted for, but not the quantity or frequency of news published. The efficient hypothesis predicts that returns reflect all publicly available information: the information provided by media is considered as redundant. However, there are various reasons why media may affect stock markets. For instance, in political science, media coverage is usually considered as a good proxy for public concern over an issue. In our study, this effect is particularly important because chemical disasters have obvious social and public implications. If the space devoted to chemical disasters in the media is a good indicator of its importance for the public, it may convey information about its legal consequences (clean-up cost, penalties, etc.) and might even indicate law reinforcement in the future (Kahn, 2007). If intensity of press coverage is associated with bad publicity, one should expect investors to react negatively to intense media coverage.

Yet, news coverage can affect stock prices for other reasons. Recent studies recognize the role of media as an information intermediary to bring to light and to summarize information that is sometimes costly to acquire.[2] Dyck and Zingales (2003) argue that the media is one vehicle through which information is aggregated and credibly communicated to the public, and that the media can play a substantial role in reducing the costs of contracting. According to Bushee *et al.* (2007), the press has the potential to shape a firm's information environment by increasing the amount of information flow in the market, by alerting a broader set of investors to news about the firm, and by reducing the level of information asymmetry across investors. Media may also help investors to coordinate (Shiller, 2000, Morris and Shinn, 2002, Veldkamp, 2006), and temper information asymmetry between informed and non-informed investors (Grossman and Stiglitz, 1976, Diamond and Verrecchia, 1991, Easley and O'Hara, 2004). In our study, informational asymmetry between owners and managers is exacerbated by the difficulty of assessing the distribution of pollution and safety risks at the firm level. Furthermore, a great deal

[1] CSR is usually defined as the self-regulation of negative externalities. In a survey run by PriceWaterhouseCoopers among French firms, 90% of the managers cite image as the main motivation to promote CSR inside the firm.

[2] According to Healy and Palepu (2001), an information intermediary provides information that is new and useful to other parties. The information may be new and useful due to the fact that it has not previously been publicly disseminated, or it may be new and useful due to the fact that it has not been widely disseminated according to Bushee *et al.* (2007).

of uncertainty surrounds liability, insurance coverage, litigation risk, and the firm environmental and safety reputation. Thus, our second central hypothesis is that media in the event of disasters might help alleviate these information deficiencies. According to this hypothesis, one might conclude that more news coverage after a disaster, by decreasing information uncertainty, may indeed lead to lower losses.

Finally, there is also a growing literature on the role of media in presence of cognitively biased investors. According to this literature, media alleviate bounded rationality problems such as limited attention, and limited capacity of information treatment. A few papers document the stock market response to earnings announcements and find that news coverage has an attention-grabbing effect which favors the incorporation of news into prices. This interpretation is more behavioral than rational: media variables are used to proxy for the number of informed investors or for news salience (Chan, 2003 Hong and Stein, 2006, Bushee *et al.*, 2007, DellaVigna, 2008, Peress, 2008).

In this paper, in order to study the causal effect of news coverage on stock returns, we first investigate the determinants of media coverage. This research question is not trivial and raises a number of empirical problems. First, news coverage is determined simultaneously along with stock returns. In particular, the most severe disasters appear more often in the news and induce higher equity losses. Second, the fact that stock returns reflect all public information available may lead to a potential endogeneity bias. More specifically, news coverage and stock market response may be be correlated even if the number of news has no effect on returns, because they both depend on other and unrelated newsworthy materials about the firm at the time of disasters. Thus, it is reasonable to suspect that unexplained stock returns will be correlated to the intensity of media coverage. In other words, the firm might be under the public spotlight for different reasons (threat of takeover, earning announcements, etc), and this may induce more disaster news coverage. Conceptually, this is a difficult question to analyze, because we must think of a situation where news coverage could vary exogenously, even though in the data stock returns and news coverage are generated simultaneously (Wooldridge, 2002). At least one instrumental variable is required, a variable which is exogenous to the unexplained part of the stock market returns and at the same time strongly correlated with news coverage. In this article, as instrumental variable, we use the firm abnormal's media coverage in the twenty days before the disaster to proxy for the firm's newsworthiness. In addition, we conjecture that the attention paid to chemical accidents by the press in a given period is driven by political agenda issues. In other words, attention may be crowded out by other and more important political events at the time of disasters.[3] Therefore, we use a measure of news pressure provided by Eisensee and Strömberg (2007). News pressure, which is defined as the availability of other newsworthy materials in a given day (elections, olympics, wars, etc), is a good candidate because it is a time-varying factor, independent of the accident occurrence as well as of the firm idiosyncratic risk. So far, this measure has not been used in the financial literature. News pressure will constitute an alternative instrumental variable.

A summary of our results is the following. First, by modeling the determinants of media, we find that news coverage is explained by the social cost of the accident, as measured by the occurrence of pollution, and by the number of fatalities, as well as by the number of accidents previously experienced by each firm. Second, we surprisingly find that in the short term (*i.e.*, two days after the accident), all else being equal, media coverage *lowers* the market penalty. More precisely, more intense media coverage actually mitigates the financial drop incurred by firms responsible for the accident. However, when considering the average stock returns over

[3] Strömberg and Eisensee (2007) show that the news coverage of natural hazards depends on the occurrence (or absence) of competing and more important news that capture the attention of mass media at the time of the disasters.

the six months after the accident, the firms that received more important media coverage in the first two days after the disaster also incur lower abnormal returns regardless of the seriousness of the accident. Stated in other words, the reaction to intense press coverage reverses (it becomes negative) in the long-term, and is delayed. Therefore, we interpret this result as evidence that press coverage cannot be associated with increased attention or information of better quality. If this were the case, the loss should have increased with media instantaneously (e.g., due to a greater number of informed investors).

The remainder of the paper is organized as follows. Sections 2 describes the data, and the instrumental variables. Sections 3 describes the econometric model. The results are presented in Section 4 and 5. The paper concludes with a summary in Section 6.

## 2 Event-Study Econometrics and News Coverage

In this article, we study the implications of intense news coverage on stock market outcomes following a chemical disaster. In empirical finance, the main problem raised by the use of news coverage metrics is related to the exogeneity of media with regards to new information arrival. News salience or stock visibility as measured by intense media coverage (or headlines in major newspapers) is difficult to disentangle from an information effect.

### 2.1 Can News Selection by the Press Be Ignored?

Since the late 1990s, the problem of sample selection bias have received much interest in the empirical finance literature (*e.g.* Fama and French, 1998, Prabhala, 1997, Li and Prabhala, 2005). It has been reproached that samples were sometimes defined in an ad-hoc manner by the researcher in order to "dredge for anomalies" (Fama and French, 1998). Moreover, in many cases announcements couldn't be considered as exogenous to the firm's choice (*e.g.* tender offers, stock splits, etc.). Chemical disasters by contrast can be considered as low-discretion and unexpected events, so that manipulation or selection of news announcement dates by firms is almost impossible.

Yet, in this section, we focus on a new and unstudied issue: the selection of news announcements or corporate events by the press. In most event-studies, sample of events collected in the press cannot be considered as random. This is due to the fact that journalists track what they perceive as the most important (or newsworthy) news in a given day. To be disclosed or announced by journalists, the net value associated with the publication of news need to be perceived as positive. Media coverage might then give rise to sample selection bias. The central question of this article can be formulated as follows: Are accident news sufficiently newsworthy per se to justify publication? Does being published by the press convey additional information that exogenous measures of seriousness (pollution and fatalities) do not capture?

Let $s$ be a binary selection indicator representing a random draw from the population:

$s = 1 \Longleftrightarrow NSW \geq 0$

where $NSW$ represents the event newsworthiness which can be estimated using a number of exogenous information $\mathbf{x}$ (such as the event size) so that:

$E(NSW|\mathbf{x}) = \beta\prime\mathbf{x}$

Overall, we have:

$$
\begin{aligned}
s = 1 &\Leftrightarrow NSW > 0 \\
s = 0 &\Leftrightarrow NSW \leq 0 \qquad (1)
\end{aligned}
$$

Incidental truncation of the least newsworthy events will occur, so that only the most newsworthy events will be covered by the press, and eventually considered by the researcher. The population model is thus the standard single-equation linear model with possibly endogenous explanatory variables:

$$\begin{aligned} AR_0 &= \gamma\prime\theta + u \\ E(u|z) &= 0 \end{aligned} \qquad (2)$$

$z$ represents the whole set of exogenous regressors (including $\theta$), and $AR_0$ represents abnormal returns on the accident day. Now we have formally assessed the problem of sample selection raised by news coverage. Does this selection bias affect the way we estimate population parameters? Since $s$ is a deterministic function of $z$ which includes the $NSW$ variable, it follows from the the theorem on ignorability of sample selection in Wooldridge (2002) that the two-stage least squares estimator is consistent under sample selection if $E(u|z, s) = E(u) = 0$. Thus, only if the event newsworthiness is not a predict of the unexplained part of stock returns, sample selection by the press can be ignored. This is true if the newsworthiness is only determined by the accident seriousness. For example, intuitively, one may argue that the market value loss due to pollution news represent an upper bound since it is more likely that the press ignores the least serious events. This statement applies to most financial and accounting news, but for more political news such as pollution or industrial accidents, there is reason to suspect that press coverage is not necessarily systematic or complete. In this article, we conjecture that the disaster news coverage (and newsworthiness) is also related to the firm newsworthiness at the time of disasters. Therefore, it may be influenced by other and unrelated information available about the firm at the time of disasters, that in turn may influence firm stock returns following disaster news.

If we had a sample of pollution news not covered by the press, we could infer from the news coverage magnitude whether being in the press conveys additional information with regards to the newsworthiness of the event, irrespective of the accident seriousness. In that case, press coverage would be used as a treatment effect, and we could infer from publication of disaster news in the press (when $s = 1$) the average level of newsworthiness $E(NSW|NSW \geq 0) = E(NSW|\boldsymbol{\lambda}\prime\mathbf{x} \geq 0)$ using the inverse Mills ratio. However, although we cannot account for accidents which were not covered by the press, the intensity of media coverage (as measured by the number of newspaper articles reporting the disasters) is used to proxy for the disaster newsworthiness.

### 2.2 The Simultaneity Bias

In this article, we attempt to relate the response of journalists to that of investors in the event of chemical disasters. This question raises a number of empirical issues. News coverage is determined simultaneously along with stock returns, as illustrated by the fact that the most severe disasters will appear more often in the news and will induce higher equity losses. Second, the fact that stock returns reflect all publicly available information also raises a potential endogeneity bias. Finally, news coverage and stock market response will be correlated even if the number of news has no effect on returns, because they both depend on other newsworthy materials at the time of disasters. The basic econometric problem is that news coverage and stock market reactions are both increasing in the salience of the disaster for the public. There are many aspects of this salience that we cannot observe, for example, the direct cost of the disaster, or unobserved competing shocks affecting the firm. Consequently, residuals from the outcome variable may be correlated with the regressors, and we cannot identify the causal effect of news on stock markets from a regression of the latter on the former. Using a measure of unexpected media coverage (*i.e.* the media coverage associated with the chemical disasters) is not sufficient to tackle the simultaneity problem if we suspect that media coverage also respond to the firm newsworthiness at the time of disasters.

Conceptually, this is a difficult situation to analyze, because we must think of a situation where news coverage could vary exogenously, even though in the data stock returns and news coverage are generated simultaneously (Wooldridge, 2002). To counter this simultaneity bias, at least one instrumental variable is required, a variable which is exogenous to the unexplained part of the stock market returns, and at the same time strongly correlated with the news coverage. Therefore, to determine whether news have a causal effect on stock markets, we use two sets of instrumental variables, namely the *firm newsworthiness* and *news pressure* at the time of disasters (see the Data section below).

### 2.3 A Triangular Recursive Equation System

This paper assumes that stock market returns following chemical disasters depend on the news coverage magnitude of disasters, and on the disaster seriousness. At the same time, the news coverage magnitude depends on the same variables, and on a set of instrumental variables as described below.[4]

Our econometric specification is of the following form. In our system, for each firm-disaster $i$, the dependant variable is $CAR_{i,[0,+t]}$, the cumulated abnormal returns up to $t$ days after the accident date, and the endogenous regressor is $\Delta NEWS_{i,[0;+t]}$, the cumulated number of news articles reporting the disaster $i$ up to $t$ days after the accident date. The vector $\theta_i$ contains disaster specific variables, such as the number of fatalities and serious injuries, a dummy for toxic release, but also, firm specific variables, number of previous accidents experienced, and fixed effects for country, time period, etc. Thus, for each firm-disaster $i$, and $t$ days after the accident date ($t = 0$), and $\forall t = 0, 1, 2$, the two-equation system is triangular as follows:

$$\Delta NEWS_{i,[0;+t]} = \delta_1 ABNNEWS_{i,t=[-2,-22]} + \delta_2 NewsPressure_t + \delta\prime\theta_i + \xi_i \quad (3)$$
$$CAR_{i,[0,+t]} = \gamma_1 \Delta NEWS_{i,[0;+t]} + \gamma\prime\theta_i + \epsilon_i \quad (4)$$

Note first that we assume that the increase in the firm news coverage after $t = 0$ is entirely due to the chemical disaster, since $\Delta NEWS_{i,[0;+t]}$ measures the total number of news articles published about the accident (and not about the firm $i$). Our central hypothesis to control for exogenous variations of the disaster news coverage is that disasters are more likely to be covered when the firm is more newsworthy, as well as when at the time of disasters, important political events break the news (war, terrorist attacks, etc.), as respectively captured by the two variables firm newsworthiness ($ABNNEWS_{i,t=[-2,-22]}$) and disaster newsworthiness ($NewsPressure_t$) as described in the Data section below.

Empirically, several methodologies are implemented. First, our system of simultaneous equations is triangular, in that we assume that abnormal returns depend on the media coverage, but not the opposite. If the disturbances $\epsilon_i$ and $\xi_i$ are uncorrelated, then the system is a fully recursive model. In this case, the entire system may be estimated consistently and efficiently by ordinary least squares. In the more general case, in which the residual covariance matrix is

[4]The system is triangular or recursive rather than simultaneous, with X entering the equation determining Y , but not the other way around. This differs from the recursive form of the general simultaneous equations model (e.g., Hausman, 1983), where the recursive nature is by construction. In contrast to the recursive form in such linear simultaneous equations models the unobserved components are potentially correlated (Greene, 1993).

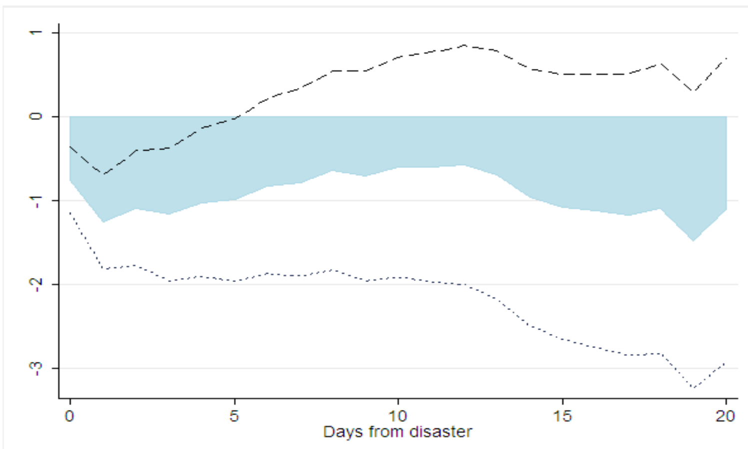
not diagonal, the preceding argument does not apply, and we have to implement a two-stage least squares (TSLS). Assuming a linear model and assuming that the instrument variables are uncorrelated with the unobserved part of the stock market reactions, $\epsilon_i$, and unobserved news coverage, $\xi_i$, conditional on the variables in $\theta_i$, the model is identified and the parameters may be consistently estimated using TSLS.

## 3 Background and Data

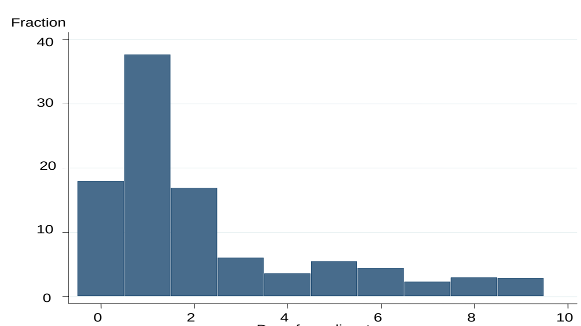
In this section, we present how the media coverage associated to each disaster as well the subsequent stock market outcomes following the disasters are computed.

The abnormal returns incurred by each firm following the disasters are computed a companion paper. On average, they amount to -1.4% for the first week (Capelle-Blancard and Laguna, 2007). On average, the abnormal loss amount to -1% within the first week (see Figure 1).

Figure 1: News coverage and stock market returns following chemical disasters




(a) Cumulative average abnormal returns (in %) with confidence intervals at the 5% level, by days from the disaster




(b) News stories on disasters (in %), by days from the disaster

Notes: Abnormal returns are computed given the market model parameters estimated with OLS through the period [-190; -10] in event time. Event time is days relative to the accident date. The sample period is from 1990 to 2005.

Table 1: **Summary Statistics**

The sample is composed of 64 accidents in the petrochemical industry over the period 1990-2005. Accidents are identified using the software Factiva. Only publicly listed firms are considered.

| | # | **Mean** | **Median** | **Std. Dev.** | **Min** | **Max** |
|---|---|---|---|---|---|---|
| **Dependant Variables** | | | | | | |
| $CAR_{t=0}$ | 64 | -0.81 | -0.64 | 1.57 | -6.36 | 2.93 |
| $CAR_{[0,1]}$ | 64 | -1.23 | -0.93 | 2.21 | -7.35 | 3.32 |
| $CAR_{[0,2]}$ | 64 | -1.16 | -0.90 | 2.86 | -7.91 | 5.13 |
| $NEWS_{t=0}$ | 64 | 7.92 | 2 | 16.39 | 0 | 81 |
| $NEWS_{[0;+1]}$ | 64 | 24.58 | 7 | 77.51 | 0 | 608 |
| $NEWS_{[0;+2]}$ | 64 | 32.06 | 10 | 104.37 | 1 | 826 |
| **Instrumental Variables** | | | | | | |
| Firm Newsworthiness (%) | 64 | 5.46 | 4.99 | 3.15 | 0.00 | 20.19 |
| Disaster Newsworthiness ($\times$1000) | 64 | 1.51 | 1.08 | 0.83 | 0.54 | 3.12 |
| **Explanatory Variables** | | | | | | |
| Ser. injuries and fatalities | 64 | 2.36 | 1 | 4.76 | 0 | 30 |
| Toxic release | 64 | 0.23 | 0 | 0.43 | 0 | 1 |
| # previous accidents | 64 | 0.73 | 0 | 1.13 | 0 | 5 |
| Chemicals | 64 | 0.68 | 1 | 0.47 | 0 | 1 |
| Dummy year > 1999 | 64 | 0.36 | 0 | 0.48 | 0 | 1 |
| **Financial variables** | | | | | | |
| log (Market value) (billion 2005 $) | 64 | 43.36 | 7.28 | 74.04 | 0.09 | 340.04 |
| **Country of listing** | | | | | | |
| US | 64 | 0.36 | 0 | 0.48 | 0 | 1 |
| EU | 64 | 0.32 | 0 | 0.47 | 0 | 1 |
| Japan | 64 | 0.11 | 0 | 0.31 | 0 | 1 |
| Emerging countries | 64 | 0.06 | 0 | 0.24 | 0 | 1 |
| **Country of accident** | | | | | | |
| US | 64 | 0.39 | 0 | 0.49 | 0 | 1 |
| EU | 64 | 0.33 | 0 | 0.47 | 0 | 1 |
| Japan | 64 | 0.12 | 0 | 0.33 | 0 | 1 |
| Emerging countries | 64 | 0.06 | 0 | 0.24 | 0 | 1 |

Abbreviations: $CAR_{[0,t]}$: Cumulative Abnormal Returns up to $t$ days after the accident date averaged across firms; $NEWS_{[0;+t]}$: Number of newspaper articles reporting the disasters for the first $t$ days the disaster date (Factiva database); Ser. injuries and fatalities: Number of serious injuries or fatalities; Toxic release = 1 if the accident provoked a toxic release and 0 otherwise ; Chemicals = 1 in the firms belong to the chemical industry and 0 otherwise; # previous accidents: number of previous accidents experienced by each firm before the accident date; Dummy year > 1999 = 1 if the accident occurred after 1999 and 0 otherwise; Firm Newsworthiness is the ratio of headlines mentioning the firm over twenty days before disasters to the total number of headlines received in the previous year (Factiva database); Disaster Newsworthiness is the number of newspaper headlines that mention any of the following events in the twenty days before the date of the accident: explosion, fire, blast, blaze, spill, leak, accident, disaster, hazard, or catastrophe (Factiva database); Market Value is in billion 2005 constant $. See the text for further details concerning the sample and the variables.

### 3.1 The News Coverage of Chemical Disasters

In our regression system, news coverage of chemical disasters is the endogenous regressor. Data on news coverage is taken from the software Factiva. We restrict the attention to newspaper articles, and count all articles in English and for all regions mentioning both the names of companies, the disaster, but also the town (or the country) where the accident took place to ensure we account for the disasters and not for other events (for instance a refinery explosion due to times of war in a LDC).

Two main measures of news coverage are considered: the total number of news articles on a daily basis, and the cumulated number of news articles.[5] The latter measures ignores the autocorrelated nature of press coverage, while measures of press coverage on a daily basis are well suited to measure information dissemination on stock markets. Overall, our measures are in line with the new literature on the implications of news coverage on stock market returns which use the total number of articles mentioning the firm name or a specific event depending on the subject matter.[6] As in the studies of Bushee et al. (2007) and of Fang and Peress (2007), we are interested in the intensity of news coverage, and not in the information content of news coverage. But, in contrast with previous literature, it is worth noting that our measure of intensity of press coverage is a measure of abnormal or unexpected media coverage in the event of chemical disaster. It does not incorporate on purpose the total number of news published in the disaster period. An alternative specification would have considered the abnormal media coverage in the post-event period, as measured by the difference between the media coverage on the accident day and the average media coverage in the pre-event period. This measure would have the advantage to account for the effect of other newsworthy material before and after the accident, but it is also more noisy.

The median number of press articles published about the disaster in the first three days is 10, and the average number is 32 articles. 80% of the press articles published in the ten days following disasters are printed in the first four days: 21.82%, 34.66%, 17.14% and 5.63% of news are reported respectively, the first, second, third, and fourth days (see also Figure 2). We also consider mentions in headlines only. The resulting variable is correlated at the 99% level with the number of mentions in the full article and our results do not change. We find that twelve accidents do not receive media coverage in the first two days, and 23 accidents do not receive coverage on the first day, while, 11 accidents receive coverage only the day before the disaster. Among this sub-group, as expected, the average number of injuries is also lower, in accordance with the fact that less serious accidents receive delayed, lower, or no media coverage. The average number of injuries for this sub-group is of 0.33 injuries, whereas, the average number for the 33 accidents which receive immediate coverage is of 3.93 injuries.[7] Moreover, the correlation between media coverage on day $t = 0$ (the accident day) and day $t = 1$ is far lower (64%) than between media coverage on day $t = 1$ (the accident day) and day $t = 2$, which is of 97%. This results confirms the fact that media coverage is partially delayed, but concentrated in the first two days. Finally, some accidents cause the distribution of the number of press articles to be right-tailed as shown in Figure 2, so that we use the natural logarithm rather than level. In fact, this effect is mainly due to the media coverage of an important chemical explosion in Texas on

[5]We also consider the natural logarithm of the number of press articles to account for the fact that the coverage distribution is right-tailed. See below for more details.

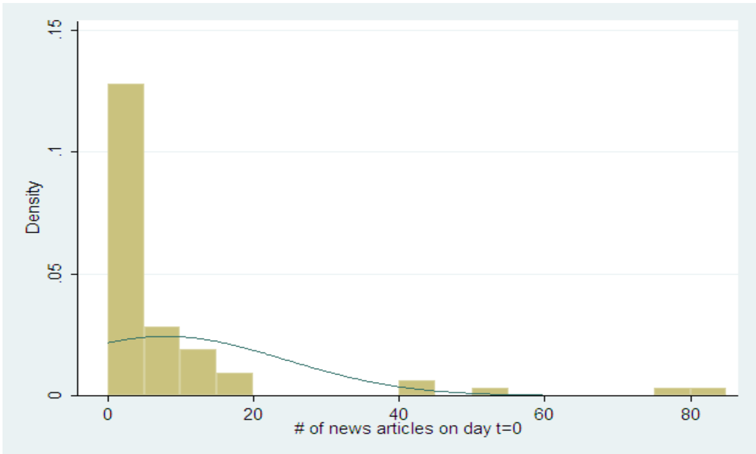
[6]Bushee et al. (2007) which investigates the effect of the firm news coverage on its stock market returns prior and after earning announcements finds that using the total number of words instead of the total number of articles do not change the results. Another strand of literature dedicated to the journalist's decision to cover an event uses by contrast an indicator variable for whether a specific event is covered in a news broadcast within a certain time window (Erfle and McMillan, 1990; Hamilton, 1995; Strömberg and Eisensee, 2007).

[7]As we will show below, in terms of abnormal returns, the difference between the two groups is less apparent.

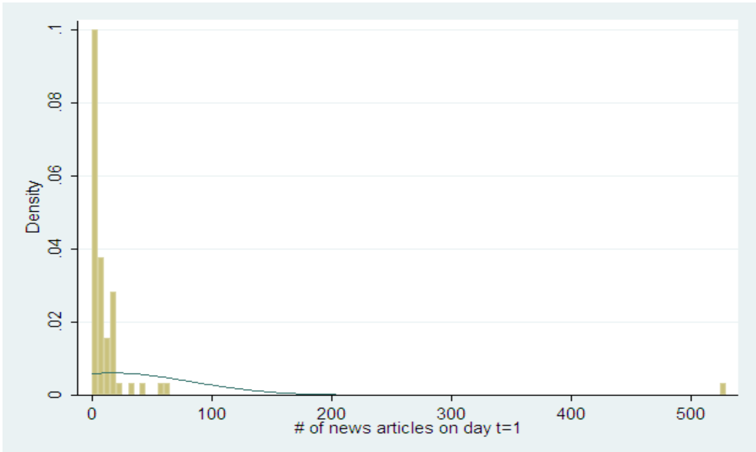
March 23, 2005. When this accident is excluded, the density of news articles in the first two days is normally distributed.

In addition to considering general press coverage, we also measure the number of financial press articles (*The Financial Times* and *The Wall Street Journal* publications) reporting the accident. In the first ten days, including the accident day, almost 40% of the accidents are covered by the financial press. Among this group, the average number of financial press articles is of 3.3, with a standard deviation of 3.8 articles.

Figure 2: Daily News Coverage of Chemical Disasters, 1990 - 2005




(a) News Articles Density on Day $t = 0$, 1990 – 2005




(b) News Articles Density on Day $t = 1$, 1990 – 2005

The figures represent the histogram of the number of news articles published about the chemical disaster on the accident day ($t = 0$), and on the following day ($t = 1$). The sample of chemical accidents is from 1990, January to 2005, March. Bar width equals 5 articles. The dark line represents normal fitted distribution.

## 3.2 Instrument Choice

In this sub-section, we present the set of instruments we use to control for exogenous variations in the disaster news coverage, irrespective of the accident seriousness.

**News Pressure and accident newsworthiness**. We first consider that other major political or public events may crowd out the coverage of disaster events. By contrast, in periods of news drought, disasters may draw the attention of journalists and investors in a greater extent. Thus, measures of the availability of newsworthy material may be used as instruments. Given its very interesting features, the variable "daily news pressure" provided by Eisensee and Strömberg (2007) is used. The availability of newsworthy material is the median (across broadcasts in a day) number of minutes a news broadcast devotes to the top three news segments in a day (daily news pressure).[8] The variable is available from 1968-2003, and to our knowledge, this is the first study to document the implications of news pressure on stock market outcomes.[9]

The intuition underlying this instrument variable is straightforward: journalists and editorial board have a fixed number of pages and words to be filled each day. If the space taken by big news is high, the space that can be devoted to others news is reduced, and therefore, these other news may be crowded out. When a large media event takes place, then that story is usually placed as one of the first news stories in a broadcast and more time is devoted to the story.[10] Thus, if two equally newsworthy disasters occur, we would expect the disaster occurring when there is a great deal of other breaking news around would have a lower chance of being covered by the news than the disaster occurring when there is little other news around. In our regression system, recall that we estimate the magnitude of disaster news coverage rather than the probability to cover disasters in a period of time.

Figure 3 plots daily news pressure from 1968 to 2003. The news stories corresponding to these dates are listed in Table **??** in the Appendix. The table also lists the main stories corresponding to the second highest yearly values of daily news pressure. Note also that there is a slight upward trend in daily news pressure, which could reflect a general upward trend in the availability of breaking news stories or changes in the news technology. We will include five-year dummy variables in all regressions to capture this time trend.

The autocorrelation of the variable daily news pressure is not high, less than 55% in one day-lag, and of less than 45% for a two-day lag. In our sample, on the accident day, the autocorrelation is even lower, around 25%, and between the two following days ($t = 1$ and $t = 2$), of 60%.

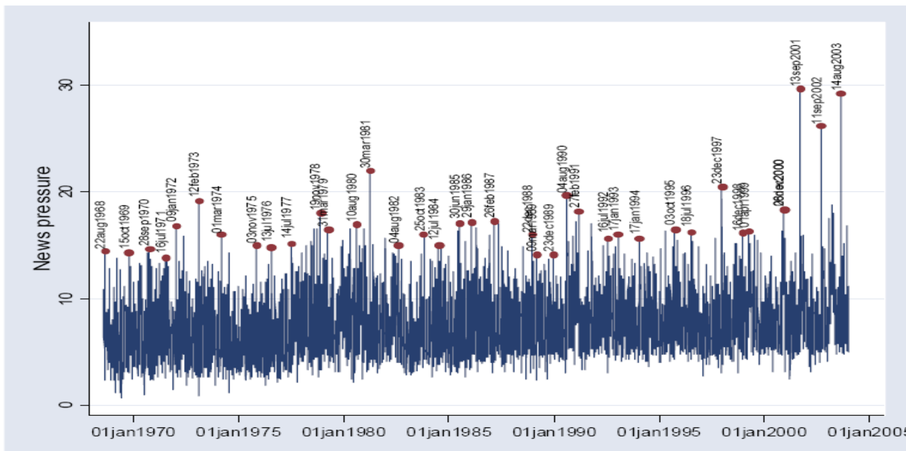
Finally, a dummy is set equal to one for disasters occurring in July and August to control for the effect of summertime news droughts. For the same reasons, a dummy is used to control for accidents that occurred during the week-end.

[8] This instrument is related to that used in Erfle and McMillan [1990], the weekly average percentage of total news time devoted to the two leading non-energy news topics.

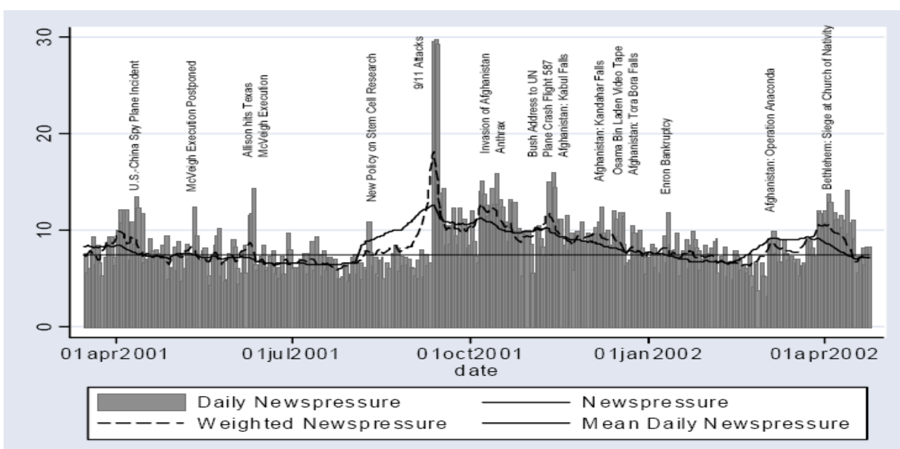
[9] Since the variable daily news pressure is available only before 2004, it reduces our size sample by almost ten observations.

[10] As Eisensee and Strömberg (2007) point out: "When a large media event takes place, then that story is usually placed as one of the first news stories in a broadcast, and more time is devoted to the story." They find strong evidence that when the news pressure is low, the probability that journalists cover natural hazards increases. For instance, on October 3, 1995, a jury found O.J. Simpson not guilty of two counts of murder. That night, the ABC, CBS and NBC devoted all of their first three news segments to that story. The top three news segments comprised an average of 16 minutes and 30 seconds – the highest value of that year. The Simpson verdict effectively crowded out other news. NBC only covered this story, while CBS also reported on one other story, and ABC included 4 other stories. This suggests that the amount of time devoted to the first three news segments is a good indicator of how much newsworthy material is available on a given day. The median value across news broadcasts in a day rather than the mean is used to reduce the effect of measurement error in the reported time for news segments.

Figure 3: Daily News Pressure (Strömberg and Eisensee, 2007), by Day




(a) Daily News Pressure (Minutes), 1968 – 2003, by Day. The horizontal flat line depicts the mean for the 1968—2002 period. The figure also displays the events occurring during the peaks of daily news pressure.




(b) News Pressure (Minutes) during 405 Days, 15 March 2001 – 23 Apr 2002, by Day

The figures are taken from Eisensee and Strömberg (2007) to illustrate major newsworthy events as measured by the variable daily newspressure. News pressure is the number of minutes devoted to the top three news on a given day. Mean daily news pressure is 40-day average news pressure. This measure puts an equal weight on all days during the 40 days.

**Firm Newsworthiness**. The news coverage of disasters may depend upon whether at the time of the accident the firm which is responsible for the disaster is of major concern for journalists. To do this, we compute the number of newspaper headlines that mention the company before the accident.[11] It is reasonable to believe that the biggest firms are more newsworthy (*i.e.*, they receive more headlines) overall. Therefore, to avoid multi-collinearity problem in our regressions with the firm's size and to account for the time-varying nature of firm newsworthiness, we use the the ratio of the number of headlines that mention the firm in the twenty days before a disaster to the total number of headlines received in the previous year, which we call firm newsworthiness. As expected, the variable firm newsworthiness is equal to 5.5% on average, but varies between 0 and 20%. This confirms that some firms happen to be more newsworthy than others at the time of disasters. We are agnostic about which events or shocks may explain the firm newsworthiness shortly before the disaster.

We conjecture that firms which benefit from higher abnormal media coverage before the disaster are more newsworthy and would also benefit from higher abnormal media coverage after the disaster, all else being equals. Firms which are more newsworthy should receive more coverage in case of accidents, because they are already under the scrutiny of journalists. At the same time, one may also argue that the accident occurrence is more salient to journalist if no other breaking news are available about the firm. Overall, the effect of the firm newsworthiness shortly before the disaster is difficult to predict. Finally, abnormal media coverage is potentially due to firm-specific shocks, which can be equally captured by other financial-based measures of informativeness: abnormal volumes, and absolute abnormal returns in the previous days are also ideally suited to measure the firm's salience in stock markets. Table 2 lists cross-sectional regression of the firm newsworthiness on measures of abnormal market activity in the twenty days before the disaster. Specifically, we document some correlation between abnormal trading volume and the firm newsworthiness, but, the result do not appear as significant as measured by the F-statistics of joint significance. However, to avoid spurious regressions, we include in every model specification, a complete set of financial control variables (see the next section for more details).

[11] Cormier and Magnan (2007) use a very similar variable, called the "firm media exposure" as an explanatory variable to explain the news environmental voluntary reporting strategy of firms. They compute the total number of news stories referring to a particular firm's environmental activities in a given year; on the same as well as in distinct events.

Table 2: **The Correlation of Instruments with Exogenous Variables**

OLS regressions with the instruments news pressure and firm news pressure as dependent variables, and including year, and regional fixed effects. Robust standard errors in parentheses. The F-test tests the joint significance of the explanatory variables in the regression.

| | Dependent variable is : Firm Newsworthiness$_{t=[-22,-2]}$ | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Coef. | Std.Error | T-stat | Coef. | Std.Error | T-stat | Coef. | Std.Error | T-stat |
| $\text{Alpha}_{i,t=[-190,-10]}$ | −1.68 | 4.52 | −0.37 | −3.71 | 4.63 | −0.80 | −5.02 | 4.34 | −1.16 |
| $\text{CAR}_{i,t=[-22,2]}$ | −0.06 | 0.09 | −0.66 | −0.12 | 0.11 | −1.07 | −0.05 | 0.10 | −0.58 |
| $\text{AR}_{i,t=1}$ | −0.52 | 0.29 | −1.76 | −0.35 | 0.26 | −1.37 | −0.46 | 0.28 | −1.64 |
| $\text{AR}_{i,t=1}$ | 0.15 | 0.12 | 1.24 | 0.11 | 0.12 | 0.97 | 0.02 | 0.15 | 0.17 |
| $\text{Abn.V}_{i,t=[-22,2]}$ | 0.02 | 0.01 | 1.79 | 0.02 | 0.00 | 2.43 | | | |
| Constant | 5.66 | 0.49 | 11.38 | 5.45 | 0.49 | 11.07 | 5.44 | 0.43 | 12.52 |
| N | 56 | | | 56 | | | 64 | | |
| F-test of joint insignificance | 2.41 | | | 3.06 | | | 1.73 | | |
| (p-value, %) | (0.04) | | | (0.01) | | | (0.15) | | |
| R-squared | 0.20 | | | 0.14 | | | 0.06 | | |
| | Dependent variable is : Average News Pressure$_{t=[0,1]}$ | | | | | | | | |
| # Ser.Injuries and Fatalities | 0.11 | 0.07 | 1.56 | | | | | | |
| Toxic Release | −0.51 | 0.49 | −1.05 | | | | | | |
| Constant | 8.10 | 0.40 | 20.06 | | | | | | |
| N | 57 | | | | | | | | |
| F-test of joint insignificance | 1.74 | | | | | | | | |
| (p-value, %) | (18.49) | | | | | | | | |
| R-squared (%) | 6.13 | | | | | | | | |

### 3.3 Control Variables

We use a number of variables to control for structural effects, such as the listing country of the responsible firm, its industry, size, as well as time dummies. These variables are expected to have an indirect effect on the media coverage and on the stock market responses, since they also affect the firm and accident newsworthiness.

**Oil versus Chemical**. We control also for the industry: a dummy is equal to one if the company belongs to the chemicals and zero if it belongs to the oil sector.

**Countries**. We expect that structural differences between countries may be relevant, as are differences in environmental liability (see Clarke, 2001), differences in the stringency of regulation, and differences in legal origin (see La Porta et al., 2002). Thus, we introduce 4 country variables to control for accidents that occurred in the United Kingdom, in continental Europe, in Japan or in emerging countries (the reference variable is when accident occurred in North-America).[12]

**Financial controls**. In each regression, we include several standard financial control variables to assess whether intensity of news coverage is able to explain abnormal returns above and beyond already-known measures of information arrival and newsworthiness on stock markets. We include the firm close-to-close abnormal returns on each of the previous two trading days ($AR_{i,t-1}$, and $AR_{i,t-2}$), and, to reciprocate the firm newsworthiness instrument variable (as measured by abnormal news coverage), I include cumulated abnormal returns in the twenty days before the accident ($CAR_{i,[-22,-2]}$). These controls are also designed to capture return predictability past returns (*e.g.* Jegadeesh and Titman, 1993). In addition, we control for firm size and book-to-market ratios using each firm's log of market capitalization and log of book-to-market equity measured at the end of the most recent year. These controls mimic the variables that Fama and French (1992) use to predict returns. Obviously, in percentage value, all else being equals, the drop in equity returns incurred by small firms should be higher. Moreover, small firms do not have the same opportunity as big firms to reallocate their production across plants in order to fulfill their contracts in the event of an accident. Book-to-market is designed to control for firms in financial distress.

We also control for trading volume before the disaster as measured by the ratio of the number of shares traded to the number of shares outstanding. Greater trading volume is often driven by greater numbers of traders, and it is nearly tautological that when more people are trading a stock, more people are paying attention to it.[13] To reciprocate the firm newsworthiness variable, the average percentage increase in volume is measure within the twenty days before the accident date ($AV_{i,[-22,-2]}$), using two estimation periods ($t = [-42, -32]$, and $t = [-1Y, -32]$) to compute the expected level of trading volume. Finally, we include the Amihud's illiquidity ratio defined as a stock's absolute daily return divided by its daily trading volume averaged across the most recent year (Amihud, 2005). This measure captures the absolute percentage price change per dollar of trading volume, *i.e.* the price impact of trades. A larger price impact per unit of volume indicates a more illiquid stock, a stock that is more difficult to arbitrage. A stock with a low turnover is lightly traded, and thus potentially more difficult arbitrage. In addition, the impact of an accident on more liquid firms may be more severe.

[12]We also considered dummy variables for country of listing, but they were highly correlated. To save space, we do not report the results.

[13]Volume may also proxy for investor disagreement. Note that formally, investor inattention and investor disagreement lead to the same predictions, that is under-reaction to news announcements (Hong and Stein, 1999).

# 4 Results

## 4.1 What Drives the News Coverage of Chemical Disasters?

In this section, we document the disaster news coverage determinants in the first days after the accident date. Recall that disaster news coverage variables use the total number of newspaper articles published about the accident.

OLS regressions are used to relate the cross-sectional variance in the disaster news coverage to the accident-specific features, the firm-specific features, and various standard controls. Table 3 reports the results. In the second set of regressions (columns (4)-(6)), our two time-varying instruments are included in the regression models: the news pressure variable at the time of disasters; and the firm newsworthiness shortly before the disaster (as measured by abnormal media coverage). Recall that instruments have to be strongly correlated with the endogenous regressor (in our study, the news coverage) to be relevant. It is worth noting that if we include instruments separately, results do not change notably. Several measures of press coverage magnitude are used: the daily number of newspaper articles from $t = 0$ to $t = 1$ in event-time ($News_t$); and, the cumulated number of natural newspaper articles from $t = 0$ to $t = 2$ in event-time ($CumNews_[0, +t]$).

Newspapers focus their attention on accidents which provoke fatalities and serious injuries. In every model specification, the coefficient for human harm is positive and statistically significant at the 5% level: One more fatality is associated with one additional newspaper article on the accident day (see model (4) in Table 3 which has the highest r-squared). Results also show evidence of a significant non-linear effect of the number of injuries and fatalities on the disaster news coverage. The coefficient associated with the squared number of fatalities and serious injuries is negative and significant at the 1% level. Therefore, the marginal effect of human harm on the number of newspaper articles decreases with the total number of injuries and deaths witnessed. The effect of pollution (and subsequent social costs due to containment and evacuation) is less robust. In columns (1)-(3), absent exclusion restrictions (instrument variables), the effect of the toxic release dummy on news coverage is positive and significant at the 10% level, but in specifications (4)-(6), the effect is no longer significant. Surprisingly, most financial control variables (unreported results) do not increase the explanatory power of the regressions and in almost every specification, coefficients associated with these variables are not significant. However, regressions in columns (4)-(6) confirm that the news coverage of accidents is more intense when the responsible firm is bigger.

As expected, the disaster news coverage increase when firm responsible for the disaster is of major concern for journalists shortly before disasters, and, irrespective of the firm-specific features, such as size (columns (4)-(6)). On average, a 1% increase in the firm newsworthiness variable increases significantly the disaster news coverage by almost two articles in the first two days. One may be concerned that the introduction of the firm newsworthiness variable in addition to financial controls may spur the regressions. Actually, when the firm newsworthiness variable is excluded from the regression, neither financial control is significant. In addition, on the accident day, intense news pressure, as measured by the time devoted to the top three news in a day, increases the news coverage of disasters. This result is in accordance with the fact that chemical disasters news are related to concern over other political issues, such as wars and terrorist attacks.[14] However, the intensity of news pressure decreases at the 10% level the cumulated number of articles on the day after. This is in line with our initial assumption that other newsworthy material and intense news pressure crowd out the news coverage of disasters.

[14]In unreported results, we also use control for the total number of headlines mentioning wither the word "war" or "terrorism", and its coefficient is positive and significant.

Finally, the news coverage is more important for accidents occurring in the USA by contrast with accidents occurring in continental Europe. In the first two days, accidents occurring in continental Europe receive on average 14 less articles (significant at the 1% level) than accidents occurring in the US (see column (6)). Since our sample also includes various non english-spoken countries such Japan, this result cannot be due to the fact that newspaper articles are collected in the English press.

**Summary.** Overall, the results confirm that press coverage is highly sensitive to the seriousness and social cost of accidents as measured by the number of injuries and fatalities. Similarly, the reputation of firms as measured by the number of previous accidents experienced by each firm is crucial to explain the magnitude of the disaster news coverage. On the accident day, these two variables help explain almost 50% of the news coverage variance (as measured by the *adjusted r-squared* metric). Finally, the disaster news coverage is related to the firm newsworthiness shortly before the disaster. This result is worth noting because, our measure of the disaster news coverage captures articles related to the disaster (and ignores the other news articles related to the firm), so that, all else being equal, firms under the scrutiny of journalists before the accidents will benefit from higher news coverage in the event of chemical disasters. We also document that news pressure is also an important predictor of the media coverage. From a pure journalistic point of view, the event is more newsworthy when news pressure related to other events is low (mainly macro and political event unrelated to the firm). News pressure exogenously decreases the magnitude of the disaster news coverage, without affecting the firm's specific risks, and is ideally suited to instrument disaster news coverage, more so than the firm newsworthiness.

To summarize our results, we confirm that news coverage respond both to the seriousness of accidents, but also to time-varying and exogenous factors, unrelated to the information content of news, namely, the daily news pressure, and the firm newsworthiness at the time of disasters.

Table 3: **News Coverage Determinants following Chemical Disasters**

This table reports results from robust OLS regression. The dependant variable is the number of newspapers articles published about the disaster. Several measures are used: $News$ represents the daily number of articles, while, $Cum.News$ represents the cumulated number of articles in a given period. In columns (1)-(3), natural logarithm of the number of newspaper articles is used to correct the news coverage right-tailed distribution. In columns (4)-(6), the news pressure variable represents the median time spent on top three news segments (minutes), which is available from 1990-2003. During this period (1990-2003), the disaster news coverage is not right tailed, and the log transformation is not necessary. Each model includes a complete set of regional dummies (UK, Emerging countries, Japan, and continental Europe), and a complete set of standard financial control variables. Firm newsworthiness represents the abnormal media coverage in the period $[-22, -2]$ in event-time. Standard financial control variables include: the firm close-to-close abnormal returns on each of the previous two trading days ($AR_{i,t-1}$, and $AR_{i,t-2}$); the cumulated abnormal returns in the twenty days before the accident ($CAR_{i,[-22,-2]}$); firm size as measured by the firm's log of market capitalization; and book-to-market ratios using log of book-to-market equity at the end of the most recent year; abnormal trading volume is measured by the ratio of the number of shares traded to the number of shares outstanding within the twenty days before the accident date ($AV_{i,[-22,-2]}$), using the estimation period $t = [-1Y, -32]$ to compute the expected level of trading volume; the Amihud's illiquidity ratio which is the stock's absolute daily return divided by its daily trading volume averaged across the most recent year (Amihud, 2005). The sample period is from 1990 to 2005.

| Dependant variable is: | $News_{t=0}$ (log) | $News_{t=1}$ (log) | $Cum.News_{t=[0,+1]}$ (log) | $News_{t=0}$ | $News_{t=1}$ | $Cum.News_{t=[0,+1]}$ |
|---|---|---|---|---|---|---|
| Constant | 0.113 | 0.929 | 0.980 | −13.829 | 2.631 | −11.756 |
| | [0.34] | [2.22]** | [2.37]** | [4.81]*** | [0.52] | [1.38] |
| Fatalities and serious injuries | 0.280 | 0.273 | 0.325 | 1.083 | 1.236 | 2.503 |
| | [4.02]*** | [4.47]*** | [5.07]*** | [2.10]** | [1.90]* | [2.42]** |
| Fatalities and serious injuries$^2$ | −0.007 | −0.007 | −0.008 | −0.048 | −0.048 | −0.100 |
| | [3.07]*** | [3.68]*** | [4.24]*** | [2.71]** | [2.26]** | [2.97]*** |
| Toxic release | 0.536 | 0.755 | 0.822 | −2.228 | 0.193 | −1.745 |
| | [1.79]* | [1.86]* | [2.09]** | [0.80] | [0.04] | [0.27] |
| # previous accidents | 0.325 | 0.133 | 0.215 | 3.656 | 3.455 | 7.134 |
| | [2.40]** | [1.22] | [1.66] | [2.38]** | [2.05]** | [2.30]** |
| Firm newsworthiness$_{[-22,-2]}$ | | | | 0.834 | 1.395 | 2.100 |
| | | | | [2.72]*** | [2.42]** | [2.33]** |
| News pressure | | | | 0.757 | | |
| | | | | [3.83]*** | | |
| Average news pressure$_{[0,+1]}$ | | | | | −0.981 | −0.062 |
| | | | | | [1.72]* | [0.06] |
| 11-sept | | | | 15.114 | 14.877 | 28.530 |
| | | | | [2.47]** | [1.82]* | [2.04]** |
| Market value (2005$, log) | 0.036 | 0.124 | 0.118 | 1.680 | 2.519 | 4.167 |
| | [0.47] | [1.39] | [1.29] | [2.23]** | [2.39]** | [2.50]** |
| $1994 < Year < 2000$ | −0.221 | −0.225 | −0.247 | 1.364 | −2.782 | −1.641 |
| | [0.69] | [0.51] | [0.59] | [0.67] | [0.75] | [0.35] |
| $> 1999$ | 0.566 | 0.716 | 0.746 | −1.194 | 3.098 | 2.352 |
| | [1.85]* | [2.24]** | [2.17]** | [0.44] | [0.78] | [0.38] |
| Continental Europe | −0.292 | −1.174 | −1.004 | −2.424 | −11.094 | −14.094 |
| | [0.92] | [3.86]*** | [2.99]*** | [1.06] | [3.57]*** | [2.99]*** |
| Emerging countries | 0.562 | −1.396 | −0.528 | | | |
| | [0.80] | [2.21]** | [0.72] | | | |
| Japan | 0.794 | −0.220 | 0.209 | 1.987 | 1.200 | 2.771 |
| | [2.08]** | [0.39] | [0.38] | [0.60] | [0.20] | [0.35] |
| UK | 0.197 | −0.606 | −0.396 | −4.878 | −15.994 | −20.224 |
| | [0.29] | [0.81] | [0.46] | [1.17] | [2.70]** | [2.18]** |
| Fin.Controls | | | | YES | | |
| N | 64 | 64 | 64 | 55 | 55 | 55 |
| F | 9.9288 | 10.6280 | 16.2392 | 11.1813 | 7.0838 | 9.0926 |
| Adj. R-squared | 0.4665 | 0.4351 | 0.4566 | 0.5905 | 0.4731 | 0.5369 |

## 4.2 Effect of Disaster News Coverage on Stock Market Returns

In this section, we document the effect of the disaster news coverage on the drop in equity returns following chemical disasters. To estimate the effect of the disaster news coverage on stock market returns, a two-equation triangular system is estimated, where the endogenous and dependent variables are respectively: (i) in the first equation, the disaster news coverage, and (ii) in the second equation, the cumulative abnormal returns. The two variables are regressed on the same exogenous variables, including a complete set of standard financial controls.

In the first two days, the disaster news coverage is particularly heterogenous, and delayed in some cases (for example, the correlation between $News_{t=0}$ and $News_{t=1}$ is of only 60% while the correlation between $News_{t=1}$ and $News_{t=2}$ is above 90%). Therefore, to account for the effect of delayed news coverage on stock market outcomes, we use $News_{t=0}$ and $News_{t=1}$ jointly in some model specification. In contrast, $CumNews_{[0,+t]}$ is a more conventional measure which captures the overall intensity of press coverage in the first $t$ days after the accident, and deliberately ignores daily autocorrelation in the news coverage metrics.[15] Note also that the natural logarithm is used to correct for the right-tailed distribution of press coverage documented in the Data section. Finally, to account for a potential non-linear effect of news coverage, we also include the square number of newspaper articles. Results are reported in Table 4 (columns (4)-(8)), Table 5, Table 6, and Table **??**. Table 4 estimate the contemporaneous effect of the disaster news coverage on the abnormal return using robust Ordinary Least Squares; Table 5 estimate dynamic equations (*i.e.* the effect of the disaster news coverage on the subsequent day abnormal return) using robust Ordinary Least Squares; while Table 6 and Table **??** estimate contemporaneous equations using respectively Two-stage Leas Squares, and Seemingly Unrelated Regression.[16]

Our first result is that in the first days after the accident, intense media coverage, which cannot be imputed to fatalities and pollution or to standard financial risk-factors, mitigates the drop in stock returns. In every specification, and irrespective of the estimator used (TSLS, SUR, or OLS), the effect of disaster news coverage on abnormal returns is positive and significant at the 5% level (at least). Moreover, both the cumulated number of news articles, and the daily number of articles have a positive effect. As shown in Table 5, in the dynamic equation setting, intensity of news coverage on the accident day help explain at the 1% level cumulated abnormal returns on the subsequent days. Finally, there is also strong evidence that the marginal effect of one additional press article decreases with the total number of press articles available: the coefficient associated with the square number of press articles introduced in Table 5 and Table 4 is negative and significant at the 1%.

**Relevance, Efficiency, and Heteroscedasticity of Instruments.** The firm newsworthiness and the daily news pressure prove to be good and valid instruments. First, as shown in Table 2, instruments are uncorrelated to the severity of disasters, especially chemical disasters do not influence the daily news pressure variable. The Cragg-Donald F-statistic for excluded instrument in the first stage is much greater than the critical values for the weak instrument test based on TSLS size provided by Stock and Yogo (2002), and the partial R2 for excluded instruments is very high (between 45% and 50%). Finally, over-identification tests (using the Hansen test statistic) is not rejected.

**Endogeneity test.** Using our instrument variables, we are able to test for the endogeneity of the disaster news coverage with regards to (unexplained) abnormal returns following chemical disasters. The null hypothesis of news coverage exogeneity is accepted (using the Hausman

[15] The cumulated number of news avoids problems lead by the fact that certain disasters may occur in the late afternoon.

[16] Results from a three-stage least squares regression implemented to tackle more precisely the correlation between equations is not reported, but do provide the same results.

Table 4: **Determinants of Cumulative Abnormal Returns Following Chemical Disasters - Contemporaneous Equations**

This table reports results from robust OLS regressions, where the dependent variable is the raw return on the accident day ($R_t$, the cumulative abnormal return up to the second day following disasters ($CAR_{[0;+t]}$ for $t = 0, 1, 2$), as well as, in columns (9)-(11), the associated shareholder loss ($SL_{[0;+t]}$ for $t = 0, 1, 2$). In columns (5)-(8), measures of the number of newspapers articles published about the disaster are included: $News$ represents the daily number of articles, while, $Cum.News$ represents the cumulated number of articles in a given period. Each model includes a complete set of regional dummies to control for the continent where the accident occurred, as well as, standard financial variables. Standard financial control variables include: the firm close-to-close abnormal returns on each of the previous two trading days ($AR_{i,t-1}$, and $AR_{i,t-2}$; the cumulated abnormal returns in the twenty days before the accident ($CAR_{i,[-22,-2]}$); firm size as measured by the firm's log of market capitalization; and book-to-market ratios using log of book-to-market equity at the end of the most recent year; abnormal trading volume is measured by the ratio of the number of shares traded to the number of shares outstanding within the twenty days before the accident date ($AV_{i,[-22,-2]}$), using the estimation period $t = [-1Y, -32]$ to compute the expected level of trading volume; the Amihud's illiquidity ratio which is the stock's absolute daily return divided by its daily trading volume averaged across the most recent year (Amihud, 2005). Abnormal returns are computed using the one factor market model. The sample period is from 1990 to 2005. Note: Robust standard errors are in brackets: ***, **, * denote statistically significance at the 1%, the 5% and the 10% level, respectively.

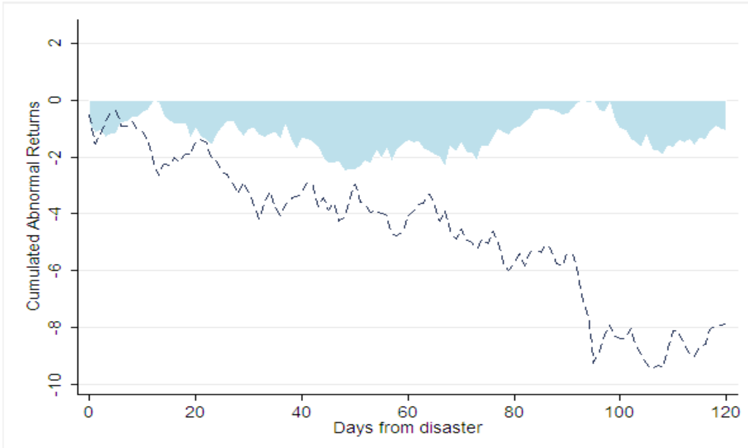
| Dependant variable is: | $R_{i,t=0}$ (1) | $AR_{i,t=0}$ (2) | $CAR_{[0;+1]}$ (3) | $CAR_{[0;+2]}$ (4) | $R_{i,t=0}$ (5) | $AR_{i,t=0}$ (6) | $CAR_{[0;+1]}$ (7) | $CAR_{[0;+2]}$ (8) |
|---|---|---|---|---|---|---|---|---|
| $News_{t=0}$ | | | | | 0.136 | 0.094 | | |
| | | | | | [0.044]∗∗∗ | [0.031]∗∗∗ | | |
| $News^2_{t=0}$ | | | | | −0.001 | −0.001 | | |
| | | | | | [0.001]∗∗ | [0.000]∗ | | |
| $Cum.News_{t=[0,+1]}$ | | | | | | | 0.043 | |
| | | | | | | | [0.016]∗∗ | |
| $Cum.News^2_{t=[0,+1]}$ | | | | | | | −0.000 | |
| | | | | | | | [0.000]∗∗∗ | |
| $Cum.News_{t=[0,+2]}$ | | | | | | | | 0.028 |
| | | | | | | | | [0.023] |
| $Cum.News^2_{t=[0,+2]}$ | | | | | | | | −0.000 |
| | | | | | | | | [0.000] |
| Fatalities | −0.146 | −0.118 | −0.113 | −0.115 | −0.209 | −0.164 | −0.153 | −0.159 |
| | [0.062]∗∗ | [0.044]∗∗ | [0.068] | [0.088] | [0.046]∗∗∗ | [0.042]∗∗∗ | [0.079]∗ | [0.089]∗ |
| Toxic release | −0.510 | 0.013 | −1.107 | −0.964 | −0.769 | −0.139 | −1.382 | −1.171 |
| | [0.497] | [0.389] | [0.573]∗ | [0.878] | [0.487] | [0.357] | [0.564]∗∗ | [0.922] |
| # prev. accidents | −0.378 | −0.409 | −0.264 | −0.460 | −0.529 | −0.550 | −0.412 | −0.597 |
| | [0.216]∗ | [0.174]∗∗ | [0.235] | [0.349] | [0.212]∗∗ | [0.175]∗∗∗ | [0.234]∗ | [0.355]∗ |
| 1994 <Year< 2000 | −0.299 | −0.483 | −0.146 | 0.195 | −0.094 | −0.339 | 0.213 | 0.414 |
| | [0.400] | [0.347] | [0.542] | [0.763] | [0.410] | [0.338] | [0.628] | [0.901] |
| > 1999 | −0.970 | −0.467 | −0.735 | −0.671 | −1.601 | −0.959 | −1.395 | −1.222 |
| | [0.600] | [0.455] | [0.663] | [0.960] | [0.623]∗∗ | [0.503]∗ | [0.716]∗ | [1.065] |
| MV ($2005, log) | 0.423 | 0.394 | 0.530 | 0.468 | 0.338 | 0.330 | 0.416 | 0.389 |
| | [0.170]∗∗ | [0.133]∗∗∗ | [0.197]∗∗∗ | [0.294] | [0.151]∗∗ | [0.117]∗∗∗ | [0.185]∗∗ | [0.308] |
| Regional dummies | | | | | YES | | | |
| Financial controls | | | | | YES | | | |
| N | 64 | 64 | 64 | 64 | 64 | 64 | 64 | 64 |
| Adj. R-squared | 0.1741 | 0.2397 | 0.1958 | 0.0708 | 0.3087 | 0.3434 | 0.2592 | 0.0671 |

specification tests), such that the disaster news coverage can be considered as uncorrelated to other new information arrival at the time of disasters (as measured by the unexplained part of abnormal returns). This result is in line with results from the Seemingly Unrelated Regression estimator in Table **??**, which document no correlation between the news coverage and abnormal return residuals (using the Breusch-Pagan test). Finally, this result confirms that the OLS estimator is the most consistent to estimate the effect of news coverage on abnormal returns.

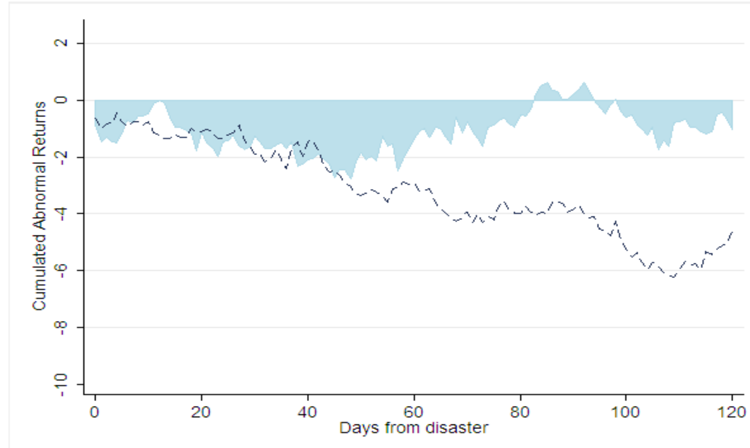
**Summary.** Shareholder value losses following disasters do increase with the social consequences of accidents, namely, the number of fatalities, serious injuries, and toxic release occurrences. Most likely, the information conveyed by the number of deaths, injuries and pollution is related to uninsured costs, litigation and reputation risks. Besides, the shareholder loss increases with the number of previous accidents experienced by each firm, so that the firm reputation is not totally incorporated into prices, and accidents are worth a signal for investors.

The inclusion of disaster news coverage metrics into the specification models doubles their explanatory power, and confirm preliminary evidence that the social cost of accidents is incorporated into prices. Results can be summarized as follows. First, disaster news coverage affects stock returns irrespective of the information content (we do not control for the positive or negative nature of news for example), and is exogenous to the unexplained part of the abnormal returns at the time of disasters. Second, in the short-term, a marginally negative effect of news coverage (due to reputation loss for example) is discarded or perfectly captured by the number of injuries and pollution cases. We document instead that intense news coverage is associated with lower losses in the first days, and, at the same time, that the marginal effect of newspaper articles on abnormal returns decreases with the total number of articles available. This result is in line with the evidence of Chan (2003) which documents that prices are slow to reflect bad public news. At the same time, our results are not in accordance with previous evidence showing that media facilitates the incorporation of earnings announcement surprises into stock market prices (see Bushee *et al.*, 2007, Peress, 2008).

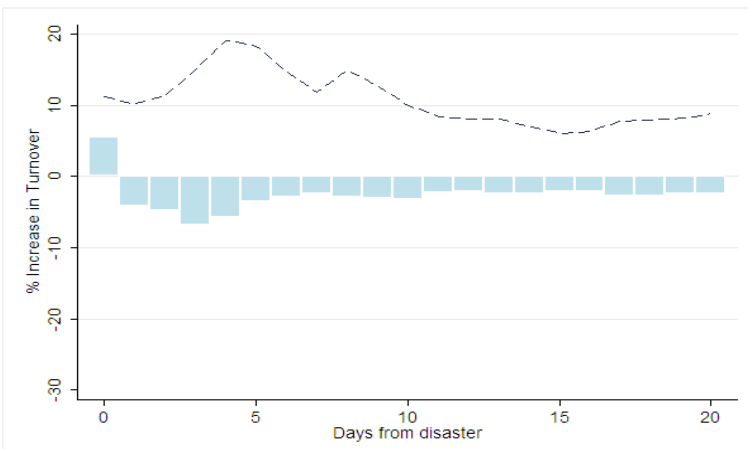
Figure 4: The Stock Market Response to Pollution News and Press Coverage



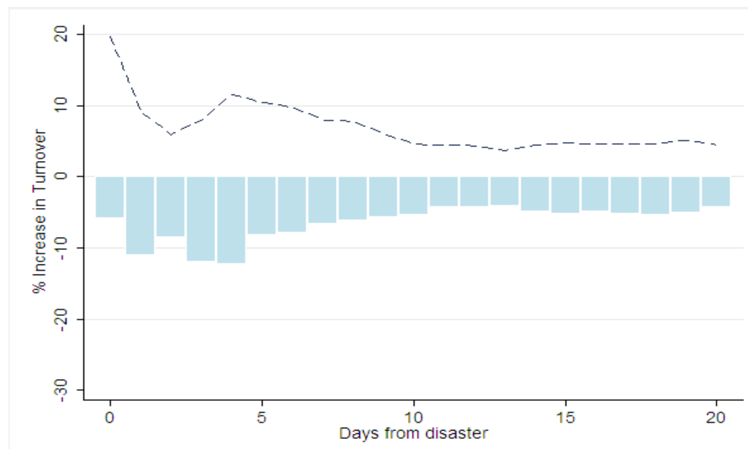

(a) Pollution




(b) Press Coverage




(c) Pollution




(d) Press Coverage

Notes: Abnormal returns are computed using the market model parameters estimated with OLS through the period [-190; -10] in event time. Event time is days relative to the accident date. The sample period is from 1990 to 2005.

# 5 Discussion and Additional Evidence

## 5.1 Long-term Evidence

In this section, we document the long-term effect of chemical disasters on stock market returns, using the cumulated abnormal return up to six months after the accident. Graphically, and using sub-sample analysis (see Table **??**, and, Figure 4), there is clear evidence that in the long-term, the most publicized accidents, as well as the most serious accidents, are associated with a stronger drop in equity returns. By comparison, cumulated abnormal returns associated with non-polluting accidents, and the least publicized accidents are closed to zero levels. As shown in Table **??**, the differences in abnormal returns across these sub-samples are significantly different from zero at the 1% level. However, we also document that polluting accidents are associated with higher abnormal return variance, so that, test statistics may be overstated. To counter this problem, we suggest to use the cross-sectional variance of abnormal returns after the disaster (rather than historical abnormal return variance) in a multivariate regression setting to test for differences across accident sub-samples. In Table 7, we report results from cross-sectional regressions using robust OLS, where the cumulated abnormal returns up to six months after the disaster is the dependant variable.

There is clear evidence that over the first six month after the disaster, abnormal returns incorporate the negative effect associated with pollution news and intense media coverage. Firms which benefit from more intense news coverage in the first three days after the disaster irrespective of the accident seriousness also incur lower abnormal returns only twenty days after the accident. The coefficient associated with news coverage is negative and statistically significant at the 5% level. This result confirms that all else being equal marginally more intense press coverage is costly (and potentially, proxies for reputation loss and degradation of the firm's image). However, at the same time, the result is not economically significant, because in Table 7, we document that the marginal loss associated with one additional newspaper article is only of 0.03% six months after. This marginal effect is therefore too low to be considered as relevant (the average drop associated with the most serious accidents is on average of 7%). Finally, we document that, after six months, the marginal loss associated with pollution news is of 12%. This effect is both statistically and economically significant at the 5% level. This result confirms that investors are slow to recognize the extent of the loss associated with pollution news. This result is not surprising since there is great uncertainty surrounding pollution news, with regard to litigation, reputation risk, and the damage extent. By contrast, the effect of the number of serious injuries and fatalities on abnormal returns in the long-term is not significant.

Table 5: **Abnormal Return Determinants following Chemical Disasters - Dynamic Equations**

This table reports results from the robust OLS estimator where the dependent variable is the raw return on the accident day, the cumulative abnormal return up to the second day following disasters: $CAR_{[0;+t]}$ for $t = 0, 1, 2$, as well as, the associated shareholder loss: $SL_{[0;+t]}$ for $t = 0, 1, 2$. Each model includes a complete set of dummies to control for the continent where the accident occurred, as well as, standard financial variables. Standard financial control variables include: the firm close-to-close abnormal returns on each of the previous two trading days ($AR_{i,t-1}$, and $AR_{i,t-2}$; the cumulated abnormal returns in the twenty days before the accident ($CAR_{i,[-22,-2]}$); firm size as measured by the firm's log of market capitalization; and book-to-market ratios using log of book-to-market equity at the end of the most recent year; abnormal trading volume is measured by the ratio of the number of shares traded to the number of shares outstanding within the twenty days before the accident date ($AV_{i,[-22,-2]}$), using the estimation period $t = [-1Y, -32]$ to compute the expected level of trading volume; the Amihud's illiquidity ratio which is the stock's absolute daily return divided by its daily trading volume averaged across the most recent year (Amihud, 2005). Abnormal returns are computed using the one factor market model. The sample period is from 1990 to 2005.

| | $CAR_{[0;+1]}$ | $CAR_{[0;+2]}$ | $CAR_{[0;+1]}$ | $CAR_{[0;+2]}$ |
|---|---|---|---|---|
| Constant | −0.581 | −0.399 | 0.172 | −0.500 |
| | [0.86] | [0.56] | [0.17] | [0.43] |
| $News_{t=0}$ | 0.240 | 0.085 | 0.107 | |
| | [5.01]*** | [2.90]*** | [3.35]*** | |
| $News^2_{t=0}$ | −0.002 | | | |
| | [3.59]*** | | | |
| $News_{t=1}$ | | −0.004 | −0.004 | |
| | | [1.02] | [0.95] | |
| $Cum.News_{t=[0,+1]}$ | | | | 0.067 |
| | | | | [3.05]*** |
| $Cum.News^2_{t=[0,+1]}$ | | | | −0.000 |
| | | | | [2.94]*** |
| Fatalities and serious injuries | −0.555 | −0.408 | −0.478 | −0.498 |
| | [3.77]*** | [2.32]** | [2.08]** | [1.89]* |
| Fatalities and serious injuries$^2$ | 0.015 | 0.010 | 0.012 | 0.013 |
| | [3.12]*** | [1.81]* | [1.66] | [1.55] |
| Toxic release | −1.845 | −1.111 | −0.937 | −1.613 |
| | [3.64]*** | [2.07]** | [1.16] | [1.83]* |
| # previous accidents | −0.501 | −0.702 | −1.037 | −0.737 |
| | [1.99]* | [2.38]** | [2.64]** | [2.07]** |
| $1994 < Year < 2000$ | −0.281 | −0.370 | −0.064 | 0.289 |
| | [0.51] | [0.65] | [0.08] | [0.30] |
| $> 1999$ | −2.348 | −1.843 | −2.051 | −2.252 |
| | [3.12]*** | [2.29]** | [1.81]* | [1.79]* |
| Market value ($2005, log) | 0.369 | 0.467 | 0.394 | 0.274 |
| | [2.40]** | [2.77]*** | [1.53] | [0.97] |
| Regional dummies | | YES | | |
| Fin.Controls | | YES | | |
| N | 64 | 64 | 64 | 64 |
| F-stat | 9.3505 | 15.4949 | 8.5645 | 7.1328 |
| R-squared | 0.6093 | 0.5206 | 0.4209 | 0.3858 |
| Adj. R-squared | 0.4495 | 0.3395 | 0.2021 | 0.1346 |

Note: Robust standard errors are in brackets: ***, **, * denote statistically significance at the 1%, the 5% and the 10% level, respectively.

Table 6: **Abnormal Return Determinants following Chemical Disasters - Two-stage Least Squares**

This table reports results from the two-stage least squares estimator where the dependent variable is the cumulative abnormal return up to the first day following disasters: $CAR_{[0;+t]}$ for $t = 0, 1$, and the endogenous regressor is the number of newspaper articles published about the disaster on day $t = 0, 1$, instrumented by the firm exposure to media before disasters (Firm Newsworthiness$_{t=[-20,-2]}$), and the news pressure variable. Each model includes a complete set of regional dummies (UK, Emerging countries, Japan, and continental Europe). Standard financial control variables include: the firm close-to-close abnormal returns on each of the previous two trading days ($AR_{i,t-1}$, and $AR_{i,t-2}$); the cumulated abnormal returns in the twenty days before the accident ($CAR_{i,[-22,-2]}$); firm size as measured by the firm's log of market capitalization; and book-to-market ratios using log of book-to-market equity at the end of the most recent year; abnormal trading volume is measured by the ratio of the number of shares traded to the number of shares outstanding within the twenty days before the accident date ($AV_{i,[-22,-2]}$), using the estimation period $t = [-1Y, -32]$ to compute the expected level of trading volume; the Amihud's illiquidity ratio which is the stock's absolute daily return divided by its daily trading volume averaged across the most recent year (Amihud, 2005). Abnormal returns are computed using the one factor market model. First stage results are not presented. The sample period is from 1990 to 2005.

| Dependant variable is: | $R_{i,t=0}$ | $AR_{i,t=0}$ | $CAR_{[0;+1]}$ | $CAR_{[0;+1]}$ |
|---|---|---|---|---|
| Constant | 0.164 | 0.233 | −0.274 | −1.174 |
| | [0.30] | [0.51] | [0.43] | [1.57] |
| $News_{t=0}$ | 0.133 | 0.106 | 0.132 | |
| | [3.94]*** | [3.77]*** | [3.35]*** | |
| $News_{t=1}$ | | | | 0.076 |
| | | | | [2.29]** |
| Fatalities and serious injuries | −0.375 | −0.396 | −0.547 | −0.388 |
| | [2.97]*** | [3.77]*** | [3.71]*** | [2.57]** |
| Fatalities and serious injuries$^2$ | 0.006 | 0.009 | 0.013 | 0.009 |
| | [1.32] | [2.43]** | [2.68]*** | [1.61] |
| Toxic release | −0.793 | −0.301 | −1.473 | −1.775 |
| | [1.82]* | [0.83] | [2.90]*** | [2.85]*** |
| # previous accidents | −0.648 | −0.676 | −0.591 | −0.416 |
| | [2.98]*** | [3.73]*** | [2.33]** | [1.46] |
| $1994 < Year < 2000$ | −0.253 | −0.603 | −0.419 | 0.144 |
| | [0.53] | [1.51] | [0.75] | [0.21] |
| $> 1999$ | −2.368 | −1.783 | −2.170 | −1.743 |
| | [4.36]*** | [3.94]*** | [3.42]*** | [2.47]** |
| Market value ($2005, log) | 0.337 | 0.271 | 0.481 | 0.486 |
| | [2.83]*** | [2.72]*** | [3.45]*** | [2.91]*** |
| Regional dummies | | YES | | |
| Fin.Controls | | YES | | |
| N | 55 | 55 | 55 | 55 |
| F-stat | 3.1672 | 2.9392 | 3.2225 | 2.1664 |
| R-squared | 0.5532 | 0.5315 | 0.5851 | 0.4181 |
| Adj. R-squared | 0.3814 | 0.3513 | 0.4256 | 0.1942 |
| Partial R-squared (excl.IV) | 48.63 | 48.63 | 48.63 | 55.72 |
| F-stat (excl.IV) | 11.67 | 11.67 | 11.67 | 11.33 |
| Sargan $\chi^2$ | 3.49 | 2.31 | 4.20 | 13.43 |
| (p-value,%) | (17.47) | (31.46) | (12.24) | (0.38) |
| Wu-Hausman stat. p-value (%) | 26.47 | 25.97 | 83.66 | 9.76 |
| Durbin-Wu-Hausman $\chi^2$ p-value (%) | 18.04 | 17.59 | 80.29 | 4.88 |
| Pagan-Hall stat. p-value | 94.75(%) | 89.40 | 83.71 | 80.75 |



Note: Student t-statistics are in brackets; ***, **, * denote statistically significance at the 1%, the 5% and the

Table 7: **Long-term Abnormal Returns Determinants following Chemical Disasters**

This table reports results from robust OLS regressions. In columns (1)-(5), the dependent variable is the cumulated abnormal return computed from day $t = 2$ up to day $h = +120, 100, 80, 60, 40, 20$ in event-time, depending on the model specification ($CAR_{[+2,+h]}$. Each model includes a complete set of regional dummies (UK, Emerging countries, and Japan, and continental Europe), as well as, standard financial variables. Standard financial control variables include: the firm close-to-close abnormal returns on each of the previous two trading days ($AR_{i,t-1}$, and $AR_{i,t-2}$); the cumulated abnormal returns in the twenty days before the accident ($CAR_{i,[-22,-2]}$); firm size as measured by the firm's log of market capitalization; and book-to-market ratios using log of book-to-market equity at the end of the most recent year; abnormal trading volume is measured by the ratio of the number of shares traded to the number of shares outstanding within the twenty days before the accident date ($AV_{i,[-22,-2]}$), using the estimation period $t = [-1Y, -32]$ to compute the expected level of trading volume; the Amihud's illiquidity ratio which is the stock's absolute daily return divided by its daily trading volume averaged across the most recent year (Amihud, 2005). The sample period is from 1990 to 2005.

| Dependant variable is: | $CAR_{t=[+2,+120]}$ | $CAR_{t=[+2,+100]}$ | $CAR_{t=[+2,+80]}$ | $CAR_{t=[+2,+40]}$ | $CAR_{t=[+2,+20]}$ |
|---|---|---|---|---|---|
| Constant | 21.559 | 10.034 | 8.351 | 3.813 | −0.542 |
| | [2.41]** | [1.32] | [1.31] | [0.52] | [0.15] |
| $Cum.News_{t=[0,+1]}$ | −0.035 | −0.023 | −0.005 | −0.023 | −0.017 |
| | [1.69]* | [1.31] | [0.33] | [2.21]** | [2.09]** |
| Fatalities and serious injuries | 0.461 | 0.194 | −0.090 | −0.025 | 0.156 |
| | [0.89] | [0.39] | [0.19] | [0.08] | [1.23] |
| Toxic release | −12.853 | −8.875 | −4.010 | −2.126 | 0.407 |
| | [2.38]** | [2.22]** | [0.97] | [0.51] | [0.17] |
| # previous accidents | −0.268 | 0.880 | 0.148 | −1.113 | −0.411 |
| | [0.12] | [0.46] | [0.09] | [0.81] | [0.48] |
| $> 1999$ | −6.147 | −0.317 | 1.611 | 2.915 | 3.306 |
| | [1.11] | [0.08] | [0.43] | [0.90] | [2.03]** |
| $1994 < Year < 2000$ | −6.060 | −4.505 | −4.402 | 0.248 | 2.698 |
| | [0.99] | [0.87] | [0.98] | [0.07] | [1.29] |
| Market value ($2005, log) | 0.443 | 0.221 | −0.628 | 0.576 | −0.014 |
| | [0.29] | [0.21] | [0.63] | [0.65] | [0.03] |
| Regional Dummies | | | YES | | |
| Fin.Controls | | | YES | | |
| N | 64 | 64 | 64 | 64 | 64 |
| F-stat | 3.25 | 4.88 | 5.00 | 2.79 | 6.18 |
| R-squared (%) | 59.98 | 56.17 | 53.47 | 36.89 | 52.15 |
| Adj. R-squared (%) | 32.19 | 26.55 | 2203 | −5.75 | 19.82 |

Note: Robust Student t-statistics are in brackets: ***, **, * denote statistically significance at the 1%, the 5% and the 10% level, respectively.

## 5.2 Effect of the Disaster News Coverage on Abnormal Return Variability

In this section, we investigate the effect of disaster news coverage on the variability of stock returns. The variance of abnormal returns in the event of disaster, is used to capture the uncertainty (or noisiness) surrounding chemical disaster news. In Table 8, we report results from robust OLS regressions where abnormal return variance is the dependant variable.

Results document two interesting effects. First, pollution news as measured by the toxic release dummy increase significantly (at the 10% level) the stock return variance. This result confirms that pollution news are associated with greater uncertainty on stock markets. Second, intense media coverage is associated with return variability of a lower magnitude. The coefficient of news coverage, measured both on a daily basis, and by the cumulated number of news articles, is negative and significant at the 1% level. This result is in line with the fact that news coverage induce abnormal returns of a lower magnitude following chemical disasters. Even if it is difficult to disentangle the effect of news coverage on mean abnormal returns, from the effect on the return variance, this result may be due to the fact that intense media coverage reduces information uncertainty following chemical disasters. Therefore, it might confirm that intense media coverage marginally alleviate information problems on stock markets.

Table 8: **Abnormal Return Variability and Abnormal Volume Determinants following Chemical Disasters**

This table reports results from a robust OLS regression. In columns (1)-(3), the dependent variable is the abnormal return variability on day $t = 0, 1$, as measured by the square level of the abnormal return, while in columns (4)-(5), the dependant variable is the average logged abnormal volume on day $t = 0$ and in the period $t = [0, +1]$. Each model includes a complete set of regional dummies (UK, Emerging countries, and Japan, and the reported dummy for continental Europe), as well as, standard financial variables. Standard financial control variables include: the firm close-to-close abnormal returns on each of the previous two trading days ($AR_{i,t-1}$, and $AR_{i,t-2}$); the cumulated abnormal returns in the twenty days before the accident ($CAR_{i,[-22,-2]}$); firm size as measured by the firm's log of market capitalization; and book-to-market ratios using log of book-to-market equity at the end of the most recent year; abnormal trading volume is measured by the ratio of the number of shares traded to the number of shares outstanding within the twenty days before the accident date ($AV_{i,[-22,-2]}$), using the estimation period $t = [-1Y, -32]$ to compute the expected level of trading volume; the Amihud's illiquidity ratio which is the stock's absolute daily return divided by its daily trading volume averaged across the most recent year (Amihud, 2005). Abnormal returns are computed using the one factor market model. The sample period is from 1990 to 2005.

| Dependant variable is: | $AR^2_{i,t=0}$ | $AR^2_{i,t=1}$ | $AR^2_{i,t=1}$ | $AV_{t=0}$ | $AV_{t=[0,+1]}$ |
|---|---|---|---|---|---|
| Constant | 3.942 | 2.545 | 3.235 | 29.297 | 27.219 |
| | [1.86]* | [2.16]** | [2.63]** | [0.99] | [0.80] |
| $News_{t=0}$ | −2.090 | −1.228 | | −7.516 | |
| | [2.78]*** | [2.84]*** | | [0.76] | |
| $Cum.News_{t=[0,+1]}$ | | | −0.896 | | −1.405 |
| | | | [2.48]** | | [0.17] |
| Fatalities and serious injuries | 0.469 | 0.118 | 0.087 | 2.684 | 1.947 |
| | [2.55]** | [1.02] | [0.73] | [1.49] | [1.14] |
| Toxic release | 0.229 | 2.119 | 2.214 | −6.429 | −8.112 |
| | [0.17] | [1.77]* | [1.71]* | [0.29] | [0.37] |
| # previous accidents | 0.204 | 0.527 | 0.320 | 12.252 | 10.137 |
| | [0.38] | [1.58] | [0.99] | [1.43] | [1.31] |
| $1994 < Year < 2000$ | 0.155 | −1.507 | −1.425 | −3.138 | −0.108 |
| | [0.11] | [1.62] | [1.53] | [0.12] | [0.00] |
| $> 1999$ | 3.411 | 2.543 | 2.547 | −1.279 | −3.429 |
| | [2.49]** | [2.39]** | [2.32]** | [0.07] | [0.18] |
| Market value ($2005, log) | −0.483 | −0.550 | −0.488 | −10.758 | −10.775 |
| | [1.21] | [1.90]* | [1.77]* | [2.43]** | [2.34]** |
| Regional dummies | | | YES | | |
| Fin.Controls | | | YES | | |
| N | 64 | 64 | 64 | 56 | 56 |
| F-stat | 2.2436 | 1.6278 | 1.5595 | 4.0775 | 3.3945 |
| R-squared (%) | 36.31 | 43.64 | 41.30 | 29.91 | 28.63 |
| Adj. R-squared (%) | 15.99 | 25.65 | 22.57 | 03.63 | 1.87 |

Note: Robust Student t-statistics are in brackets: ***, **, * denote statistically significance at the 1%, the 5% and the 10% level, respectively.

### 5.3 Effect of the Disaster News Coverage on Share Trading Volume

We document that on average, chemical disasters are associated with an average abnormal volume of 9% on the accident day, and that in the subsequent days volume decrease and reach expected levels (*i.e.*, zero levels). However, abnormal volume following chemical disasters are also featured by a strong variance: for the most serious accidents, the effect on abnormal volume is on average around 20% on the accident day. On the other hand, certain sub-samples of accidents are also associated with negative abnormal volumes on the accident day and in the subsequent days. In this section, we attempt to document this variability in abnormal trading volume following disasters.

In Table 8, we report results from robust OLS regressions using abnormal trading volumes in the first $t$ days in event-time as dependant variables. Results do not show evidence of any significant determinant to explain the variability in abnormal volumes. This result is surprising, because it does not confirm previous evidence (both graphically and using univariate comparisons) that the investor attention is driven by the seriousness of disasters. In addition, this result casts doubt on the attention investor hypothesis that the number of informed investors (or the salience of news) increases with the intensity of news coverage.

## 6 Conclusion

In this article, we analyze news coverage following chemical disasters. This subject matter is relatively unexplored. In fact, most of the previous literature assumes that press coverage is exogenous and does not attempt to model it (Veldkamp (2006) and Kyanezeva (2007) constitute two exceptions).

Our results can be summarized as follows. First, we show that news coverage is explained by the social cost of the accident, as measured by the extent of pollution, by the number of fatalities, and by the number of accidents previously experienced by the firm. In the second part of the paper, we investigate the implications of news coverage on the market value of the firm that is responsible for the accident. We emphasize that, in contrast to previous literature on earning announcements and media, we consider only the articles that specifically mention the accident and disregard those that discuss the firm for unrelated reasons.

The main result of this article is that receiving more news coverage actually decreases, in the first days, the equity loss following a disaster. Since media coverage is usually considered as a good proxy for public concern, this result may appear counter intuitive. We may expect that more publicized disasters would result in a greater reputation loss for the firm and, consequently, in larger equity losses. Our results document instead that from a financial point of view, the link between media coverage and stock market returns is far less obvious.

Various explanations can be advanced. First, it might be the case that more news introduce more noise. This might happen if the reports about deaths and pollution gravity are not unanimous. This may induce investors to disagree, as well as to hold on for more information. This explanation would account for the fact that when looking at the effect of news coverage in the long term (as opposed to the short term), disasters that were more covered by the press experience, after controlling for the gravity of the accident, a slightly larger drop. Another (and opposite) explanation of the mitigating effect of news coverage is that, differently from what assumed before, more news coverage disseminates more information: after an accident, investors that are more informed may react less (and stock returns would then drop by less) than non informed investors who suspect that the accident is more serious than in reality.

To further explain this result, we control for exogenous variations of the news coverage irrespective of the informational content of the diaster. By doing that, we show that disaster news coverage is amplified by the firm's newsworthiness (the abnormal media coverage of the firm before the accident). That is, disasters caused by firms that are under the public spotlight receive more attention in the press. Firm's newsworthiness proxies for the fact that the total number of breaking news about the firm, but unrelated to the accident, is high. Therefore, we can interpret this result as the fact that, all else being equal, marginally more intense news coverage reflects a situation of information overload, rather than increased attention. In the literature, information overload (as measured by the total number of news available at the market level or at the firm level) is associated with investor inattention (or under-reaction) to new information arrival (Hirshleifer, Teoh, 2007, Peress, 2008). This statement is also in accordance with the fact, that, in the subsequent month, we document a negative effect of disaster news coverage on stock market returns.

# References


[1] Amihud, Y., 2002, Illiquidity and stock returns: cross-section and time-series effects, Journal of Financial Markets, 5, 31-56.

[2] Bushee, B.J., Core, J., Guay, W., and W. Jihae, 2006, The Role of the Business Press as an Information Intermediary, The Wharton School, University of Pennsylvania, Working Paper (as of January, 2007).

[3] Capelle-Blancard, G., and M.-A. Laguna, 2008, How do Stock Markets Respond to Chemical Disasters?, Université Paris 1 *Panthéon-Sorbonne*, Working Paper (as of July, 2008).

[4] Chan, W., 2003, Stock price reaction to news and no-news: drift and reversal after headlines, Journal of Financial Economics, 223-260.

[5] Clarke, C., 2001, Update Comparative Legal Study, European Commission/Europa.

[6] Dasgupta, S., Hong, H.J., Laplante, B., and N. Mamingi, 2006, Firms' environmental performance: Does news matter?, Policy Research Working Paper no, WPS 3888.

[7] Dyck, A., Morse, A., Zingales, A., 2006, Who blows the whistle on corporate fraud?, Working Paper.

[8] Dyck, A., Volchkova, N., Zingales, L., 2006, The corporate governance role of media: clinical evidence from Russia, Working Paper.

[9] Eisensee, T., and D.Strömberg, 2007, News Droughts, News Floods, and U.S. Disaster Relief, The Quartlery Journal of Economics, May, Vol. 122, No. 2, Pages 693-728.

[10] Fang, L., and J. Peress, 2007, Media Coverage and the Cross-Section of Stock Returns, INSEAD, Working Paper (as of February, 2007).

[11] Hamilton, J.T., 1995, Pollution as News: Media and Stock Market Reactions to the Toxic Release Inventory Data, Journal of Environmental Economics and Management, 28, Pages 98-103.

[12] Hirshleifer, D., and S. Teoh, 2003, Limited Attention, Information Disclosure, and Financial Reporting, Journal of Accounting and Economics, 36, 337-386.

[13] Hong, Harrison, and Jeremy C. Stein, 2006, Disagreement and the Stock Market, Journal of Economic Perspectives, 21, Spring, 109-128.

[14] Jegadeesh, N., and S. Titman, 1993, Returns to Buying Winners and Selling Losers: Implications for Stock Market Efficiency, Journal of Finance, 48, 65-91.

[15] Kahn, M., 2007, Environmental disasters as risk regulation catalysts? The role of Bhopal, Chernobyl, Exxon Valdez, Love Canal, and Three Mile Island in Shaping U.S. Environmental Law, 35(1), 17-43.

[16] Knyazeva, D., 2007, Corporate Governance, Analyst Following, and Firm Behavior, New York University, Job Market Paper (as of January, 2007).

[17] Lahiri, K., and P. Schmidt, 1978, On the Estimation of Triangular Structural Systems, Econometrica, 46, Pages 1217-1221.

[18] LaPorta, R., F. Lopez-de-Silanes, A. Schleifer, and R. Vishny, 1998, Investor Protection and Corporate Valuation, Journal of Political Economy, 106, 1113-1156.

[19] Morris, S., and H.S. Schinn, 2002, Social Value of Public Information, The American Economic Review, December, 1521-1534.

[20] Peress, J., 2008, Media coverage and Investors' Attention to Earnings Announcements, INSEAD, Working Paper.

[21] Salinger, Michael, 1992, Value Event Studies, Review of Economics and Statistics, November, Volume 74 , Issue 4, Pages 671-77.

[22] Shiller, R., 2000, Irrational Exuberance, eds. Broadway Books/New York, 2000.

[23] Stock, J.H., and M. Yogo, 2002, Testing for Weak Instruments in Linear IV Regression, Technical Working Paper No.284, National Bureau of Economic Research, November, Pages 671-77.

[24] Tetlock, P. C., 2007, Giving Content to Investor Sentiment: The Role of Media in the Stock Market, Journal of Finance 62, 1139-1168.

[25] Tetlock, P.C., Saar-Tsechansky, M., and S. Macskassy, 2007, More Than Words: Quantifying Language to Measure Firms' Fundamentals, Journal of Finance, forthcoming.

[26] Wooldridge, S., 2002, Econometric Analysis of Cross Section and Panel Data, Cambridge, MA: MIT Press.