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Stock Market Reactions to Environmental News in the Food Industry

Zsuzsanna Deák and Berna Karali

Few studies to date have addressed the relationship between the food industry's environmental and financial performances although the industry is one of the biggest contributors of greenhouse gas emissions. We analyze the impact of environmental news about selected food companies on their stock prices. Results show that positive (negative) events that are the result of direct internal company actions lead to higher (lower) predicted returns, whereas events related to third-party opinions lead to smaller changes in predicted returns in short event windows. This study highlights the importance of conducting the analysis on a disaggregated basis by incorporating firm-level variables.

Key Words: environmental performance, firm-level indicators, food industry, news impact, stock markets

JEL Classifications: G14, G30

Although environmental regulations have been around for many years, it is generally recognized that their efficiency in controlling pollution is rather inadequate. This is mainly attributed to weak monitoring standards and enforcement of the regulations and to the minimal penalties assessed. Because the command-and-control approach seems to have failed many times, in recent years, so-called market-based instruments such as taxes or tradable permits have emerged to enforce regulations. One such instrument, considered by many economists as the most efficient, is the "information-based regulation" that relies partly on the investor community for monitoring and enforcing environment-friendly behavior (Lanoie, Laplante, and Roy, 1998; Tietenberg, 1998). With the increased importance of socially responsible investing coupled with the proliferation of the Internet and the media, executives of publicly traded companies seeking to maximize shareholders' wealth are now believed to align their environmental strategies with the stock market valuation of their company's environmental performance (Barnett and Salomon, 2006). One such market valuation of environmental performance is the effect of company-specific environmental news on its stock returns.

Earlier results on the link between firm-level social responsibility, including environmental behavior, and financial performance have been mixed.[1] Even the direction of causality is not clearly defined. Is it being socially responsible that leads to higher profits or is it that firms with higher profits can afford to be socially responsible? There are two seemingly

Zsuzsanna Deák is a visiting scholar from the Department of Food Economy, Corvinus University of Budapest, Budapest, Hungary. Berna Karali is an associate professor from the Department of Agricultural & Applied Economics, The University of Georgia, Athens, Georgia.

[1] For a comprehensive review, see Margolis and Walsh (2003) and Orlitzky, Schmidt, and Rynes (2003).

competing views in the literature. The traditionalist, cost-oriented (neoclassical) school asserts that the sole responsibility of a firm is to generate profit for its owners, that is, its shareholders (Friedman, 1970). On the other hand, the revisionists' view takes into account the interest of a much wider group including anyone who holds a stake in the firm's operations such as employees, suppliers, and customers (Freeman, 1984). Supporters of this stakeholder theory assert that management policies that focus solely on satisfying shareholders without regard to the wider community, which is affected by the firm's operations, are unlikely to be successful. Porter and van der Linde (1995) even go a step further claiming that socially responsible operations can actually lead to a competitive advantage.

The diverging nature of results obtained is not surprising considering the complex environment in which firms operate. Financial returns in response to any socially responsible behavior would be influenced by the industry they operate in, their country of operation, the nature of the action they choose to undertake, or the competitive environment. Even if we compared the social and financial performance of the same company at different points in time, we would undoubtedly obtain different results. A universally acceptable business case for or against corporate social responsibility (CSR) is therefore virtually unattainable (Margolis and Walsh, 2003; Rowley and Berman, 2000). More recent studies argue that a well-executed CSR policy, i.e., one that focuses on those aspects of CSR that bring the most reward at the time, does in fact result in better financial performance (Bird et al., 2007; Marom, 2006).

To study financial consequences of environmentally responsible company behavior, we focus on the food industry because food production and consumption have recently been identified as one of the major contributors to resource consumption and waste generation. According to a study commissioned by the European Commission, the food and drink sector contributes to 23% of global resource use, 18% of greenhouse gas emissions, and 31% of acidifying emissions (ETC/SCP, 2009). These figures include all resource use and pollution emitted during the process of bringing the food from the farm to supermarket shelves, including the production and application of fertilizers, fuels in agricultural machinery, and electricity consumed in food processing plants. The United Nations reports similar numbers. Of total global emissions in 2005, agriculture accounted for an estimated 10–12% of carbon dioxide, 60% of nitrous oxide, and approximately 50% of methane (excluding emissions from electricity and fuel use). Globally, agricultural methane and nitrous oxide emissions have increased by nearly 17% from 1990–2005 (IPPC, 2007). Recent research published by the Environment America Research and Policy Center (EAP, 2010) states that major agribusiness firms are responsible for the degradation of 100,000 miles of rivers and streams and 2,500 square miles of inland lakes in the United States.

Our research extends on previous event study literature but with specific emphasis on the food industry. Despite the high impact of food production on our environment, there are few studies focusing on this industry and particularly on the relationship between its environmental and financial performances. There are studies addressing general CSR methodology (Jones, Comfort, and Hillier, 2008; Maloni and Brown, 2006; Marotta and Nazzaro, 2012), the effects of food quality shocks on the stock and futures markets (Garcia-Fuentes et al., 2010; Kong, 2012; Paiva, 2003; Thomsen and McKenzie, 2001; Wang et al., 2002), or regional characteristics of CSR (Guthrie, Cuganesan, and Ward, 2008; Odor, 2009). Unlike these studies, we categorize environmental events based on whether they are the result of internal company actions or of external assessments of the companies' environmental behavior and examine if the stock market treats these events differently. Finally, in addition to firm-level financial variables, we take a closer look at how media coverage and general environmental reputation of the selected companies influence market reactions.

Our results are based on the analysis of 526 environmental news items, which appeared in the written media between 2007 and 2010, related to 23 selected firms. We find that favorable events that are the result of direct internal

company actions lead to higher predicted abnormal returns than the events related to third-party opinions. We also find that the market reaction to negative internal environmental news is influenced by companies' size, riskiness, profitability, environmental reputation, and media coverage, whereas the reaction to other event news does not vary with these firm-level variables in most cases.

Related Literature

The reaction of capital markets to environmental news has been widely analyzed in the literature. Although, in general, it has been found that companies experience a drop (increase) in their market value after adverse (favorable) environmental news, empirical findings are by no means homogenous. Hamilton (1995) and Konar and Cohen (1997) investigated the effect of the disclosure of the Toxics Release Inventory data on the market value of firms and found significant negative abnormal returns. Klassen and McLaughlin (1996) and Laplante and Lanoie (1994) analyzed stock market reactions to environmental news that appeared in the media. The latter authors documented significantly positive market reaction (i.e., increase in stock price) after independent third-party awards for companies' environmental performance. They also found that positive abnormal returns after favorable events were relatively smaller than negative abnormal returns in response to adverse environmental events. In contrast, Gilley et al. (2000) examined stock market reactions to environmental process improvements and found that news about such improvements have actually resulted in a drop in stock prices. Nicolau and Sellers (2002) showed a significantly positive reaction to the announcement of a company's ISO9000 certification, whereas Paulraj and de Jong (2011) showed just the opposite for ISO14001 certificates. Dasgupta et al. (2006), Gupta and Goldar (2005), and Lanoie, Laplante, and Roy (1998) investigated polluter lists issued by national governments and found that the stock market penalizes companies that are perceived to be less environmentally friendly. Muoghalu, Robison, and Glascock (1990) examined the impacts of hazardous waste mismanagement lawsuits on capital markets and found that firms suffer significant losses in their market values. Karpoff, Lott, and Wehrly (2005), however, stated that the drop in the share value was simply proportional to the size of the penalty.

These varying results suggest that the market does not value all environmental accomplishments or misconducts equally and that the reaction could differ with firm characteristics. As a result, the relationship between market reaction and firm characteristics has become a topic of interest in the literature. King and Baerwald (1998) argued that unique firm characteristics influence how events are interpreted when comparing environmental performance. Cormier and Magnan (2007), Horváthová (2010), and Wagner (2010) also confirmed that the diverging reactions to environmental news could be attributed to firm-level characteristics. Most of the firm-level characteristics examined were financial- or business-specific in nature such as size, research and development expenditure, advertising intensity, riskiness, leverage, industry, or country.

Among these firm-level characteristics, the most frequently investigated is the size of the company followed by the industry and company risk (van Beurden and Goessling, 2008). Company risk is generally measured by beta, which is the responsiveness of company stock return to a general market portfolio return, whereas size is measured by sales and assets. Leverage ratio, which is the ratio of long-term debt to equity, is another financial characteristic investigated (Waddock and Graves, 1997). Firm size has been generally found to affect a company's ability to profit from CSR measures. Generally speaking, larger firms are more exposed to stakeholder scrutiny and more often included in rating schemes. Additionally, smaller firms are less committed to invest in CSR. Both operating risk (beta) and financial leverage are expected to be negatively correlated with stock price because management's risk tolerance or attitude can influence the decisions to invest in CSR activities. Management's risk tolerance is usually proxied by the company's debt level (Fiori, di Donato, and Izzo, 2007; Waddock and Graves, 1997).

Several studies concluded that analyses that cover many industries would lead to ambiguous results resulting from the considerable variation among industries and therefore one should focus on a single industry (Chand, 2006; Griffin and Mahon, 1997). In the past, the food industry had not been viewed as one of the traditionally high-polluting industries such as oil, utilities, or chemicals. However, this perception has been rapidly changing in the last couple of years. In a recent study commissioned by the European Union, food and beverage consumption was identified as the sector producing the largest environmental impact (ETC/SCP, 2011). In the 2012 international Ipsos survey, consumers identified economic development (jobs) and product safety as the most important CSR issue food companies should address. However, when it came to the second most important concern, the companies' environmental impact was named next (Ipsos, 2012). Prior studies showed that firms in highly polluting industries pay more attention to environmental disclosure (Deegan and Gordon, 1996; Halme and Huse, 1997). Therefore, it could be expected that as a result of the heightened awareness of the role the food industry plays in pollution, the company executives in this industry would also need to consider the results of their actions related to environmental issues.

With the increased role and proliferation of the media and the growing attention to the topic of sustainability and the environment (Figure 1), the impact of media coverage and reputation on firms' market value also became an important research question. Any evidence on the impact of media or firm reputation supports the resource-based view of strategic management, which asserts that a firm's superior ability to manage their environmental problems and reputation compared with others in the industry could lead to higher returns (Barney, 1986; Wernerfelt, 1984). For instance, Bansal and Clelland (2000) argued that if a company has a high environmental reputation, then, based on past performance, investors would believe that an adverse environmental event is out of the ordinary. In this case, the company would not suffer from the full consequences of an adverse event. In a meta-analysis, based on 30 years of studies, Orlitzky, Schmidt, and Rynes (2003) reported that reputation seemed to be an important mediator of the relationship between social and financial performance. Additionally, they concluded that third-party opinions seemed to affect financial results more significantly than self-disclosed ones. Karpoff, Lott, and Wehrly (2005), however, claimed that the reputational penalty for environmental violations is not significant, unlike in the case of criminal fraud. Dasgupta et al. (2006) found that the wider the coverage of a certain event in newspapers, the greater the reduction in a firm's market value. This can be, of course, the result of the fact that larger events by their nature receive greater media attention (like the most recent BP Deepwater Horizon oil spill in April 2010). Aerts, Cormier, and Magnan (2008) examined the role

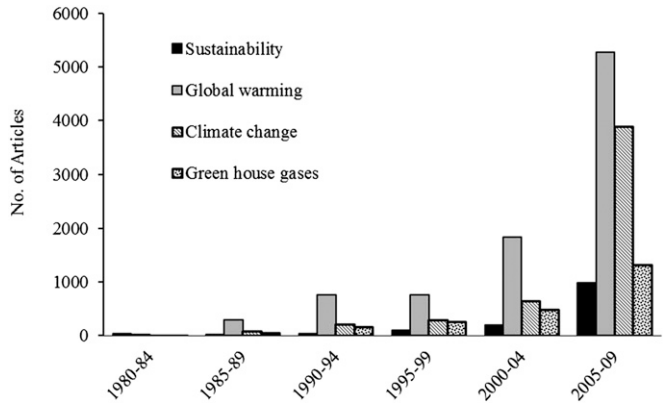

Figure 1. News Articles by Topic in the *New York Times*

of the media in exerting public pressure and found that media exposure is a significant determinant of environmental disclosure; that is, the amount of environmental news published affects a firm's environmental riskiness. Their observations are underpinned by the "agenda-setting theory," first developed by McCombs and Shaw (1972), which posits that mass media sets the agenda for public opinion by highlighting certain issues. Although environmental protectionism has been around for quite a while (some count its birthday from April 22, 1970, the first Earth Day), it took some time before it really crossed a public awareness threshold. Undoubtedly, high-profile incidents like Bhopal, Three Mile Island, or the Exxon Valdez have helped, gaining many supporters. Referred to as "unobtrusive," these events are perceived to be remote for most of the general public and thus require considerable involvement by the media (Zucker, 1978). The less direct experience people have with an issue, the greater is the news media's influence on public opinion on that issue. In their article, Kinsey et al. (2009) concluded that the agenda-setting effect is influenced by both the type of the event and the intensity of media coverage.

Unlike prior studies that examined the impact of firm-specific variables discussed previously on company voluntary disclosure (Aerts, Cormier, and Magnan, 2008; Huang and Kung, 2010), our study analyzes the impact of environmental news on stock prices of selected food companies that have similar firm-level characteristics.

Econometric Methodology

The event study methodology developed by Fama et al. (1969) has become the standard method of measuring stock price reactions to announcements or events in the financial economics literature. Event studies have been used 1) to test the null hypothesis that markets efficiently incorporate new information; and 2) under the maintained hypothesis of market efficiency to examine the impact of an event on a firm's shareholder wealth (Binder, 1998).

An event study starts with identification of the event of interest and the event window, which is the time period over which the stock prices of firms will be examined. Assessment of an event's impact requires a measure of abnormal return. The abnormal return is the difference between the ex-post return and the normal return of a firm's stock over the event window. For firm i and event date t it is then computed as:

$$(1) \qquad AR_{it} = R_{it} - E(R_{it}|X_t),$$

where AR_{it}, R_{it}, and $E(R_{it}|X_t)$ are the abnormal, actual, and normal returns respectively, and X_t is the conditioning information for the normal return model. Two common choices for modeling the normal return are the constant mean return model where X_t is a constant, and the market model where X_t is the market return. The constant mean return model assumes that the mean return of a stock is constant over time, whereas the market model assumes a stable linear relationship between the market return and the stock return. The market model is defined as:

$$(2) \qquad R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it},$$

where R_{mt} is the return of the market portfolio for the period t, ε_{it} is the zero mean disturbance term, and α_i and β_i are the parameters to be estimated. Most often a broad-based stock index such as the Standard and Poor's (S&P) 500 is used as a proxy for the market portfolio. In this framework then, abnormal returns are modeled as prediction errors from the market model:

$$(3) \qquad AR_{it} = R_{it} - \left(\hat{\alpha}_i + \hat{\beta}_i R_{mt}\right).$$

One can simply estimate the market model in equation (2) with ordinary least squares (OLS). However, OLS estimation is based on several assumptions. The first assumption is that the error term ε_{it} is serially uncorrelated. However, Lo and MacKinlay (1988) showed that successive returns on individual stocks are indeed correlated with large returns tending to be followed by further large returns. The second assumption is that the error term follows a normal distribution with constant variance, i.e., it is homoscedastic. Giaccoto and Ali (1982) documented that if the assumption of

homoscedasticity is not met, the parameter estimates are inefficient and thus any inferences based on these estimates are potentially misleading. Therefore, to measure the effect of a specific event on stock prices, one must account for time-varying variance (heteroscedasticity). Engle (1982) developed a model, called autoregressive conditional heteroscedasticity (ARCH), in which current conditional variance depends on the past values of squared random disturbances. The ARCH model is modified by Bollerslev (1986, 1987) to allow current conditional variance to depend on the past conditional variances as well as the past squared random disturbances. The advantage of the generalized autoregressive conditional heteroscedasticity (GARCH) model is that not only does it model the mean of the returns, R_{it}, but at the same time allows for time-varying volatility. Since then, GARCH models have been widely used in the literature and are found to be suitable in explaining stock price distributions (Baillie and DeGennaro, 1990; Bollerslev, 1987; Bollerslev, Engle, and Wooldridge, 1988; French, Schwert, and Stambaugh, 1987).

Another issue is that regressions involving stock returns rarely produce normally distributed error terms (Fama, 1963). In fact, stock return distributions are found to exhibit excess kurtosis, i.e., they are leptokurtic. GARCH models with conditional normal distribution allow unconditional error distribution to be leptokurtic, but they might not fully explain the observed excess kurtosis (Corhay and Rad, 1996). In the literature, it is generally accepted that the Student's t distribution performs better (see Baillie and Bollerslev, 1989; Hsieh, 1989). More recently, McKenzie, Thomsen, and Dixon (2004), for example, conducted simulations to assess the inferential accuracy of statistical event study methods using daily futures returns. Methods considered include the constant mean return model and regression models with OLS, GARCH (1, 1) with normal errors, and GARCH (1, 1) with Student's t errors. They showed that regression models have a clear advantage over the constant mean return model. Furthermore, they found that test statistics from GARCH models are more powerful than the ones from OLS, and at small levels of abnormal performance, the GARCH (1, 1) model with Student's t distribution was consistently the most powerful model.

Based on this prior evidence of the performance of the GARCH (1, 1) model with Student's t errors, we adopt the following econometric specification for our empirical analysis[2]:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it}, \tag{4a}$$

$$\varepsilon_{it} \sim t(0, h_{it}, \nu), \tag{4b}$$

$$h_{it} = \omega + \theta\varepsilon_{i,t-1}^2 + \gamma h_{i,t-1}, \tag{4c}$$

where ε_{it} is the error term that follows Student's t distribution with mean zero, variance h_{it}, and degrees of freedom ν. R_{it} represents the daily stock return of firm i on day t and R_{mt} represents the daily return on the S&P 500. Stock returns are computed as $R_{it} = 100 \times (\ln P_{it} - \ln P_{i,t-1})$, where P_{it} is the stock price of company i on day t. This measure represents continuously compounded daily return and is widely used in the literature. It also eliminates the non-stationarity problem found in price levels. Similarly, market return is computed as $R_{mt} = 100 \times (\ln P_{mt} - \ln P_{m,t-1})$, where P_{mt} is the S&P 500 index. The standardized residuals obtained from this estimation are used to calculate cumulative abnormal returns for company i over event window $(-s, s)$ as:

$$\begin{aligned} CAR_{it_0}(-s, s) &= \sum_{t=t_0-s}^{t_0+s} \widehat{AR}_{it} \\ &= \sum_{t=t_0-s}^{t_0+s} \frac{R_{it} - \left(\hat{\alpha}_i + \hat{\beta}_i R_{mt}\right)}{\sqrt{h_{it}}}. \end{aligned} \tag{5}$$

We present results with both a three-day event window ($s = 1$) and five-day event window ($s = 2$). For the three-day event window, for instance, we add abnormal returns on the event day (t_0), one day prior $(t_0 - 1)$, and one day after

[2] We also estimated each GARCH (1, 1) specification with normally distributed error terms and found that the normality of residuals is rejected in all cases. Furthermore, we tested for asymmetric effects. However, few of the models had a statistically significant asymmetry parameter.

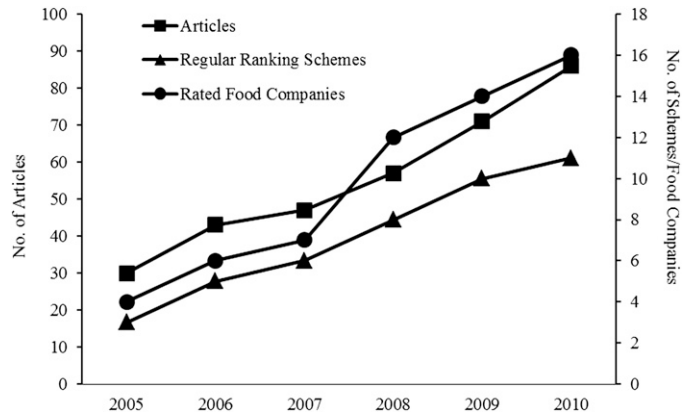

Figure 2. Development of Media Coverage and Reputational Surveys for Food Companies

the event day (t_0+1): $CAR_{it_0}(-1,1) = AR_{i,t_0-1} + AR_{i,t_0} + AR_{i,t_0+1}$. Similarly, five-day cumulative abnormal returns are calculated as: $CAR_{it_0}(-2,2) = AR_{i,t_0-2} + AR_{i,t_0-1} + AR_{i,t_0} + AR_{i,t_0+1} + AR_{i,t_0+2}$. To test whether there is any difference in cumulative abnormal returns on days with different event types and whether those effects vary with company-specific financial and nonfinancial categories, we estimate the following model:

$$CAR_{it_0}(-s,s) = \alpha + \sum_{k=2}^{4} \beta_k E_{it_0k} + \sum_{j=1}^{6} \delta_j F_{it_0j} + \sum_{k=2}^{4}\sum_{j=1}^{6} \theta_{kj} E_{it_0k} F_{it_0j} + \gamma FC_{t_0} + u_{it_0}. \quad (6)$$

The variable E_{it_0k} represents the four dummy variables for the environmental events, the variable F_{it_0j} represents the six company-specific financial and nonfinancial variables chosen for this study, and the variable FC_{t_0} is a dummy variable indicating the financial crisis of 2008–2009 (explained subsequently).

Sample and Data Description

Our sample consists of stock prices (closing prices adjusted for dividends) of food industry companies, traded on the New York Stock Exchange and NASDAQ, between January 2007 and December 2010. The time period was chosen mainly based on the availability of environmental reputational rankings and news items for food companies. Environmental coverage of the food industry has been steadily growing in the last five years and the persistence and consistency of such ratings have also greatly improved (Figure 2). Additionally, the recent consolidation spree in the rating industry signals a more mature and established market.[3] Although only seven of the selected food companies have been consistently included in these rankings, more and more food manufacturers managed to be included in the rankings over time.

Only companies that were continuously traded and have sales greater than $1 million per year are included in the sample. Our sample includes 23 unique firms from 18 primary Standard Industrial Classification codes (Table 1). We exclude companies that produce alcohol- and tobacco-related products because of the potential bias of the results resulting from reputational preconceptions. With a list of keywords and phrases generally used in the environmental news, a search string is created in the *Wall Street Journal* Factiva database and all announcements that meet the search criteria are downloaded (the Factiva database was selected because it contains articles that are published globally both in the printed and electronic media). Following the standard event study procedure, in the case of news that appeared in

[3] For a complete review of the rating schemes please, see SustainAbility (2013).

Table 1. Type of Food Production

Primary SIC	Description	No. of Firms
2011–15, 2510–39, 5144–47	Meat & meat products, poultry, eggs	5
0175–79, 1610–19, 1750–99, 5148	Fruit & vegetables	2
0723, 2071–79, 5153	Grains, oils	2
2095, 5499	Coffee	1
2041–53	Flour, cereals, breads	3
2086–87, 5149	Beverages	2
2032–38, 99	Canned & other prepared food	4
2064–68, 96	Snacks & candy	2
2021–26	Dairy, cheese	2

Note: SIC, Standard Industrial Classification.

more than one publication or multiple times in the same publication, only the news with the earliest publication date is retained.[4] Additionally, days with multiple announcements or days where event windows of different announcements overlap are excluded, because it would be impossible to determine which environmental announcement is responsible for market reaction, if there is any. Only days with no additional confounding events such as dividend and earnings announcements are used. After these adjustments, we are left with 526 environmental events (Table 2).

Given that the environmental news collected consists of different types of events, both positive and negative, it is possible that market reaction varies across different event categories. For example, market participants may react to negative news by a larger amount than they do to positive news. Aggregating positive and negative news could bias market reactions toward zero. To distinguish the effect of specific events, the news sample is first divided into positive and negative events and then to external and internal events to form the following four subcategories:

Event type one: Actions taken by the companies to improve their environmental performance or perception.
Key words: carbon, certification, climate, conservation, donation, eco, EMS, endow, energy, environment, footprint, green, "ISO 14001," LEED, nature, recycling, renewable, reusable, "SA 8000," stewardship, support, sustainability.
Event type two: Awards and rankings issued by an outside source to the companies.
Key words: admire, award, celebrate, certificate, honor, index, prize, rank, recognition, scorecard, tribute, win, won.
Event type three: News relating to penalties, government action, lawsuits, etc., against the companies.
Key words: clean, cleanup, "Department of Justice," "Environmental Protection Agency," fine, lawsuit, notice, order, penalty, settle, spill, superfund, tort, toxic, violation.
Event type four: Boycotts, external company reports and studies, and other external nonclassifiable events.
Key words: accuse, action, activists, boycott, contamination, disaster, dump, emission, environment, Greenpeace, incident, rally, report, research, pollution, study.

[4] It should be noted that this approach would not account for the volume and persistence of media coverage of particular events. However, the primary focus of the current study is to analyze the immediate news impact on stock prices rather than the role of the media on the prolonged impacts on stock prices. Investigating the impact of the volume and persistence of media coverage on stock prices is an interesting research topic for future work.

Table 2. Number of Environmental Events

Year	E1	E2	E3	E4	Total
2007	35	24	15	7	81
2008	59	26	15	21	121
2009	71	50	10	7	138
2010	99	67	11	9	186

Event types one and two represent positive news items, whereas event types three and four represent negative news. Furthermore, event types one and three focus on events that are the direct result of specific internal actions of the companies, whereas event types two and four are opinions of external parties. The Factiva database was searched using these key words for each event type. Articles with even one key word were sufficient to be considered; however, all resultant articles have been checked for relevancy before inclusion in the data set.

Based on prior studies, we consider the following firm-level financial variables: company size (assets), profitability (return on equity [ROE]), market risk (beta), and long-term debt-to-capital ratio (leverage). Nonfinancial variables include media coverage (coverage) and green reputation (reputation). For company media coverage, we determine the number of articles related to environmental issues published in the printed media. For environmental reputation, we compute an average environmental score based on rankings published in the media (*Newsweek Greenscore, Just Means Ranking, CRO Magazine*), by investment fund analyst companies (Maplecroft, KLD), and by NGOs (CDP, Climate Counts). We create dummy variables for each of these variables by comparing each company's data with the sample median in each year. Accordingly, these financial and nonfinancial variables for a company take the value one if they are above the sample median and zero if they are below the sample median in a given year. In our empirical model, we incorporate the lagged values of these financial and nonfinancial dummy variables to reflect the most recent information publicly available to investors.

Our sample period coincides with the severe financial crisis experienced globally in recent years. There has been a downward trend in stock prices in part of the sample period followed with an upsurge, a fall, and an upsurge again. Based on the movement of the Dow Jones U.S. Food and Beverage Index (Figure 3), the financial crisis dummy variable takes the value of one for the periods September 15 to October 24, 2008, and February 6 to March 6, 2009, and zero otherwise.

Table 3 presents summary statistics of these variables across 23 companies included in our sample as of year-end 2010. In our study, the average size of companies in terms of market capitalization is approximately $24 billion, whereas the average profitability expressed as the price/earnings (P/E) ratio is approximately 19, which is in line with the industry average.

Results

Results regarding the environmental news impact on abnormal returns (equation [6]) are presented in Table 4. The base category for estimation is chosen as E1 (positive internal events) and therefore all coefficients on the interaction variables are interpreted relative to this event type. Our discussion first focuses on the results for three-day cumulative abnormal returns ($s = 1$). The event dummy coefficients

Figure 3. Dow Jones U.S. Food & Beverage Index

Table 3. Descriptive Statistics of Sample Firms for Year-end 2010

	Mean	Median	Standard Deviation	Minimum	Maximum
Sales ($M)	18,698	11,158	3,800	917	61,682
Total assets ($M)	20,285	8,840	26,271	1,198	95,289
Market capitalization ($M)	24,046	10,477	7,649	744	145,170
P/E ratio	19.07	14.88	3.43	–0.06	85.47
Beta	0.72	0.63	0.41	0.11	1.98
Debt/capital ratio	40.11	41.53	18.13	0	69.75
ROE	26.53	17.49	24.18	–3.78	100.36
Coverage (%)	4.35	3.64	2.64	1.36	13.18
Green score	53.43	57.55	12.08	26.18	68.15

Note: P/E, price/earnings; ROE, return on equity.

by themselves are not statistically different from zero. On event days, only approximately 13% of the variation in three-day cumulative abnormal returns can be explained by the environmental events and the selected firm-level variables. However, some firm characteristics seem to influence reactions to environmental news.

The results show that the event type most sensitive to the firm-level variables is E3 (negative internal events). Thus, reactions to the news of lawsuits, penalties, or government actions are influenced by all firm-level financial and nonfinancial variables except for leverage and ROE. In fact, leverage does not play any significant role in shaping reactions to environmental news. Interestingly, the largest effect is found for the two nonfinancial variables: media coverage and reputation. On the days with type three events (E3), companies that appear in the media more frequently or have better environmental reputation compared with sample median values experience a 2.6% and 1.3% reduction, respectively, in their stock returns compared with the returns on the days with type one events (E1). This shows that as a result of higher visibility or expectations of increased environmental performance, negative internal events lead to higher reduction in stock returns.

Company size measured with asset, on the other hand, has the opposite effect. Larger companies experience an increase of 1.6% in their stock returns on the days with negative internal events (E3). It seems like the size of a company reduces the impact of negative internal events. Companies that are more risky than the sample median (measured by beta) experience an increase of 0.6% in their stock returns on the days with positive internal events (E1), whereas they experience a decrease of 0.4% (0.629–1.051 = –0.422) on the days with negative internal events (E3). In addition, the stock returns of companies with better than median profitability (ROE) are 1.9% lower on the days with negative external events (E4) compared with the days with positive internal events (E1).

The financial crisis dummy variable is found to be statistically insignificant. This result is consistent with the findings in Schnitkey and Kramer (2012), who showed that the AgIndex constructed using the stock prices of selected publicly traded agricultural firms outperformed the S&P 500 index during 2000–2011 and the performance of agricultural companies was not affected during the period of financial crisis.[5]

Predicted returns obtained from regression (equation [6]) are presented in Table 5. For each company, we report the predicted abnormal returns on days with four different event types after averaging across years. For each company,

[5] Our regression analysis is performed to explain the "abnormal" returns around the event days, not to explain the daily returns. In fact, when daily stock returns are regressed on the market portfolio return, event dummies, financial and nonfinancial company-specific variables, their interaction terms with the event dummies along with the financial crisis dummy, the coefficient on the financial crisis variable is negative and statistically significant. These results are available from authors on request.

Table 4. Determinants of Abnormal Returns

	Three-day Cumulative Abnormal Returns (s = 1)		Five-day Cumulative Abnormal Returns (s = 2)	
Independent Variables	Coefficient	Robust Standard Error	Coefficient	Robust Standard Error
Constant	0.052	(0.384)	–0.053	(0.620)
E2	–0.446	(0.557)	–1.024	(0.836)
E3	1.042	(0.999)	0.802	(1.086)
E4	0.716	(0.969)	0.868	(1.170)
Asset	–0.177	(0.274)	–0.026	(0.367)
Asset*E2	0.196	(0.402)	–0.223	(0.517)
Asset*E3	1.585**	(0.681)	2.212***	(0.788)
Asset*E4	–0.843	(0.992)	–0.964	(1.018)
Beta	0.629**	(0.262)	0.811**	(0.377)
Beta*E2	–0.193	(0.400)	0.159	(0.530)
Beta*E3	–1.051*	(0.593)	–1.061	(0.745)
Beta*E4	0.302	(0.806)	0.262	(0.768)
Leverage	0.004	(0.221)	0.097	(0.297)
Leverage*E2	0.051	(0.351)	–0.134	(0.462)
Leverage*E3	–0.637	(0.676)	–0.474	(0.698)
Leverage*E4	–1.082	(0.791)	–0.656	(0.837)
ROE	0.077	(0.249)	0.211	(0.365)
ROE*E2	0.337	(0.357)	0.458	(0.537)
ROE*E3	0.210	(0.535)	0.610	(0.797)
ROE*E4	–1.890**	(0.780)	–2.220***	(0.756)
Reputation	0.397	(0.302)	0.260	(0.415)
Reputation*E2	–0.200	(0.406)	–0.031	(0.561)
Reputation*E3	–1.261**	(0.572)	–1.437*	(0.837)
Reputation*E4	1.002	(1.014)	0.873	(0.730)
Coverage	0.103	(0.253)	–0.265	(0.349)
Coverage*E2	–0.139	(0.425)	0.775	(0.549)
Coverage*E3	–2.623***	(0.686)	–2.364***	(0.770)
Coverage*E4	–0.383	(0.817)	–0.404	(0.901)
Financial crisis	0.113	(0.331)	0.321	(0.439)
R^2	0.131		0.097	
N	487		486	

Note: ROE, return on equity. * indicates significance at the 10% level, ** indicate significance at the 5% level and *** indicate significance at the 1% level.

we also report the normal returns estimated with the market model in equation (2) with GARCH (1, 1) Student's *t* specification using the sample period of 2004–2006. The last row of the table shows the average across 23 firms.

Average three-day cumulative abnormal returns for the various event types confirm our prior expectations. Cumulative abnormal returns are positive on the days with positive internal events (E1) for all 23 companies and on the days with positive external events (E2) for 19 companies. The average cumulative abnormal returns are positive across all the firms on E1 and E2 days. On the other hand, predicted cumulative abnormal returns are negative for 11 companies on the days with negative internal (E3) and negative external (E4) events. Although the overall average cumulative abnormal returns are negative on both E3 and E4 days, market reactions are not homogeneous across these events. For both positive and negative events, external events have less impact than internal events. On average, three-day cumulative abnormal returns are 0.51% on E1 days compared with 0.15% on E2 days. When we consider daily terms, daily abnormal returns

Table 5. Predicted Daily Stock Returns on Event Days

			Average Returns across Years							
				Three-day Cumulative Abnormal Return (s = 1)				Five-day Cumulative Abnormal Return (s = 2)			
	Company	Ticker	Normal Return	E1	E2	E3	E4	E1	E2	E3	E4
1	Archer-Daniels-Midland Co.	ADM	0.098	0.675	0.233	–0.148	–0.153	0.653	0.490	0.313	–0.331
2	Bunge Ltd.	BG	0.097	0.655	0.116	–0.329	0.100	0.600	0.245	0.042	0.057
3	Conagra Foods Inc.	CAG	0.027	0.271	–0.202	0.199	–0.302	0.139	–0.670	0.559	–0.294
4	Coca-Cola Enterprises Inc.	CCE	0.017	0.713	0.317	0.146	–0.273	0.707	0.326	0.283	–0.302
5	Campbell Soup Co.	CPB	0.047	0.555	0.333	0.000	0.000	0.589	0.289	0.000	0.000
6	Chiquita Brands International Inc.	CQB	0.041	0.343	0.024	0.000	0.000	0.428	–0.036	0.000	0.000
7	Dean Foods Co.	DF	0.034	0.246	0.201	0.000	0.021	0.205	0.042	0.000	0.025
8	Fresh Del Monte Produce Inc.	FDP	0.054	0.170	0.000	0.080	0.000	0.189	0.000	0.065	0.000
9	General Mills Inc.	GIS	0.028	0.376	0.241	0.000	–0.602	0.350	–0.309	0.000	–0.665
10	Green Mountain Coffee Roasters Inc.	GMCR	0.064	1.206	0.293	0.000	0.435	1.025	0.496	0.000	0.448
11	The Hain Celestial Group Inc.	HAIN	0.062	0.562	–0.095	–0.294	0.780	0.436	–0.067	–0.408	0.777
12	H. J. Heinz Co.	HNZ	0.012	0.775	0.351	–0.659	–0.502	0.527	0.476	–0.654	–0.645
13	Hormel Foods Corp.	HRL	0.032	0.366	0.070	0.000	0.000	0.373	–0.173	0.000	0.000
14	The Hershey Co.	HSY	0.038	0.059	0.038	–0.256	–0.531	–0.002	–0.222	–0.061	–0.438
15	Kellogg Co.	K	0.045	0.220	0.161	0.000	–0.436	0.316	–0.277	0.000	–0.403
16	Kraft Foods Group Inc.	KFT	0.020	0.312	–0.023	–1.303	0.217	0.066	–0.215	–1.123	0.072
17	The Coca-Cola Co.	KO	0.003	0.314	0.319	–0.254	–0.166	0.162	0.198	–0.075	–0.263
18	Pepsico Inc.	PEP	0.036	0.482	0.243	–0.455	–0.236	0.232	0.155	–0.120	–0.430
19	Pilgrim's Pride Corp.	PPC	0.042	0.340	0.036	0.336	0.510	0.379	0.039	0.250	0.637
20	Smithfield Foods Inc.	SFD	0.013	0.791	0.099	–0.610	0.241	0.817	0.320	–0.596	0.497
21	Sara Lee Corp.	SLE	0.008	0.989	0.442	0.218	0.000	1.181	0.213	0.488	0.000
22	Tyson Foods Inc.	TSN	0.044	0.481	–0.056	–0.650	–0.372	0.393	–0.105	–0.070	–0.319
23	Unilever PLC	UL	0.068	0.741	0.269	–0.656	–0.003	0.599	0.177	–0.163	–0.162
Average			0.040	0.506	0.148	–0.202	–0.055	0.451	0.061	–0.055	–0.076

on E1 days (0.17%) are higher than the normal daily return of 0.04%, whereas daily abnormal returns on E2 days (0.05%) are only 0.01 percentage point higher than the daily normal return. Similarly, on average, three-day cumulative abnormal returns are –0.20% on days with E3 events and –0.06% on days with E4 events. Daily predicted abnormal return on E3 days is a loss of 0.07%, whereas it is a loss of only 0.02% on E4 days. It seems that investors pay more attention to news items that will result in immediate financial consequences. It is also possible that third-party opinions and reports have lost their initial appeal in the last couple of years because of the great proliferation and heterogeneity of such news items.

To investigate the speed of adjustment to environmental news, we performed the same analysis with a five-day event window ($s = 2$). This specification results in a lower R^2 with only 10% of the variation in five-day cumulative abnormal returns explained by the environmental news and the selected firm-level variables. Table 4 shows that the same coefficients, except for the interaction term between beta and E3, are statistically significant as in the case with three-day event window. Results in Table 5 demonstrate that the five-day cumulative abnormal returns are positive for 22 companies on the days with positive internal events (E1) and for 14 companies on the days with positive external events (E2). On average, five-day cumulative abnormal returns are 0.45% on E1 days compared with 0.06% on E2 days. When compared with the results with the three-day event window, it is seen that although the cumulative abnormal returns are still positive on E1 and E2 days, the magnitudes of the returns are smaller on average. Thus, the positive environmental events are quickly incorporated into stock prices. Of the 23 companies, nine and 11 of them have negative abnormal returns on the days with negative internal events (E3) and with negative external events (E4), respectively. The five-day cumulative abnormal returns are –0.06% on E3 days and –0.08% on E4 days. In contrast to the results with the three-day event window, the impact of negative external events is stronger than that of negative internal events. Also, the average five-day cumulative abnormal return on E4 days is higher than the average of three-day abnormal return. This shows that it takes more time for the stock prices to adjust to negative external environmental news.

In summary, our results confirm the general findings of previous studies that negative environmental performance is punished, whereas positive performance is rewarded by the market (Dasgupta et al., 2006; Hamilton, 1995; Konar and Cohen, 1997; Lanoie, Laplante, and Roy, 1998; Laplante and Lanoie, 1994). That is, although negative events result in a decrease in stock returns, positive events lead to an increase in stock returns. It is obvious that the market is selective and does not value every environmental effort uniformly. Actions that improve environmental behavior initiated by a company itself (E1) are valued, perhaps because investors expect to see real financial return to the company from such improvements. Events with actual negative monetary consequences, the result of noncompliance (E3), still remain an important factor in the market (Dasgupta et al., 2006; Karpoff, Lott, and Wehrly, 2005; Muoghalu, Robison, and Glascock, 1990), whereas other negative news published by outside parties (E4) seem to have little or no direct effect. The finding that third-party opinions do not elicit significant market reactions contradicts earlier results by Klassen and McLaughlin (1996) and Orlitzky, Schmidt, and Rynes (2003), which is probably the result of the abundance of such news items in the media in recent years.

Conclusions

This article explores the effects of company-specific environmental news that appear in the written media on the shareholder value of companies in the food industry. The study builds on previous findings by focusing on a single industry and only one aspect of corporate social responsibility, the environment. It contributes to prior research by targeting an industry, which until recently was not considered to be a major polluter. To our best knowledge, this is the first such analysis conducted for the food industry. It combines the study of disaggregated environmental news with industry segmentation based

on firm-level financial variables. Additionally, it considers two intangible characteristics that have been playing a vital role recently: media coverage and environmental reputation. Specifically, we quantify the market reaction, measured as the abnormal stock return, in response to positive and negative, internal and external environmental events while grouping companies based on their size, profitability, riskiness, leverage, frequency of media coverage, and environmental reputation relative to the industry median.

Our results show that stock returns increase in response to environmental improvements, whereas they decrease in response to environmental violations. Furthermore, market participants do not value all environmental news equally. Positive environmental actions initiated by companies themselves are valued the most, whereas favorable actions generated by external agencies are not regarded as highly. Additionally, we find that the stock market reaction to negative internal events significantly varies depending on the firm-level financial and nonfinancial variables. Because these news events most likely result in immediate financial consequences (i.e., monetary penalties), it is natural for the stock market reaction to change with the firm-level variables. Although a company's size shields the stock returns against the full effect of penalties related to environmental misconduct, more frequent media coverage, better environmental reputation, and financial riskiness increase the impact of such penalties on stock returns. For larger companies, the financial consequences of an environmental misconduct might be very minor in monetary terms and therefore may not cause a fall in stock prices. On the other hand, these monetary penalties would contribute to the riskiness of the company and, thus, a riskier company (with a higher beta measure) will experience a drop in the stock returns. Similar arguments can be made for a company with lower return on equity. When a company has a good environmental reputation, its investors might experience more of a surprise when they learn about a negative internal event and therefore react to this adverse information by selling their shares, causing stock returns to decline. Similarly, when a company appears in the media more frequently, it is more visible to its investors and therefore negative news result in lower stock returns.

Our study provides empirical evidence on the impact of some of the environmental news considered here on the stock returns and the relationship between the market response to these news and the firm-level financial and nonfinancial variables. However, investigation of specific measures of actual company environmental performance such as emissions or the presence of environmental policy tools is left out of this study's scope, because the aggregate green score computed is based on rankings that already include various environmental performance measures. We also excluded discretionary environmental disclosures, because they are a subset of general environmental news, which in turn include third-party assessments along with self-disclosed information. For future research, a further disaggregation of the event types could be beneficial and might provide better insight regarding environmental actions the companies could invest in.

In recent international surveys addressing corporate social responsibility performance (such as *Newsweek's* Green Rankings or *CR Magazine's* 100 Best Corporate Citizens), perhaps unexpectedly, traditionally polluting industries such as energy or oil companies performed better than the food industry. However, considering that these companies were the first to fall under the scrutiny of the public eye, it is not surprising that they had sufficient time to develop better reporting, accounting, and green marketing schemes. As a result of recent food safety shocks, increased production of biofuels and the subsequent food shortage and high prices, growing global health issues, and increased importance of sustainable production, food production companies suddenly found themselves at the forefront of attention. This will undoubtedly spur the industry to scrutinize their corporate social responsibility, including environmental obligations. Our study helps to highlight those areas and situations in which food companies benefit the most from environmental actions and clearly confirms the fact that proactive measures contribute positively to the companies' financial well-being

not only directly, but also indirectly through improved environmental reputation.

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