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## RESEARCH ARTICLE

# Stakeholder engagement: Investors' environmental risk aversion and corporate earnings

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**Abstract**

How does investors' aversion to environmental risk affect their reaction towards firms' earnings announcements? We explore this by analyzing earnings announcements made by U.S. firms between 2002 and 2016. The results show that environmental performance at the firm level is important for investors as this influences the investment behaviors of investors who have some degree of aversion to environmental risk. These investors appreciate the earnings by firms that exhibit a high level of environmental performance, i.e., firms that have successfully addressed environmental risks. However, earnings are of secondary importance for investors who are highly averse to environmental risk since environmental concerns take precedence.

**KEYWORDS**

earnings announcement, earnings surprise, environmental risk, market reaction, stakeholder engagement

## 1 | INTRODUCTION

Firm's impacts on the environment garner special interests from shareholders and stakeholders (Clarkson et al., 2011; Flammer, 2013; Matsumura et al., 2014). Existing and future shareholders are interested not only in the environmental impacts a firm has but also in how the firm is managing potential environmental impacts while addressing existing and potential future regulatory requirements. Inadequately addressing any one of these aspects exposes a firm to environmental risk. Thus, a firm addresses environmental risk as part and parcel of its stakeholder management strategy. However, it is critical to understand the environmental risk aversion of shareholders (a.k.a. investors). This understanding is crucial if a firm were to

formulate an effective stakeholder management strategy. It is on this issue that this paper aims to shed light on.

We investigate the implications of investors' aversion towards environmental risk by studying how investors react to value-relevant earnings information firms announce—the earnings announcements. Earnings news is a significant and essential source of vital financial information for investors (Ke & Zhang, 2020). However, the literature on investors' reaction to earnings announcements has mainly focused on the content of the announcements (e.g., Lu et al., 2019), firm-level factors such as corporate governance (e.g., Kyaw et al., 2020), or country-level factors such as trust (e.g., Pevzner et al., 2015). We contribute to this strand of literature by examining the effect of investors' environmental risk aversion on their reaction to the earnings announced.

If investors are environmental risk-averse, but the risk aversion is not very high, they likely adopt positive investment screening whereby they are persuaded to invest in firms that exhibit good

**Abbreviations:** FE, two-way Fixed-Effects; ICBIN, Industry Classification Benchmark Number; LSDV, Least Square Dummy Variable.

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environmental risk management (i.e., firms with good environmental performance). However, good performance on the environmental front involves commitments in terms of financial resources by the firms. Therefore, we postulate that positive earnings news announced by firms with good environmental performance will be associated with a significant price reaction (Hypothesis 1). In other words, if investors exhibit moderate environmental risk aversion, they will reward firms for generating positive earnings while managing the environmental risk well. Conversely, for investors who have very high environmental risk aversion (i.e., investors who cannot be persuaded to invest in firms that potentially can impact the environment), they adopt negative investment screening whereby they shun investments in firms belonging to certain industries that are associated with having impacts on the environment. To these investors, the firm's earnings are of secondary importance: the primary importance being the environmental impact the firm can have (Riedl & Smeets, 2017). Therefore, earnings announcements will exhibit less price reaction in firms with a low environmental impact (Hypothesis 2).

To enable us to uncover the decision-making process related to environmental risk aversion, we proceed as follows. Since investors who have moderate environmental risk aversion will monitor firms' environmental performance in making their investment decisions, we employ firms' environmental performance to approximate the type of investors they attract. For instance, investors with relatively high environmental risk aversion will invest in firms belonging to industries with a low environmental impact. We contrast the investors' reaction to earnings announcements by firms with high environmental performance to that by firms with low environmental performance. By doing so, we can study the investment decisions made by investors with moderate environmental risk aversion. To study the investment decisions by investors with very high environmental risk aversion, we examined the earnings announcements by firms in industries associated with a low environmental impact and compared them against the earnings announcements by firms in high environmental-impact industries.

On Hypothesis 1, we find that investors with a moderate aversion to environmental risk respond more to earnings surprise by firms that perform well on the environmental front. Further breaking down the examination to various aspects of environmental performance, we find that emission reduction rather than innovation or resource use is the aspect of environmental performance in which investors appear most interested. Regarding investors with a very high aversion to environmental risk (Hypothesis 2), we find that investors react significantly less to firms' earnings surprises in industries with a low environmental impact. This supports the notion that financial performance is relatively less important for investors whose major concern is to minimize a firm's impact on the environment.

This paper contributes to the emerging literature on environmental stakeholder management. To our knowledge, this is the first to integrate the investors' environmental risk aversion in investigating firms' earnings announcements. Further, we shed light on how the investors' reaction to value-relevant information varies with their environmental risk aversion.

Findings in this study have implications for managers and regulators. Businesses are subject to investors' expectations regarding environmental performance. Therefore, they should pay heed to safeguarding the environment. Regulators should consider financial market implications in formulating environmental regulations.

The rest of the paper is organized as follows. Section 2 discusses the theoretical background and our hypotheses; Section 3 provides the data and variables used; Section 4 explains the empirical results; and Section 5 concludes the paper.

## 2 | THEORETICAL BACKGROUND AND HYPOTHESES

Earnings announcements contain information on a firm's economic performance at present as well as the anticipated future performance; thus, earnings announcements contain value-relevant information for investors. Efficient market theories predict that investors react to any value-relevant information embedded in earnings announcements. Through examining the price reactions around earnings announcements, empirical studies have found that investors indeed respond to the information released through earnings announcements (see, e.g., Ball & Brown, 1968; Basu, 1997; Lopez & Rees, 2002). In particular, investors respond positively (negatively) to earnings announcements where earnings have surpassed (fallen short of) market expectations, otherwise referred to as positive (negative) surprises. In other words, share price rises (falls) when firms announce positive (negative) earnings surprises. However, Chen and Tiras (2015) find that investors appear to react negatively (positively) to a positive (negative) earnings surprise in 42% (41) of the cases. These are puzzling results. Consequently, some studies point to over- or under-reaction by the market (e.g., Alwathnani et al., 2017), whereas other studies delve into information other than the earnings surprise that is inherent in the announcement (e.g., Kyaw et al., 2020). This paper contributes to this debate.

From the environmental perspective, stakeholder theory claims that how well a firm addresses the environmental issues appeals to investors (Hillman & Keim, 2001; Kassinis & Vafeas, 2006). Underpinning this theory is that owners are averse to environmental risk and they would rather that the firm addresses and manages the issues and risks associated with the impacts the firm has on the environment, including the related regulatory requirements. A firm's environmental performance indicates how well a firm manages the environmental issues (Fisher-Vanden & Thorburn, 2011). This can range from introducing a greenhouse emission gas reduction program to managing the risk of environmental litigations or circumventing the risk of expensive lawsuits (Omran et al., 2021). Kong et al. (2014) and Yadav et al. (2016) show that investors positively view a firm's engagement in initiatives that preserve and sustain the environment. In other words, the firm's improvements on the environmental front reassure investors.

In general, we can say that a firm's address to the environment is a double-edged sword: it can counteract its competitive advantage or act as a catalyst to boost the same competitive advantage. Moreover,

addressing environmental issues is costly. For example, investments to improve carbon emissions or recycling lead to a rise in capital outlays, adversely affecting financial performance (Hart & Dowell, 2011). Thus, if a firm remains financially sound after successfully addressing the environmental concerns of the investors, it will enjoy rewards. Studies have shown that firms with good environmental performance are associated with a higher firm value (Boakye et al., 2021), are repaid with higher returns (Konar & Cohen, 2001; Kong et al., 2014; Qian et al., 2020), have enhanced financial performance (Feng et al., 2018; Lee et al., 2016), enjoy better competitiveness (Romero et al., 2018), have a good reputation (Yu et al., 2018), and uphold the firm's legitimacy (Jin et al., 2020; Shevchenko, 2020; Wei et al., 2017). These possibilities can be explained as a firm improving its environmental sustainability by directing its resources towards engaging in fundamental tactical initiatives, such as averting pollution and encouraging sustainable growth. Those tactics, in turn, result in cost reduction, improved profitability, and enhanced competitiveness (Hart & Dowell, 2011; Yang et al., 2019). Besides, Russo and Fouts (1997) explain that firms can initiate an environmental policy to be the platform for their reputation. Since this reputation cannot be imitated in the interim (due to technological capability and resources), the firm gains a competitive advantage in the industry. Consequently, firms that strive to improve their environmental performance can improve their economic performance, thereby appealing to investors interested in firms committed to reducing their environmental risks. Based on the discussions above, we formulate the following:

**H1.** Higher earnings surprises by firms with better environmental performance will exhibit a higher price reaction.

On the other hand, the socially responsible investment philosophy involves screening investments based on the firm type (Benz et al., 2020; Hudson, 2005). Such screening can be based on positive screening, for example, choosing to invest only in firms deemed in accord with ethical guidelines such as fair trading, or negative screening, where the investors exclude from investment consideration firms that belong to an industry that score negatively on certain criteria. For example, investors exclude from investment consideration firms that belong to sin industries such as the tobacco industry (García-Sánchez et al., 2020). Similarly, investors with a very high aversion towards environmental risk will exclude firms in industries with high environmental impact from their investments. Financial performance is of secondary importance to these investors' investment decision-making since being environmental-friendly, i.e., being green, is of utmost importance. So investors who adopt this philosophy will have a strong position towards firms' fundamental relationship to the environment. In other words, they make their investment decisions based on the firms' business model. Thus, investors who have as their top priority minimizing the environmental impact will invest in industries with as low an environmental impact as possible (Wei et al., 2019). Moreover, unlike conventional investors, environmental investors' consideration for non-financial information, such as the

environmental impact, precedes their consideration for financial information (Xue et al., 2019).

Therefore, we predict the following:

**H2.** Earnings announcements by firms in low environmental-impact industries will exhibit a lower price reaction than that by firms in high environmental-impact industries.

### 3 | DATA AND VARIABLES

From Thomson Reuters<sup>1</sup> Eikon (Eikon), we collect the following data: annual earnings announcement dates, the reported earnings per share (eps), the analysts' mean eps forecast on the day before the announcement date, and the analysts' revised eps forecast on the day after the announcement. The other accounting data are derived from the same data provider as well as environmental sustainability data. The sample period is from January 2002 through December 2016.

Our initial sample consists of a total of 28,008 announcements by 2,123 U.S. companies. First, to do a market model estimation, we select only the earnings announcements with a minimum of 60 observations available. Second, following Barber et al. (2013), we exclude instances of a firm publishing two annual earnings announcements in the same calendar year. Third, we eliminate those announcements with missing information on the reported eps, analysts' mean eps forecast on the day before the announcement, and/or analysts' revised mean eps forecast on the day after the announcement. Fourth, we remove the announcements for which Eikon does not provide data concerning our control variables (i.e., the market-to-book ratio) which we will describe later. Finally, we eliminate observations with a negative market-to-book ratio. After applying these filters, our sample is composed of 12,466 observations by 1,620 firms with available accounting and financial data. However, when we combine the accounting data with environmental data, we reduce the size of our sample, composed of 7,531 observations by 845 firms.

#### 3.1 | Dependent and independent variables

The market reaction around earnings announcements,  $Will_{cret}$ , is our dependent variable. Following Williams (2015), it coincides with the difference between the compound return for each firm and each announcement and the compound market return over the same period.

Earnings surprises are the basis of our independent variable. Following Bouwman (2014), we calculate the earnings surprise for each firm  $i$  at time  $t$  as the difference between the reported eps and the market consensus eps forecast we approximate with the analysts' mean eps forecast on the day before the announcement day  $t$ . To

<sup>1</sup>In October 2018, Eikon was transferred to Refinitiv as a result of a large deal between Blackstone and the Financial and Risk Business of Thomson Reuters.

obtain our variable ( $ue$ ), we multiply the surprise per share by the number of outstanding shares and divide the resulting value by total assets at the beginning of the year.

### 3.2 | Control variables

Our first control variable is *prospect*. We define this as the difference between analysts' mean eps forecast on the day following the earnings announcement and the eps reported on the day of the announcement, scaled by the eps per share on the announcement day.

The other control variables are firm size we approximate with the natural logarithm of market capitalization ( $lnmv$ ); growth we estimate with the market-to-book ratio ( $mtbv$ ); profitability we define as the return on assets ( $roa$ ); leverage we approximate with the ratio of total debt to total assets ( $debt\ ratio$ ); systematic risk we estimate with the market beta<sup>2</sup> ( $beta$ ); firm's return over the 250 trading days leading up to the 2 days before the earnings announcement ( $momentum$ ); ownership we define as the natural logarithm of the number of large shareholders whose shareholding is greater than 3% ( $nshr$ ); and firm coverage we approximate with the natural logarithm of the number of the analysts following a stock ( $na$ ). We summarize the variable definition in Table A1.

### 3.3 | Model

We use a regression-based approach to test our hypotheses formally. Our baseline regression model is

$$y_i = \beta_0 + \sum_{i=1, \dots, N; j=1, \dots, p} \beta_j X_{ij} + \varepsilon_i \quad i = 1, \dots, N; j = 1, \dots, p, \quad (1)$$

where  $y_i$  is our dependent variable for firm  $i$ ,  $\beta_0$  is the intercept of the model,  $X_{ij}$  corresponds to the  $j$ th explanatory variable of the model for firm  $i$ ,  $\varepsilon_i$  is the random error with expectation 0 and variance  $\sigma^2$ , and  $\beta_j$  is a vector of coefficients to be estimated. Our dependent variable is the market reaction around earnings announcements,  $Will\_cret$ , we define following Williams (2015). We use the earnings surprise for each firm  $i$  at time  $t$  as our variable of interest, and we control for the covariates described in the previous subsection. To estimate the baseline model in Equation 1, we use the two-way Fixed-Effects (FE) estimator.<sup>3</sup>

We want to explore the effect of environmental sustainability arranged at different levels (firm versus industry<sup>4</sup>) on the relationship between the earnings surprise and market reaction. To pursue our goal, we split our sample into two subsamples using two different

criteria, based on the firm level and the industry level, respectively. First, the two subsamples we select are composed of the firms with an environmental score higher than our sample firms' median environmental score and the firms in the opposite situation (with an environmental score lower than our sample firms' median environmental score). We estimate Equation 1 for each subsample. We also apply the same analysis focusing on the environmental score's main components: emission reduction, innovation, and resource reduction.<sup>5</sup> Then, we investigate if earnings surprises are influenced by the industry a firm belongs to. As the industry membership is a time-invariant variable, we could not carry on our analysis using the FE estimator. For this reason, we run a Least Square Dummy Variable (LSDV) regression model. As most industry dummies' coefficients are statistically significant and the corresponding test turns out an industry effect, we identify two additional subsamples, composed of the firms belonging to high-impact industries and low-impact industries, respectively. According to Melloni (2015), "Basic Materials," "Industrials," "Oil & Gas," and "Utilities" are high-impact industries, while the remaining ones are low-impact industries. Just over 36% of our sample firms belong to the first category of industries. Concerning this last division, we run two groups of regression models. While the first group is equal to our baseline model, the second group has the environmental score as our second variable of interest. We want to investigate whether environmental sustainability at both levels (firm versus industry) works simultaneously or if a level dominates on the other.

## 4 | RESULTS

Table 1 gives a summary of the variables. The 3-day abnormal return centered on the earnings announcement dates averages around 0.35%. Earnings surprises can range from a negative 31.96% (underestimating the earnings) to a positive 44.81% (overestimating the earnings). A positive mean of about 9% for *prospect* indicates that analysts, on average, forecast higher earnings on the day following the announcement date. Firms in the sample have an average firm size of approximately 3 billion dollars. This last value reflects that firms' environmental engagements and activities are more readily available for larger firms. On average, our sample firms have a market-to-book ratio of about 3, although the value ranges from 0.03 to 12.43. On average, the sample firms exhibit a ROA of 12%, with a debt ratio of 28% and a market beta of 1.07. In sum, the sample consists of large firms with normal growth potential and a reasonable level of risk.

*highenscore* is a dummy equal to one for firms with their average annual environmental score higher than our sample firms' median environmental score and zero for firms in the opposite situation. This value is based on the environmental score from Eikon that indicates the company's commitment to reducing its impact on natural systems such as the air, land, and water (see Appendix A for more details) and can range from 0.00 (i.e., no environmental engagement) to 100 (i.e., high level of environmental engagement). As we use the median,

<sup>2</sup>We obtain this value regressing a company returns on market returns for the period 253 to 2 days before the announcement date.

<sup>3</sup>We chose the two-way Fixed-Effects (FE) estimator as the Hausman Test suggests preferring this estimator to the Random-Effects (RE) estimator.

<sup>4</sup>We use the industry classification by Eikon using the datatype ICBIN which allows to identify 10 industries as reported in Table 2.

<sup>5</sup>We collect all data on environmental sustainability at firm level from Eikon.

**TABLE 1** Descriptive statistics

Variable	Mean	Std. dev.	Min	Max
<i>Will_cret</i>	0.0035	0.0628	-0.2753	0.2403
<i>ue</i>	0.0007	0.0094	-0.3196	0.4481
<i>prospect</i>	0.0899	3.5090	-180.6150	98.9290
<i>lnmv</i>	22.4285	1.1146	18.5964	25.6036
<i>mtbv</i>	3.0030	2.3438	0.0300	12.4300
<i>roa</i>	0.1253	0.0931	-0.8452	1.4961
<i>debt ratio (%)</i>	0.2767	0.1680	0.0023	0.8600
<i>beta</i>	1.0679	0.4152	0.0546	2.8690
<i>momentum</i>	0.0543	0.3760	-1.8578	1.3654
<i>nshr</i>	0.7486	0.5479	0.0000	2.3026
<i>na</i>	2.4605	0.6661	0.0000	3.8067
<i>highenscore</i>	0.5003	0.50003	0.0000	1.0000

Note: The table provides descriptive statistics of the variables. Table A1 reports detailed definitions of the variables. The sample period is from January 2002 through December 2016. The number of observations is 7,531.

**TABLE 2** Sample breakdown by year and by industry

Year	N	%	Industry	N	%
2002	334	4.4	Basic materials	408	5.42
2003	348	4.6	Consumer goods	828	10.99
2004	377	5	Consumer services	1,060	14.08
2005	387	5.1	Financials	1,492	19.81
2006	419	5.6	Health care	660	8.76
2007	469	6.2	Industrials	1,471	19.53
2008	481	6.4	Oil and gas	517	6.86
2009	494	6.6	Technology	642	8.52
2010	517	6.9	Telecommunications	85	1.13
2011	551	7.3	Utilities	368	4.89
2012	586	7.8	Total	7,531	100
2013	614	8.2			
2014	661	8.8			
2015	635	8.4			
2016	658	8.7			
Total	7,531	100			

Note: The table describes earnings announcements across years and industries as defined by Eikon (datatype: ICBIN).

50% of our sample firms have strong engagements in activities directed towards minimizing the environmental impacts the firm can have and thus is in a relatively better position in managing its environmental risks. Dobler et al. (2014) explain that a firm's operations can result in pollution, emissions, etc., which pose environmental risks. However, firms can alleviate/manage these risks by addressing their environmental performance, such as emission reduction and recycling programs. Dobler et al. (2014) report a positive impact of environmental performance on environmental risk. Furthermore, Sharfman and

**TABLE 3** Correlation matrix

	1	2	3	4	5	6	7	8	9	10	11	#
<i>Will_cret</i>	1											
<i>ue</i>	0.0998 ***	1										
<i>prospect</i>	0.0170	-0.0142	1									
<i>lnmv</i>	-0.0178	0.0374 ***	-0.0136	1								
<i>mtbv</i>	0.0103	0.0283 **	0.0097	0.2393 ***	1							
<i>roa</i>	0.0845 ***	0.1562 ***	0.0336 ***	0.0974 ***	0.3397 ***	1						
<i>debt ratio (%)</i>	-0.0355 ***	-0.0060	-0.0112	-0.0455 ***	0.1337 ***	-0.0910 ***	1					
<i>beta</i>	0.0197 *	-0.0004	-0.0039	-0.1694 ***	-0.0906 ***	-0.1244 ***	-0.0141	1				
<i>momentum</i>	0.0304 ***	0.0493 ***	0.0486 ***	0.0963 ***	0.1050 ***	0.1700 ***	-0.0665 ***	-0.037 ***	1			
<i>nshr</i>	-0.0073	0.0012	-0.0411 ***	-0.1766 ***	-0.0144 ***	-0.0945 ***	0.1338 ***	0.1021 ***	-0.029 **	1		
<i>na</i>	0.0120	0.0441 ***	-0.0068	0.5555 ***	0.1493 ***	0.0939 ***	-0.1330 ***	0.0742 ***	0.0093 ***	-0.079 ***	1	
<i>highenscore</i>	-0.0013	0.0177	0.0055	0.3286 ***	0.0615 ***	0.0441 ***	0.0338 ***	-0.0474 ***	-0.0035 ***	-0.1248 ***	0.1514 ***	1

Note: The table provides the correlation matrix between the variables.

\**p* < 0.10, \*\**p* < 0.05, \*\*\**p* < 0.01.

TABLE 4 Firms with a high environmental performance versus firms with low environmental performance

Panel A. High environmental score firms versus low environmental score firms									
	High envscore (a)			Low envscore (b)			(a-b)		
	Coeff.	SE	Sign.	Coeff.	SE	Sign.	Coeff.	SE	Sign.
<i>constant</i>	0.0549	0.0672		0.2521	0.0652	***			
<i>ue</i>	2.1302	0.4466	***	0.4432	0.1156	***	1.6870	0.4610	***
<i>prospect</i>	-0.0001	0.0007		0.0002	0.0002		-0.0003	0.0007	
<i>lnmv</i>	-0.0015	0.0032		-0.0128	0.0032	***	0.0113	0.0046	**
<i>mtbv</i>	-0.0017	0.0008	**	-0.0012	0.0012		-0.0006	0.0014	
<i>roa</i>	0.0931	0.0280	***	0.0680	0.0441		0.0251	0.0522	
<i>debt ratio (%)</i>	-0.0096	0.0162		-0.0084	0.0166		-0.0012	0.0232	
<i>beta</i>	0.0015	0.0043		0.0077	0.0042	*	-0.0063	0.0060	
<i>momentum</i>	-0.0077	0.0052		0.0008	0.0049		-0.0085	0.0071	
<i>nshr</i>	-0.0009	0.0025		-0.0035	0.0029		0.0026	0.0038	
<i>na</i>	-0.0116	0.0042	***	0.0089	0.0041	**	-0.0205	0.0059	***
Firm fixed effects	YES			YES			YES		
Year fixed effects	YES			YES			YES		
R-squared overall	0.0505			0.0255					
Test F	3.07	***		2.82	***				
N	3,768			3,763					
Panel B. High emission reduction score firms versus low emission reduction score firms									
	High emredscore (a)			Low emredscore (b)			(a-b)		
	Coeff.	SE	Sign.	Coeff.	SE	Sign.	Coeff.	SE	Sign.
<i>constant</i>	0.0465	0.0667		0.2554	0.0647	***			
<i>ue</i>	2.2970	0.4271	***	0.4607	0.1152	***	1.8363	0.4420	***
<i>prospect</i>	0.0000	0.0003		0.0003	0.0003		-0.0003	0.0004	
<i>lnmv</i>	-0.0013	0.0031		-0.0128	0.0032	***	0.0115	0.0045	**
<i>mtbv</i>	-0.0013	0.0007	*	-0.0015	0.0012		0.0002	0.0014	
<i>roa</i>	0.0890	0.0263	***	0.0673	0.0469		0.0217	0.0537	
<i>debt ratio (%)</i>	-0.0117	0.0156		-0.0078	0.0178		-0.0039	0.0237	
<i>beta</i>	-0.0023	0.0041		0.0106	0.0044	**	-0.0129	0.0060	**
<i>momentum</i>	-0.0098	0.0051	*	0.0022	0.0049		-0.0120	0.0071	*
<i>nshr</i>	0.0000	0.0025		-0.0041	0.0029		0.0041	0.0038	
<i>na</i>	-0.0084	0.0050	*	0.0060	0.0040		-0.0144	0.0063	**
Firm fixed effects	Yes			Yes			Yes		
Year fixed effects	Yes			Yes			Yes		
R-squared overall	0.0515			0.0254					
Test F	3.28	***		2.65	***				
N	3,774			3,757					
Panel C. High innovation score firms versus low innovation score firms									
	High innovationscore (a)			Low innovationscore (b)			(a-b)		
	Coeff.	SE	Sign.	Coeff.	SE	Sign.	Coeff.	SE	Sign.
<i>constant</i>	0.0812	0.0757		0.2764	0.0648	***			
<i>ue</i>	1.4400	0.4997	***	0.5959	0.2811	**	0.8441	0.5730	
<i>prospect</i>	0.0010	0.0005	**	-0.0001	0.0002		0.0010	0.0005	**
<i>lnmv</i>	-0.0028	0.0035		-0.0140	0.0032	***	0.0112	0.0048	**

TABLE 4 (Continued)

Panel C. High innovation score firms versus low innovation score firms									
	High innovationscore (a)			Low innovationscore (b)			(a-b)		
	Coeff.	SE	Sign.	Coeff.	SE	Sign.	Coeff.	SE	Sign.
<i>mtbv</i>	-0.0021	0.0009	**	-0.0009	0.0011		-0.0012	0.0014	
<i>roa</i>	0.0850	0.0298	***	0.1325	0.0232	***	-0.0475	0.0378	
<i>debt ratio (%)</i>	-0.0009	0.0173		-0.0040	0.0150		0.0031	0.0229	
<i>beta</i>	-0.0009	0.0045		0.0081	0.0040	**	-0.0090	0.0060	
<i>momentum</i>	-0.0017	0.0050		-0.0034	0.0054		0.0017	0.0073	
<i>nshr</i>	-0.0032	0.0028		-0.0004	0.0027		-0.0027	0.0039	
<i>na</i>	-0.0071	0.0048		0.0031	0.0040		-0.0103	0.0062	
Firm fixed effects	Yes			Yes			Yes		
Year fixed effects	Yes			Yes			Yes		
R-squared overall	0.0461			0.0315					
Test F	3.08	***		3.33	***				
N	3,635			3,630					
Panel D. High resource reduction score firms versus low resource reduction score firms									
	High resredscore (a)			Lowresredscore (b)			(a-b)		
	Coeff.	SE	Sign.	Coeff.	SE	Sign.	Coeff.	SE	Sign.
<i>constant</i>	0.1132	0.0695		0.2199	0.0653	***			
<i>ue</i>	1.3153	0.4931	***	0.5181	0.1376	***	0.7972	0.5117	
<i>prospect</i>	-0.0005	0.0013		0.0002	0.0002		-0.0007	0.0013	
<i>lnmv</i>	-0.0045	0.0032		-0.0109	0.0033	***	0.0063	0.0046	
<i>mtbv</i>	-0.0019	0.0008	**	-0.0011	0.0012		-0.0007	0.0014	
<i>roa</i>	0.1279	0.0274	***	0.0503	0.0427		0.0775	0.0507	
<i>debt ratio (%)</i>	0.0016	0.0164		-0.0178	0.0166		0.0193	0.0233	
<i>beta</i>	0.0020	0.0043		0.0074	0.0041	*	-0.0054	0.0060	
<i>momentum</i>	-0.0065	0.0052		0.0012	0.0049		-0.0077	0.0071	
<i>nshr</i>	-0.0018	0.0025		-0.0028	0.0029		0.0011	0.0038	
<i>na</i>	-0.0087	0.0045	*	0.0057	0.0040		-0.0144	0.0061	**
Firm fixed effects	Yes			Yes			Yes		
Year fixed effects	Yes			Yes			Yes		
R-squared overall	0.0407			0.0228					
Test F	2.73	***		2.43	***				
N	3,752			3,769					

Note: Equation 1 is estimated for each subsample. Subsamples are based on our sample firms' mean scores. The high-score group consists of firms with an average annual score higher than the sample median of these average scores, while the low-score group consists of firms with an average annual score lower than the same value. Panel A is based on the environmental score; Panel B is based on the emission reduction score; Panel C is based on the innovation score; Panel D is based on the resource reduction score.

\* $p < 0.10$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$ .

Fernando (2008) indicate that firms that manage their environmental risks also enhance their environmental performance. Consequently, they have a lower chance of exposure to environmental risk and its associated costs.

Table 2 shows that our sample firms are mostly financial firms (20%), industrials (20%), and consumer services (14%). Data availability increased significantly from 4% (of the total firm-year observations) in 2002 to 9% in 2016.

Positive and significant correlations on the last row in Table 3 indicate that high environmental performance is positively associated with firm size (*lnmv*), market-to-book ratio (*mtbv*), profitability (*roa*), debt ratio (*debt ratio*), and the number of analysts following the firm (*na*). These, together with the correlations for firm size in column *lnmv*, highlight that larger firms tend to have higher profitability, higher growth opportunities, lower leverage, and attract more attention from the analysts while performing better on the

environmental front. Also, abnormal return ( $Will\_cret$ ) is positively correlated with the level of earnings surprise ( $ue$ ), suggesting a positive association between earnings surprise and investors' reaction to the surprise.

#### 4.1 | Do investors with moderate environmental risk aversion react differently to earnings news?

To investigate the role investors' environmental risk aversion has on their reaction to earnings news, we estimate Equation 1 for firms with high (or low) environmental performance. A firm has high environmental performance if its average annual environmental performance score is above the sample median. The coefficient value for  $ue$  in column (a) shows that the investors react two times the level of earnings surprise ( $ue$ ) announced by firms with high  $envscore$ , but just 0.44 times the level of  $ue$  announced by firms with low  $envscore$ . Column (a-b) indicates that investors' reaction to earnings surprises by firms with high environmental performance is significantly higher than investors' reaction to earnings surprises by firms with low environmental performance. These results suggest that investors pay more heed to a unit of earnings surprise announced by firms that exhibit high environmental performance than they do to a unit of earnings surprise announced by firms that exhibit low environmental performance. This result is consistent with the prediction by Hypothesis 1.

To shed more light on the types of environmental performance that could be related to the results observed in Panel A of Table 4, we re-estimate Equation 1 for each of the three dimensions of environmental performance: (1) emission reduction (Panel B), (2) innovation (Panel C), and (3) resource reduction (Panel D). The last column in Panel B indicates that investors' reaction to earnings announcements is different between firms with high and low emission reductions. Investors react more to the earnings surprises by firms that perform well on emission reduction. However, Panel C (Panel D) shows no difference in the investors' reactions to the earnings surprises between firms with high environmental innovation (resource reduction) and low environmental innovation (resource reduction). Therefore, the aspect of environmental performance that investors are responding to seems to be the firms' performance concerning emission reduction rather than innovation or resource reduction. Wamba et al. (2020) have pointed out that certain aspects of environmental performance are more relevant to some investors than others.<sup>6</sup>

Since the FE model does not allow including industry dummies as firms' industry is time-invariant, we estimate a Least Square Dummy Variables (LSDV) model to capture the industry effect. Table 5 summarizes the estimation results. The second last row in the table shows that the test on the industry effect is significant at the 5% level. Thus, we reject the null hypothesis that there is no industry effect. Therefore, the investors' reactions to earnings announcements differ across industries.

<sup>6</sup>As a sensitivity test, we also re-estimated an interactive model with environmental performance and earnings surprise as the interactive term for each panel in Table 4. The results, available upon request, are qualitatively similar to those reported in Table 4.

The results in Table 4 support Hypothesis 1 that firms with higher environmental performance experience higher price reactions towards their earnings. This finding implies that investors reward firms for good financial performance despite the heavy capital outlays incurred to address environmental risk. However, the results in Table 5 indicate that the reaction varies with industry too.

#### 4.2 | How do investors with very high environmental risk aversion (i.e., investors who are intolerant to environmental risk) react to earnings news?

Here, we examine how investors with very high environmental risk aversion react to earnings news by studying earnings announcements by firms that belong to high environmental-impact industries versus low environmental-impact industries. Xue et al. (2019) find that generally, service-related industries have a low environmental impact as they exhibit lower carbon emissions than Manufacturing or Oil & Gas industries, which are high environmental-impact industries. Therefore, investors who are very averse to environmental risk will choose to exclude from their investments firms from industries that have a high impact on the environment by nature.

We estimate Equation 1 using Melloni's (2015) classification to identify high versus low environmental-impact industries. Results in Table 6 show that investors react 1.9 times the earnings surprise announced by firms in high environmental-impact industries but only 0.5 times the earnings surprise announced by firms in low environmental-impact

**TABLE 5** Industry effect

	Coeff.	SE	Sign.
<i>constant</i>	0.0425	0.0202	**
<i>ue</i>	0.6064	0.1464	***
<i>prospect</i>	0.0002	0.0002	
<i>lnmv</i>	-0.0024	0.0009	**
<i>mtbv</i>	-0.0007	0.0005	
<i>roa</i>	0.0467	0.0160	***
<i>debt ratio (%)</i>	-0.0089	0.0053	*
<i>beta</i>	0.0042	0.0023	*
<i>momentum</i>	-0.0016	0.0034	
<i>nshr</i>	-0.0013	0.0016	
<i>na</i>	0.0018	0.0015	
Year fixed effects	Yes		
Industry fixed effects	Yes		
R-squared	0.0254		
Test F	3.20	***	
Test industry effect	2.39	**	
N	7,531		

Note: The table reports the coefficients of a Least Square Dummy Variables (LSDV) regression model.

\* $p < 0.10$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$ .

**TABLE 6** Firms belonging to high-impact industries versus firms belonging to low-impact industries

	High-impact industries (a)			Low-impact industries (b)			(a-b)		
	Coeff.	SE	Sign.	Coeff.	SE	Sign.	Coeff.	SE	Sign.
constant	0.1605	0.0776	**	0.1809	0.0613	***			
ue	1.9400	0.5500	***	0.5415	0.1336	***	1.3984	0.5648	**
prospect	0.0003	0.0002		0.0001	0.0003		0.0001	0.0004	
lnmv	-0.0063	0.0038	*	-0.0091	0.0030	***	0.0027	0.0048	
mtbv	-0.0020	0.0016		-0.0012	0.0008		-0.0008	0.0017	
roa	0.0997	0.0298	***	0.0626	0.0430		0.0371	0.0523	
debt ratio (%)	-0.0292	0.0205		-0.0010	0.0145		-0.0282	0.0251	
beta	-0.0013	0.0051		0.0070	0.0037	*	-0.0083	0.0063	
momentum	-0.0055	0.0051		-0.0011	0.0047		-0.0045	0.0069	
nshr	-0.0013	0.0028		-0.0027	0.0025		0.0014	0.0038	
na	-0.0057	0.0054		0.0040	0.0038		-0.0096	0.0066	
Firm fixed effects	YES			YES			YES		
Year fixed effects	YES			YES			YES		
R-squared overall	0.0343			0.018					
Test F	3.14	***		2.12	***				
N	2,764			4,767					

Note: Equation 1 is estimated for each subsample. Subsamples are based on industry membership. Following Melloni (2015), while Basic Materials, Industrials, Oil & Gas, and Utilities are high-impact industries, Consumer Goods, Consumer Services, Financial, Healthcare, Technology, and Telecommunications are low-impact industries.

\* $p < 0.10$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$ .

**TABLE 7** Firms belonging to high-impact industries versus firms belonging to low-impact industries and environmental performance

	High-impact industries (a)			Low-impact industries (b)			(a-b)		
	Coeff.	SE	Sign.	Coeff.	SE	Sign.	Coeff.	SE	Sign.
constant	0.1789	0.0921	*	0.2441	0.0778	***			
ue	1.7678	0.5982	***	0.5545	0.1367	***	1.2133	0.6121	**
prospect	0.0003	0.0002		0.0002	0.0003		0.0001	0.0004	
envscore	-0.0056	0.0106		0.0040	0.0085		-0.0096	0.0136	
lnmv	-0.0059	0.0043		-0.0114	0.0037	***	0.0055	0.0057	
mtbv	-0.0033	0.0018	*	-0.0007	0.0008		-0.0026	0.0020	
roa	0.0972	0.0361	***	0.0434	0.0491		0.0538	0.0609	
debt ratio (%)	-0.0328	0.0260		-0.0087	0.0160		-0.0241	0.0304	
beta	-0.0011	0.0061		0.0074	0.0042	*	-0.0085	0.0074	
momentum	-0.0031	0.0056		-0.0003	0.0053		-0.0028	0.0077	
nshr	-0.0035	0.0032		-0.0032	0.0027		-0.0003	0.0042	
na	-0.0116	0.0067	*	0.0024	0.0045		-0.0140	0.0080	*
Firm fixed effects	Yes			Yes			Yes		
Year fixed effects	Yes			Yes			Yes		
R-squared	0.0496			0.0219					
Test F	2.48	***		2.03	***				
N	2,327			4,142					

Note: Equation 1 is estimated for each subsample, including the environmental score as the second variable of interest. Subsamples are based on industry membership. Following Melloni (2015), while Basic Materials, Industrials, Oil & Gas, and Utilities are high-impact industries, Consumer Goods, Consumer Services, Financial, Healthcare, Technology, and Telecommunications are low-impact industries.

\* $p < 0.10$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$ .

industries. The last column in the table shows that the difference in the coefficient of  $ue$  in columns (a) and (b) is statistically different. In particular, investors' reaction to earnings surprise from firms in low environmental-impact industries is statistically significantly lower than the investors' reaction to the earnings surprise from firms in high environmental-impact industries. This finding supports our Hypothesis 2.

The results in Table 6 are consistent with the notion that investors with very high environmental risk aversion select firms based on the firm's fundamental relation to the environment rather than the level of earnings (i.e., the financial performance).

Next, we examine the relevance of a firm's environmental performance to investors with very high environmental risk aversion. To do so, we re-visit the set-up in Table 6 with *envscore* included in the equations estimated. By doing so, we extract the relevance of firm-level environmental performance to investors when the investors screen their investments based on environmental performance at the industry level. The results summarized in Table 7 show that the investors' reaction to earnings surprise is lower in firms belonging to low environmental-impact industries and that the difference is statistically significant at the 5% level. However, the coefficients for *envscore* are not different between firms in high and low environmental-impact industries. These findings suggest that firm-level environmental performance is irrelevant for investors who are very averse to environmental risk and thus consider the environmental impact at the industry level rather than at the firm level. That is, those investors are interested only in firms with low environmental impact rather than firms that manage their potentially high environmental risk well.

## 5 | CONCLUSIONS

We investigate the effect of investors' aversion to environmental risk on their decision-making by examining their reactions to earnings news. Due to the difficulty associated with measuring investors' environmental risk aversion, we employ proxies for two levels of environmental risk aversion in investors: (1) moderate level of environmental risk aversion assessed through firms' environmental performance and (2) very high level of environmental risk aversion indicated through the industry to which a firm belongs. Investors with a moderate level of environmental risk aversion may be persuaded by firms' environmental performance—i.e., positive screening. However, for investors with a very high level of environmental risk aversion, environmental performance is a non-negotiable item, and thus, those investors will refrain from investing in industries that have an impact on the environment—i.e., negative screening.

We find that investors with moderate environmental risk aversion react stronger to earnings news in firms with high environmental performance. This result suggests that when firms excel in their environmental responsibilities, they attract investors who have moderate environmental risk aversion. These investors value the firms' earnings relatively higher due to the implicit signal that investments in environmental-related matters are beginning to pay off. For instance, investments in a new recycling program can be costly and suppress a firm's earnings for a

certain number of years. However, once the program is set in motion, the investors will appreciate the eventually generated earnings.

In addition, we find that investors with a very high level of environmental risk aversion react less to earnings news by firms in industries with a low environmental impact. For these investors, earnings are of secondary importance as they are primarily attracted to the industries due to their nature and fundamental relation to the environment. For example, environmental investors who are very averse to environmental risk select industries with low environmental impact. For them, the business model takes precedence in their investment decisions. Further analyses confirm that firm-level environmental performance is irrelevant for investors with a very high level of environmental risk aversion as they are interested primarily in firms with low environmental impact rather than firms who manage well a potentially high environmental risk.

Our findings have various managerial implications. Managers should pay attention to the environmental risk aversion of their investors. For businesses that have a low environmental impact, investors will understand when earnings are not always rosy. Otherwise, managers should strive to excel on the environmental front (i.e., perform well on environmental risk management) to keep the investors with moderate environmental risk aversion satisfied.

Besides, the analyses show that environmental performance related to emission reduction attracts the most reaction from the investors. This result suggests that the investors are most sensitive to firms' engagements in emission reduction issues. Therefore, managers should pay particular attention to the emission reduction aspect of environmental performance.

Moreover, findings in this study suggest that investors with very high environmental risk aversion consider the impacts a firm has on the environment as the top priority. These investors legitimize a firm based on the environmental impact emanating from the business model. Thus, firms in industries associated with high environmental impact should strive to adjust their business model if they were to gain legitimation from the investors with high environmental risk aversion.

Policymakers should note that the market mechanism, i.e., influencing firms' environmental behavior through investors, is working in some respect. In other words, investors are playing an active role in persuading firms to engage in emission reduction, but to a minimal extent in the case of environmental innovation or resource reduction. Thus, policymakers should consider alternatives, such as regulations, incentives, subsidies, etcetera, to foster environmental performance in terms of innovation or resource reduction.

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## APPENDIX A

**TABLE A1** Variable definition

Variable	Definition
<i>Will_cret</i>	The excess return computed as the difference between the compound return for each firm and each announcement and the compound market return over the same period.
<i>ue</i>	The product of the surprise per share for the number of outstanding shares, divided by total assets at the beginning of the year.
<i>prospect</i>	The difference between analysts' mean eps forecast on the day following the earnings announcement and the eps reported on the day of the announcement, scaled by the eps per share on the announcement day.
<i>lnmv</i>	The natural logarithm of market capitalization.
<i>mtbv</i>	The market-to-book ratio.
<i>roa</i>	The return on assets.
<i>debt ratio</i>	The ratio of total debt to total assets.
<i>beta</i>	The regression slope coefficient from the market model estimated for the period from 253 days to 2 days before the announcement date.
<i>momentum</i>	The firm's return over the 250 trading days leading up to the 2 days before the earnings announcement.
<i>nshr</i>	The natural logarithm of the number of large shareholders whose shareholding is greater than 3%.
<i>na</i>	The natural logarithm of the number of analysts following a stock.
<i>envscore</i>	The environmental pillar measures a company's impact on natural systems (i.e., air, land, and water). It describes how a company uses best management practices to avoid environmental risks and benefits from environmental opportunities to generate long-term value in favor of shareholders.
<i>highenvscore</i>	A dummy equal to 1 if the average annual environmental score of the firm is higher than the sample median of these average scores.
<i>emredscore</i>	The emission reduction sub-dimension measures a company's management commitment and effectiveness in reducing environmental emissions in its production and operational processes. It describes a company's capacity to reduce air emissions, waste, and water discharges.
<i>innovationscore</i>	The product innovation sub-dimension measures a company's management commitment and effectiveness in supporting the research and development of eco-efficient products or services. It describes a company's ability to decrease environmental costs and create new market opportunities through new environmental technologies.
<i>resredscore</i>	The resource reduction category measures a company's management commitment and effectiveness in achieving efficient use of natural resources in the production process. It describes a company's capacity to reduce the use of materials, energy, or water
<i>envimpact</i>	A dummy equal to 1 if the firm belongs to high-impact industries (Basic Materials, Industrials, Oil & Gas, Utilities and zero otherwise (Melloni, 2015).