

DO INVESTORS' REACTIONS TO ENVIRONMENTALLY FRIENDLY NEWS ANNOUNCEMENTS DIFFER ACROSS INDUSTRIES? A COMPARATIVE ANALYSIS OF JAPAN'S FOOD AND AUTOMOTIVE INDUSTRIES

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Abstract. Recently, investors' growing awareness of environmental concerns has prompted many businesses to implement green policies and procedures. Investors' reactions to firms' environmental efforts vary across different industries. However, few empirical studies have addressed these differences, especially in Japan – the third-largest sustainable investor in the world. Using data from Japanese food and automotive industries, this research examined sector-specific differences in investors' reactions to firms' environmental performance, indicated by environmentally friendly news releases, using a short-term event study and Student's t-tests. Results indicated that investors respond negatively to environmental activities in the food and automobile sectors, supporting neo-classical theory. The data also imply that, in Japan, industry variances have a neutral effect on short-term performance but a significant long-term effect. In addition, long-term investor responses to environmentally friendly news in the food sector are more unfavorable than in the automobile industry. This study has implications for policymakers and managers.

Keywords: environment, investor reaction, event study, automotive industry, food industry, Japan.

JEL Classification: M14, G11, E22, N25.

Introduction

Recently, environmental issues have attracted investors' attention, prompting firms to embrace environmentally friendly practices (Zhang et al., 2022). Because investor reactions directly impact business valuation, managers must consider how investors interpret and respond to firms' environmental efforts. However, industries vary greatly. If the impact of a company's environmental performance on its corporate value differs by industry, then managers' decisions should also differ. While many existing studies have addressed the relationship between firm environmentalism and value (Deswanto & Siregar, 2018), few have empirically analyzed how it varies across sectors. Furthermore, no studies have been conducted

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in Japan – the world's third-largest sustainable investor. This study identified differences in investors' reactions to firms' environmental performance across industries, measured by environmentally friendly news announcements, using data from Japanese food and automotive manufacturing firms.

Studies on the link between a firm's environmental performance and its valuation report mixed results (Deswanto & Siregar, 2018). Several identified a favorable linkage between an organization's environmental policy and its corporate value (e.g., Rahman et al., 2020), while others argued that a negative relationship exists between environmental performance and value (e.g., Duque-Grisales & Aguilera-Caracuel, 2021). This discrepancy might be owing to the different characteristics of industries such as their legitimacy and market environment (e.g., DesJardine et al., 2021; Tuppara et al., 2016); however, such differences do not always influence shareholders and stakeholders (e.g., Osiichuk & Wnuczak, 2022) and do not always exist (Tamimi & Sebastianelli, 2017).

These findings prompt the question of whether investors' reactions to environmental activities truly differ by industry. While some studies have reported significant correlations between social activities and business performance, the results are inconclusive regarding the impact of specific industries (e.g., Matakanye et al., 2021; Tamimi & Sebastianelli, 2017; Tuppara et al., 2016; Yoon et al., 2018).

This study was set in Japan – the third-largest United Nations donor and second-largest United Nations Development Programme [UNDP] contributor. Japan has been encouraging green investments with its support of the 2030 Agenda and the Sustainable Development Goals (Schumacher et al., 2020; UNDP, 2022; United Nations, 2022). As the world's third-largest economy, it is home to a major financial hub (Ibata-Arens, 2013; World Bank, 2022). With an estimated USD 25–30 trillion in household savings invested in financial assets and some of the world's most powerful financial institutions in banking, investment, and insurance, a redistribution of funds among Japanese asset owners could significantly impact sustainable investments globally (Schumacher et al., 2020). Japanese policymakers' aspirations to promote environmental, social, and governance (ESG) investment and sustainable finance growth have been stoked by the increasing significance of sustainable finance and investment in global markets (Durrani et al., 2020; Sachs et al., 2019). Accordingly, Japan is currently the third-largest sustainable investor in the world (Global Sustainable Investment Alliance, 2018). This study presents an in-depth examination of investor behavior toward firms' environmental practices in Japan. Various corporate social responsibility practices (CSR)-related studies have been conducted in Japan (Chomei & Nanseki, 2020; Abe et al., 2017); however, none have analyzed differences in investor responses to environment-related announcements across industries.

This study targeted the food and automotive industries for three reasons. First, these industries have the largest share of value-added in the manufacturing sector and the greatest impact on the economy both in the world and in Japan (Cabinet Office Government of Japan, 2020; Database for Structural Analysis [STAN], 2020; Thomas, 2021). Second, the food and automotive industries are often subject to governmental public concern because they significantly impact greenhouse gas emissions and, accordingly, government initiatives to decrease emissions (Intergovernmental Panel on Climate Change [IPCC], 2020; Ministry of

the Environment of Japan, 2020). Finally, while the two industries share the same consumer-oriented nature (Tuppura et al., 2016), their customers' expectations differ: in the food industry, increased consumer awareness is attributable to responsibility and duty for health and food safety (Lamberti & Lettieri, 2009), not environmental considerations; conversely, for the automotive industry, customers value environmental sustainability, product and service quality, and brand empathy more than work environment and community-building activities (Loureiro et al., 2012).

This study investigated industry-specific variations in investors' responses to firms' environmental performance, as evaluated by environmentally friendly news releases, using data from Japanese food and automotive manufacturing firms. "Environmentally friendly" news refers to news related to 1) reducing environmental impacts in the supply chain and production process; 2) providing research and development, products, and services with low environmental impacts; and 3) conducting consumer awareness activities on environmental issues. I assume that soft news on ESG and the emotional language connected with it are more attractive to a big audience, including investors, than hard information like financial data (Capelle-Blancard & Petit, 2019). Grounded in signaling theory, investors infer a company's social standing from its news announcements (Groening & Kanuri, 2018). Thus, as Jacobs et al. (2010), Flammer (2013), and many other researchers believe, environmentally friendly firm news is a key indicator on which investors judge a company's environmental performance. I used the event study method to uncover the impact of positive environmental news on the food and automotive industries and Student's t-tests to compare the cumulative average abnormal returns (CAARs) of these industries.

The remainder of this paper is organized as follows. Section 1 presents the theoretical background. Sections 2 to 5 describe the data and variables, methodology, and discuss the results, respectively. The paper concludes with implications and future research directions.

1. Theoretical background

Freeman (1984) collected various ideas on the stakeholder-related approach and developed an organized theory of management, known as stakeholder theory. The theory posits that the survival of a corporation is affected not only by its shareholders but also by various other stakeholders, such as employees, governments, customers, and activists. Another meaningful theory to explore is resource-based theory, which seeks the source of competitive advantage in a company's internal management resources: tangible assets, intangible assets, and organizational capability (Barney, 1991; Wernerfelt, 1984). These theories can also be applied to the relationship between a company's environmental performance and firm value; that is, the investor's valuation. Jiao (2010) demonstrated that stakeholder wellbeing is related to a firm's positive value impacts, and that the positive effects are driven by the firm's success on employee relations and environmental issues. According to Sinkin et al. (2008), companies that implement eco-efficient business strategies achieve lower operating expenses and higher earnings. Thus, the market values these companies more than those without such strategies. The positive relationship between a firm's environmental performance and investors' valuation is also supported by many other studies, including Osazuwa and Che-Ahmad

(2016). Conversely, traditional neo-classical theory suggests that a company's investment in pro-social initiatives incurs significant expenses that result in poorer profitability and market prices (Friedman, 1970). Regarding environmental strategy, when businesses opt to participate in environmental projects, their economic resources are jeopardized, and their performance suffers as a result because excessive expenditures are necessary to minimize emissions or enhance the use of natural resources (Duque-Grisales et al., 2020). In addition, the expenses of switching to clean technologies are significant for firms using old technologies in manufacturing (Duque-Grisales & Aguilera-Caracuel, 2021). Based on these theories, multiple studies reported a negative or zero linkage between a firm's social activities and its corporate value (Hawn et al., 2018; Krüger, 2015; McWilliams & Siegel, 2000, 2001). Many studies on firms' environmental efforts have also argued for a detrimental effect on firm value (Baah et al., 2021; Duque-Grisales & Aguilera-Caracuel, 2021).

Based on signaling theory, this argument can be extended to the relationship between news announcements regarding a company's environmental performance and investor reaction. Investors may determine a firm's social standing and purpose based on its pro-social news as it demonstrates how a firm handles stakeholders, whose views collectively influence a firm's overall status (Groening & Kanuri, 2018; Highhouse et al., 2009; Podolny, 1993). Therefore, a company's environmentally friendly news is one of the most powerful indicators for investors to determine its environmental performance. Jacobs et al. (2010) examined the impacts of environmental performance on firm value by measuring the market reaction related to announcements of environmental performance and showed significant market reactions for certain subcategories, including announcements of philanthropic gifts for environmental causes and ISO 14001 certifications. Using an event study, Flammer (2013) investigated whether shareholders are sensitive to corporate environmental news announcements and found that firms that reported environmentally friendly news enjoyed a significant stock price increase, whereas those that reported irresponsible environmental behavior experienced a dramatic drop.

Although many studies have discussed the impact of pro-social activities, including environmental issues on corporate value, the magnitude of the impact may differ among industries. Such differences are evident in this study between the automotive and food sectors, because of their varied characteristics. Distinct industries confront different difficulties, thus, external pressure might change correspondingly (Carroll, 1979; Groening & Kanuri, 2018). For instance, according to Groening and Kanuri (2018), environmental concerns are unquestionably more serious for the oil and gas industry than for the banking industry. Consequently, an oil firm is more likely to be affected by environmental news than a bank. Tuppura et al. (2016) provided a detailed analysis of the effect gap based on five dimensions: (1) legitimacy, (2) the structure and developmental phase, (3) stakeholder responsiveness or opportunity of response, (4) sensitivity to the environment, and (5) level of differentiation and affirmation that legitimacy varies according to industry. Maktoufi et al. (2020) noted that firms' pro-social activities may be considered a value-enhancing resource in some industries and a cost-enhancing one in others. The relationship between a firm's pro-social performance and financial results is influenced by the general operational or market framework of the industry, such as being capital- or labor-intensive, or consumer-oriented or not (Tuppura et al.,

2016). Focusing on a company's environmental performance, Suh et al. (2014) revealed different relationships between a firm's eco-friendly score and its financial performance among 16 industrial sectors.

In contrast, various studies concluded that the impact of pro-social performance and related news announcements on firm value is not affected by industrial category. They argued that both shareholders and their reactions are indifferent to various features, including industries or events related to the company (Jones et al., 2016; Osiichuk & Wnuczak, 2022; Rodrigo & Arenas, 2008). For instance, Osiichuk and Wnuczak (2022) identified no significant short-term market response upon transaction completion in their analysis. Rodrigo and Arenas (2008) and Jones et al. (2016) found that employees have an indifferent or negative reaction to the company's social activities. Matakanye et al. (2021) and Tamimi and Sebastianelli (2017) revealed no significant difference in disclosure across industries on the environmental aspects. Consequently, because there are two schools of thought in this debate, I posit two hypotheses.

H1a. Differences exist in investor reactions to automotive industry-related and food industry-related environmental news communications.

H1b. No differences exist in investor reactions to automotive industry-related and food industry-related environmental news communications.

Next, I discuss how the impact of environmentally friendly news announcements on corporate value between the food and automotive sectors differ. Both industries are perceived to be consumer-oriented (Tuppura et al., 2016) but with different types of customer expectations.

For the food industry, researchers found that it is heavily influenced by CSR success or failure and the requirements of customers for CSR in the industry are strong (Kiessling et al., 2016; Kong et al., 2019; Lerro et al., 2018). However, looking more closely at several dimensions of CSR, I find that high consumer awareness is owing to the accountability and obligation for health and food safety (Lamberti & Lettieri, 2009), not environmental issues. Kong et al. (2019) acknowledged that product recalls dramatically decrease a firm's value in the food industry, whereas Pullman et al. (2009) concluded that the performance advantages of sustainability initiatives may be difficult to discern owing to the intricacy of sustainability's influence on performance in the food industry.

The automotive industry drives the Japanese economy and attracts significant public attention. The industry is often defined by overcapacity, strong market competition, rising labor and fixed costs, and the need for continuous product growth and innovation (Martinuzzi et al., 2011), making it customer-oriented. Fuzi et al. (2012) concluded that the automotive industry often exercises a strong degree of accountability for the community and culture, such as labor engagement, climate, and public protection, owing to its broad market scale and multi-layered supply chain. According to Loureiro et al. (2012), per the perception of the industry's customers, product and service quality, brand empathy, and environmental sustainability are much more respected than work environment and community-building activities. As an example of Japan's automotive industry, Toyota first recognized its commitment toward

environmental issues as a social responsibility and developed it both organizationally and internally by establishing the Toyota Environmental Committee as early as 1992. Environmental measures have been a long-standing target of Toyota's efforts and the entire Japanese automotive industry. Based on the above discussion, the following hypothesis is proposed.

H2. Investors react positively to environmental communications in the automotive industry more than in the food industry.

2. Data

I used Nikkei Telecom, one of Japan's most prestigious business databases, to access Nihon Keizai Shimbun's (Nikkei) Preliminary Report for the earliest news reports as event data from January 1, 2012, to March 8, 2022 (the latest available). I searched Nikkei Telecom using the issue area and its industrial group by including the keywords "environment" in "food" and "automotive," and extracted those that contained positive content. The type of industry was categorized following the Tokyo Stock Exchange. In addition, studies including financial issues from the final dataset were excluded (Flammer, 2013; Krüger, 2015).

In addition, I collected daily stock prices (p) from the eol, an extensive business information database focusing on Japanese publicly traded firms. Market indexes (*TOPIX*) were obtained from the reliable online database,¹ and the rate of return on the stock price (r_{it}) and the market indexes (r_{mt}) for each firm was calculated. Factors including (1) the outperformance of small versus large companies (small minus big: *SMB*), (2) the risk-free rate (R_f), (3) the outperformance of high book/market versus small book/market firms (high minus low: *HML*), (4) the outperformance of robust operating profitability firms versus the weak operating profitability firms (Robust Minus Weak: *RMW*), and (5) the outperformance of the conservative investment firms versus the aggressive investment firms (Conservative Minus Aggressive: *CMA*) for calculating Fama and French's (1993) models, were collected from Kenneth R. French's homepage.²

Consequently, the total number of samples from January 1, 2012, to January 31, 2022 was 902, comprising the latest data for the last 10 years. The distribution of event data and summary statistics are presented in Tables 1 and 2, respectively.

Table 1. Distribution of event data

Year	Food	Automotive	Total
2012	14	39	53
2013	4	56	60
2014	13	22	35

¹ Investing.com is a financial portal that delivers real-time data and charts from over 250 global exchanges and provides breaking news and analysis articles in 44 languages. The site is rated by SimilarWeb and Alexa as one of the top three financial sites in the world. <https://jp.investing.com/indices/topix-historical-data>

² Kenneth R. French's homepage data library: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

End of Table 1

Year	Food	Automotive	Total
2015	14	50	64
2016	6	66	72
2017	13	83	96
2018	15	72	87
2019	19	63	82
2020	21	59	80
2021	33	197	230
2022	10	33	43
Total	162	740	902

Note: Yearly distribution of positive environmental news related to the food (*Food*) or the automotive (*Automotive*) industries.

Table 2. Summary statistics

Variables	Observations	Mean	Std. Dev.	Min	Max
r_{it}	454,075	0.00114	0.0785	-0.902	9.244
r_{mt}	2,465	0.000453	0.0121	-0.0726	0.0802
TOPIX	2,466	1459.553	334.177	695.51	2118.87
R_f	2,466	0.00213	0.00409	0	0.01
SMB	2,466	0.00577	0.548	-4.81	3.12
HML	2,466	-0.00771	0.662	-2.72	4.57
RMW	2,466	0.010572	0.376	-1.84	2
CMA	2,466	-0.0028	0.363	-2.36	2.29

3. Methodology

3.1. Event study

Flammer (2013) and Krüger (2015) studied publicly observable events or the outcomes of corporate behavior. Others have implemented a short-term event study methodology (Dolley, 1933; MacKinlay, 1997) to overcome reverse causality problems and measurement errors.

This study used the short-term event study approach. As the pre-event window, I considered the 270 trading days ending 20 days before the day of the event and the CAARs of the [-1, 1], [-5, 5], and [-10, 10] windows. The windows were brief because expansion would increase statistical noise. Alternatively, the power of test statistics would be reduced owing to an increase in confounding concurrent events (McWilliams et al., 1999).

First, the rate of return on the stock price and the index were required for the event study.

$$r_{it} = \frac{p_{it} - p_{it-1}}{p_{it-1}}, \quad r_{mt} = \frac{topix_t - topix_{t-1}}{topix_{t-1}}, \quad (1)$$

where p_{it} denotes the i^{th} firm's stock price at time t , r_{it} its rate of return, $topix_t$ the TOPIX at time t , and r_{mt} its rate of return. Then, a firm's abnormal returns (AR_{it}), the discrepancy between the actual rate of return, and the estimated normal rate of return were examined to investigate the impact of an event. I used the market model and the Fama–French three-factor model to estimate the normal return, following MacKinlay (1997), Krüger (2015), and other relevant studies.

(The Market Model)

$$r_{i,t} = \alpha_i + \beta_i r_{m,t} + v_{i,t}, \tag{2}$$

where α_{it} and β_{it} are unknown variables.

(The Fama–French Three-factor Model)

$$r_{i,t} - R_f = \beta_{it1}^{MKT}(R_{m,t} - R_{f,t}) + \beta_{it2}^{SMB}SMB_t + \beta_{it3}^{HML}HML_t, \tag{3}$$

where $r_{i,t}$ denotes the predicted rate of return on investment for firm i at time t , R_f represents the risk-free rate, $(R_m - R_f)$ denotes the excess stock market index return, and SMB and HML indicate the Fama–French risk factors, which measure two additional risk factors relating to a company's size and book-to-market value. β_{itn} is an undefined variable.

These variables are calculated using regression analysis and are used to estimate normal returns. The abnormal returns (AR_{it}) are calculated by subtracting the estimated normal returns from the actual returns, as follows:

(The Market Model)

$$AR_{it} = r_{it} - (\hat{\alpha}_i + \hat{\beta}_i r_{mt}); \tag{4}$$

(The Fama–French Three-factor Model)

$$AR_{it} = r_{it} - (\hat{\beta}_{it1}^{MKT}(R_{m,t} - R_{f,t}) + \hat{\beta}_{it2}^{SMB}SMB_t + \hat{\beta}_{it3}^{HML}HML_t + R_f). \tag{5}$$

The CAR_{it} can be obtained by totaling the abnormal returns at time t for firm i , as follows.

$$CAR_i = \sum_{t=1}^n AR_{it}. \tag{6}$$

I conducted several statistical tests to examine the null hypothesis that the occurrence does not affect stock returns. To validate the results from various aspects and ensure robustness, I employed four types of tests: 1) adjusted Patell test (PatellADJ; Kolari & Pynnönen, 2010), 2) adjusted standardized cross-section test (Kolari & Pynnönen, 2010), 3) generalized rank test (GRANKT; Kolari & Pynnönen, 2010), and 4) Wilcoxon signed-rank test (Wilcoxon, 1945).

As a parametric test, the PatellADJ test is robust to the pattern in which ARs are distributed over the event window when a cross-sectional correlation is considered. The Kolari test is also robust to how ARs are distributed within the event window and incorporates event-induced volatility, serial correlation, and cross-correlation.

As for a nonparametric test, GRANKT allows a cross-correlation of returns, serial correlation of returns, and event-induced volatility. The Wilcoxon test accounts for the magnitude

and the sign of ARs. Related studies widely regard these as tests better-suited to the nature of event studies (Pandey & Kumari, 2021; Sharma et al., 2020).

4. Results

4.1. Investors and environmentally friendly news communications

Table 3 lists the event study results estimating CAARs from 2012 to 2021 and those of the PatellADJ, Kolari, GRANK, and Wilcox tests for both industries. The market model and the Fama–French three-factor model were used to calculate the estimated normal return. For the food industry, as shown in Table 3, CAARs using the market model are positive but are significant for the $[-5, 5]$ window only in the GRANK test. This result implies that CAARs are significantly positive only in the $[-5, 5]$ window in the case where the data distribution was nonparametric. In contrast, the CAARs calculated using the Fama–French three-factor model are negatively significant in all tests for all windows: $[-1, 1]$, $[-5, 5]$, and $[-10, 10]$. These results imply that investors react negatively to environmentally friendly news in all windows. I found that the model used to calculate the estimated normal return makes a significant difference; however, the Fama–French three-factor model contains more variables than the market model and may better estimate normal returns.

Next, I examine the results for the automotive industry. CAARs using the market model are positive, as shown in Table 3, and significant for the $[-1, 1]$ window in the PatellADJ test, the $[-5, 5]$ window in the GRANK test, and the $[-10, 10]$ window in all but the Wilcoxon test. CAARs are significantly positive in the $[-1, 1]$ window when the data distribution is parametric, and the $[-5, 5]$ window when the data distribution is nonparametric. Moreover, the $[-10, 10]$ window, which has positive and significant results in tests assuming both parametric and nonparametric assumptions, is regarded as a more reliable result. However, CAARs computed using the Fama–French three-factor model provide negative results in all tests for all windows. According to these findings, investors respond unfavorably to environmental news in the $[-1, 1]$, $[-5, 5]$, and $[-10, 10]$ windows. Once again, I discovered that the model used in the event study makes a substantial difference in the results. As the Fama–French three-factor model incorporates more variables than the market model, it is typically thought to provide a more accurate approximation of normal returns, and therefore of CAARs. These findings based on the Fama–French three-factor model suggest that investors react negatively to a company's environmentally friendly activities in both the food and automotive industries. The discussion that follows links these findings with each of the hypotheses and elaborates upon them.

I conducted a robustness check to address potential concerns (Becchetti et al., 2012; Flammer, 2013). First, I recalculated CAARs and normal returns using Fama and French's (1993) five-factor model to override the perceived market-related factors. As shown in Table 4, the findings are similar to the main findings, thus illustrating the robustness of the analysis. Second, extending the event windows may raise the frequency of influencing concurrent occurrences, limiting the power of the test statistic (McWilliams et al., 1999). Thus, I checked the robustness by expanding the window variations by adding the $[-1, 0]$, $[0, 1]$, $[-5, 0]$, and $[0, 5]$ windows. The results shown in Table 5 are identical to the primary findings, demonstrating the robustness of the earlier analysis.

Table 3. Result of event study

Industry	Windows	Market Model					Fama-French Three-factor Model					
		Observations	Mean	PatellADJ	Kolari	GRANKT	Wilcox	Observations	Mean	PatellADJ	Kolari	GRANKT
Food	[-1;1]	142	0.00037					-0.0056	***	**	***	***
	[-5;5]	143	0.00046			***		-0.0244	***	***	***	***
	[-10;10]	143	-0.00617					-0.0641	***	***	***	***
Automotive	[-1;1]	683	0.00182	*				-0.0044	***	***	***	***
	[-5;5]	683	0.00225			**		-0.0230	***	***	***	***
	[-10;10]	682	0.00481	***	**	***		-0.0425	***	***	***	***

Note: This table contains the event study results estimating CAARs of the windows [-1; 1], [-5; 5], and [-10; 10] from 2012 to 2021. Significance of the CAARs is tested by the PatellADJ, Kolari, GRANK, and Wilcox tests. The market model and the Fama-French three-factor model are used to calculate the estimated normal return. The asterisks show the statistical significance of the means of CAARs by the t-test, where *p < .10, **p < .05, ***p < .01.

Table 4. Result of event study using Fama-French's five-factor model

Industry	Windows	Fama-French Five-factor Model					Wilcox
		Observations	Mean	PatellADJ	Kolari	GRANKT	
Food	[-1;1]	130	-0.0061	***	**	***	***
	[-5;5]	133	-0.0247	***	***	***	***
	[10;10]	132	-0.0627	***	***	***	***
Automotive	[-1;1]	602	-0.00492	***	***	***	***
	[-5;5]	599	-0.0208	***	***	***	***
	[10;10]	602	-0.040	***	***	***	***

Note: This table contains the event study results estimating CAARs of the windows [-1; 1], [-5; 5], and [-10; 10] from 2012 to 2021. Significance of the CAARs is tested by the PatellADJ, Kolari, GRANK, and Wilcox tests. The market model, the Fama-French three-factor model, and the Fama-French five-factor model are used to calculate the estimated normal return. The asterisks show the statistical significance of the means of CAARs by the t-test, where *p < .10, **p < .05, ***p < .01.

Table 5. Alternative event windows

Industry	Windows	Market Model					Fama–French Three-factor Model						
		Observations	Mean	PatellADJ	Kolari	GRANKT	Wilcox	Observations	Mean	PatellADJ	Kolari	GRANKT	Wilcox
Food	[0;1]	143	0.00212					133	-0.0028	**		***	**
	[-1;0]	143	-0.00150					131	-0.0064	***	***	***	***
	[-5;0]	144	-0.00144			**		132	-0.0173	***	***	***	***
	[0;5]	143	0.00192					130	-0.0120	***	**	***	***
Auto-motive	[0;1]	684	0.00120					609	-0.0030	***	***	***	***
	[-1;0]	681	0.00111					623	-0.0040	***	***	***	***
	[-5;0]	682	0.00070					624	-0.0125	***	***	***	***
	[0;5]	683	0.00214			*		614	-0.0130	***	***	***	***

Industry	Windows	Fama–French Five-factor Model					
		Observations	Mean	PatellADJ	Kolari	GRANKT	Wilcox
Food	[0;1]	131	-0.0019			***	**
	[-1;0]	129	-0.0059	***	**	***	***
	[-5;0]	130	-0.0133	***	***	**	***
	[0;5]	133	-0.0130	***	***	***	***
Auto-motive	[0;1]	601	-0.00302	***	***	***	***
	[-1;0]	606	-0.00314	***	***	***	***
	[-5;0]	606	-0.0122	***	***	***	***
	[0;5]	598	-0.0109	***	***	***	***

Note: This table lists the event study results estimating CAARs of the windows [-1, 0], [0, 1], [-5, 0], and [0, 5] from 2012 to 2021. Significance of the CAARs is tested by the PatellADJ, Kolari, GRANK, and Wilcox tests. The Fama–French five-factor model is used to calculate the estimated normal return. The asterisks show the statistical significance of the means of CAARs by the t-test, where *p < .10, **p < .05, ***p < .01.

4.2. Difference between the automotive and food industries

I conducted Student's t-tests to verify whether the results significantly differed across industries. Although it is difficult to statistically show that two values are "the same" or "almost the same," this study sought to clarify whether the difference was significant. The outcomes are presented in Table 6.

Column A of Table 6 compares the CAARs for each window, as estimated by the market model. In each window, Student's t-tests were performed with the null hypothesis that the two values are equal and that there is no significant difference in CAARs between the food and automotive industries in all windows.

The impact calculated by the Fama–French three-factor model is compared in Column B of Table 6. The results indicate that the impact of the food industry and automotive industry-related news is not significantly different in the $[-1, 1]$ and $[-5, 5]$ windows, but only in the $[-10, 10]$ window.

Based on these results, I conclude that investors' reactions to environment-friendly news related to the food and automotive industries do not differ in shorter periods; that is, 3 and 11 days from the news announcement date, but they do differ over a broader period; that is, 21 days from the news announcement date. However, the longer the window period in an event study, the more ambiguous it is whether the impact of the event is properly measured.

In the $[-10, 10]$ window, the food and automotive industries have coefficients of -0.0641 and -0.0425 , respectively. These results indicate that, in the long run, investors react more negatively to environmentally friendly news in the food industry than the automotive industry.

Table 6. Student's t-test: difference between the food and automotive industries

Window	A: Market Model			B: Fama–French Three-factor Model		
	Mean	t	df	Mean	t	df
$[-1;1]$	0.00145	0.596	823	0.00120	0.46	738
$[-5;5]$	0.00178	0.367	824	0.00147	0.23	743
$[0;1]$	-0.00092	-0.422	825	-0.00016	-0.07	740
$[-1;0]$	0.00261	1.377	822	0.00240	1.18	752
$[-5;0]$	0.00214	0.527	824	0.00481	1.03	754
$[0;5]$	0.00022	0.070	824	-0.00102	-0.26	742
$[-10;10]$	0.0110	1.378	823	0.0216*	1.89	736

Note: This table contains the result of Student's t-test, which was performed with the null hypothesis that the two values are equal and that there is no significant difference in CAARs between the food and automotive industries in the $[-1;1]$, $[-5;5]$, $[0;1]$, $[-1;0]$, $[-5;0]$, $[0;5]$, and $[10;10]$ windows. Column A compares the CAARs estimated by the market model and column B by the Fama–French three-factor. The asterisks show the statistical significance of the means of CAARs by the t-test, where * $p < .10$, ** $p < .05$, *** $p < .01$.

5. Discussion

This research examined sector-specific differences in investors' reactions to firms' environmental performance, as measured by environmentally friendly news releases, using data from Japanese food and automotive manufacturing firms.

The findings indicate that investors respond negatively to a company's environmentally friendly efforts in both industries; these findings are consistent with the neo-classical view (Friedman, 1970) as well as empirical findings (Baah et al., 2021; Duque-Grisales et al., 2020; Krüger, 2015; McWilliams & Siegel, 2000, 2001). I also found that, in the short term, the results are indifferent between the news from food and automotive industries; this supports Hypothesis 1b as well as the findings of Osiichuk and Wnuczak (2022). However, in the long run, I found that investors gain a better understanding of the news; this supports Hypothesis 1a and the findings of Maktoufi et al. (2020) and Tuppura et al. (2016). These results suggest that investors in the Japanese market do not distinguish between the food and automotive industries in the short term. However, over a longer period, differences do emerge. These results can be explained as follows. As Matakanye et al. (2021) and Osiichuk and Wnuczak (2022) pointed out, instantaneous investment in an event involves many different types of investors with diverse interests and pressures, and when their reactions are compiled, differences in reactions by event detail or sector disappear. However, as Tuppura et al. (2016) show, in the longer term, investors focus their investment decisions on the differences in some characteristics of the sector. As already mentioned, in the case of the Japanese food sector and the automobile sector, their customer expectation is quite different. The distinct reactions between targeted periods can also be explained based on the Japanese context. Two types of investors exist in Japan: those who react instantaneously and those who react relatively slowly. Where quick-response investors—including institutional investors—make no distinction regarding the industry to which the news relates, slow-response investors, such as elderly individual investors, scrutinize the industry. Like in other countries, Japanese institutional investors have diverse preferences and pressures which make their investments highly diversified. However, Japanese individual investors have time to carefully assess the nature of their investments based on their own values. According to the survey on Individual Investors' Investment in Securities Attitude conducted by the Japan Securities Dealers Association (2021), most (51.6%) individual investors in Japan are in their 60s or older, and nearly 30% (27.8%) are 70 years or older. In addition, the results also imply that investors' responses vary depending on the period covered, which should be carefully examined in future research.

Next, I examined how the investor reactions to the news from the two industries differ. The findings suggest that, in the long term, investors respond more adversely to environmentally friendly news in the food industry than in the automotive industry. This result contrasts with Hypothesis 2 in terms of the direction of impact. Investors' negative reactions to environmentally friendly news can be explained as investors believe firms need to put their financial resources and performance at risk to engage in environmental initiatives (Duque-Grisales & Aguilera-Caracuel, 2021). Various researchers, including Makabe (2021), have expressed concern about rapid decarbonization because many Japanese companies are forced to decarbonize with the technologies they already have, which adds to their burden. In

addition, several participants in the General Resources and Energy Research Council – with which the Ministry of Economy Trade and Industry of Japan (2021) consults—estimated that decarbonization would inflate the cost of power generation.

Furthermore, the difference in investor reaction to the two industries can be described as follows. As already mentioned above, although investors are highly interested in the social activities of the food industry, their main focus is on the safety of the products (Lamberti & Lettieri, 2009; Pullman et al., 2009). Thus, the results confirmed that investors in Japan are also more reluctant to allow the food industry to invest money in projects other than those directly related to food safety. For the automotive industry, as Loureiro et al. (2012) insisted, customers' perceptions of product and service quality, brand, and environmental sustainability are significantly more recognized than work environment and community-building initiatives.

In addition, the results have implications for the debate on whether conflicting opinions about the relationship between a firm's social activities and its corporate value are owing to differences across industries. The results imply that, at least in the last few years in Japan, industry differences have not affected the conflicting results in the short-term analysis but may have impacted longer-term analysis.

I also found that the results differed significantly depending on the model for calculating normal returns: the market model and the Fama–French three-factor model. This may account for the opposite conclusions reached in many previous studies. Therefore, scholars should carefully select their models in future event studies.

Conclusions

This study examined differences in investor attitudes to environmental news across the Japanese food and automotive industries. I found that investors react unfavorably to a company's environmental initiatives in the food and automotive industries but that industry variations tend to impact long-term, rather than short-term, performance. This may be owing to the fact that Japan is home to both quick-response and slow-response investors, who react differently. Long-term investor reactions to such news were more negative in the food (vs. automotive) industry, perhaps because investors are less willing to allow the industry to invest in initiatives unrelated to food safety.

The results suggest that despite increasing government and firm efforts to advance green initiatives, investors negatively evaluate such initiatives. Considering this, the government should more clearly recognize corporate efforts toward the environment and further explain how these efforts lead to long-term improvements in corporate value. Managers should also make greater efforts to communicate to investors the purpose and significance of the company's environmental policy. As implications for policymakers and managers, investors do not uniformly evaluate the pro-social news of two industries in the long term, and if an industry engages in thematic activities on which it should not concentrate, investors will relentlessly give it a worse rating. Further, managers should understand what investors expect of their industry and act accordingly, rather than aimlessly performing all social actions.

Although this study demonstrates investors' perceptions of environment-friendly news by industry, it only focused on two key industries. Additionally, because this study uses dynamic data for each company, panel data analysis could have been used. However, as the data for many companies are only available at a single point owing to the nature of event data, and the data are unbalanced, I could use only a cross-sectional model. Furthermore, the environment-related news data used in this study were collected manually and should be reviewed by a third party. Finally, longer-term effects, such as months or years, and comparisons with other markets should also be examined.

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