The Value of Corporate Social Responsibility: Evidence from the Humidifier Disinfectant Scandal in Korea[*]

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Abstract

As a quasi-natural experiment, we examine the effects of corporate social responsibility (CSR) on firms' stock performance amid a corporate scandal closely linked with environmental and social (ES) issues, the humidifier disinfectant scandal in Korea. We find that firms with higher ES ratings, especially those with higher social ratings, outperform firms with lower ES ratings during the product safety scandal. Our findings reveal that ES performance is influential over a firm's stock returns when investors pay high attention to CSR, suggesting that firms' CSR investments mitigate their nonfinancial risk.

JEL classification: G12, G32, M14

Keywords: Corporate Social Responsibility, Environmental and Social, Stock Performance, Humidifier Disinfectant Scandal

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1. Introduction

Although whether corporate social responsibility (CSR) enhances shareholder wealth is critical for the CSR sustainability, it is empirically challenging to answer this seemingly straightforward question. Since a firm's environmental and social (ES) policies and stock value are endogenously determined, identifying a causal relationship between them is hard. Various unobservable factors can affect both ES policies and stock prices. It is also unclear whether firms' ES investments improve their stock performance or well-performing firms afford ES investments. Moreover, since in efficient markets stock prices already reflect all available information, publicly-known ES policies cannot influence stock returns.

To circumvent these challenges, prior studies exploit financial crises as exogenous shocks to the market demand for CSR. Facilitating the stock market to re-value firms to reflect various rapid changes, financial crises can provide chances to examine the market's CSR valuation, to the extent that they unexpectedly affect the CSR demand. Lins et al. (2017) find that higher-ES-rating firms suffer less from the 2008-2009 financial crisis than lower-ES-rating firms. Albuquerque et al. (2020) and Ding et al. (2021) provide similar findings during the COVID-19 pandemic-induced market crash, using US and international data, respectively, whereas Bae et al. (2021) find no such evidence.

However, concerns arise for the above approach since most economy-wide shocks affect not only the CSR demand but many others that can be correlated with CSR, raising a possibility that estimated CSR valuation is contaminated by other uncontrollable effects. Bae et al. (2021) find that estimated CSR effects on stock performance during the COVID-19 pandemic are sensitive to regression specifications and sample composition. Ding et al. (2021) show that besides CSR, pre-crisis financial conditions, customer relations, and family and government controls influence firms' stock returns during the pandemic.

Our strategy is to examine the market valuation of CSR employing a shock more specific to the CSR demand, the humidifier disinfectant scandal in Korea (the scandal, hereafter), than general economy-wide shocks, as a quasi-natural experiment. The scandal was a chemical tragedy that inhaling toxic

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humidifier disinfectants widely used in Korea caused fatal diseases. According to the 2019 report from Environment Ministry of Korea, among over 10,000 cases registered as having lung damages and asthma associated with this disaster, 894 were officially confirmed as victims almost certainly or with high probability and more than two hundred victims died. We examine how the stock market values firms' ES performance when the whole society pays strong attention to product safety.

We extend the literature on quasi-natural experiments that investigate the effects or determinants of CSR, in addition to contributing to CSR research by examining how CSR influences stock performance employing a CSR-specific shock. Lins et al. (2017) explore how CSR affects stock performance employing the Enron/Worldcom frauds. Liang and Renneboog (2017) exploit the Chinese milk scandal, the Indian Ocean earthquake, and the Deepwater Horizon oil spill to show how legal origins impact CSR.

2. Humidifier Disinfectant Scandal

This incident was initially unveiled in 2011 when several victims died and the epidemiologic investigation revealed the responsibility of humidifier disinfectants for their deaths. However, it had not received much attention until January 26, 2016, when Supreme Prosecutors' Office unexpectedly expanded its investigation and thereafter discovered the manipulation of animal test results for humidifier disinfectants. Strong media attention was then paid and sales of associated products were suspended. The products of foreign firms and local firms affiliated with large business groups were implicated. On May 2, 2016, the head of Oxy Reckitt Benckiser Korea that accounted for 60% of humidifier disinfectant sales (Choi et al., 2017) made an official apology.

We set the scandal period from January 26 to May 3, 2016, since we expect that the scandal sparked severe concerns about product safety and significant interests in CSR in this period.[1] Consistent with our expectation, the Google trend results in Fig. 1 indicate the highest attention paid to humidifier

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[1] The 2016 survey by Asian Citizen's Center for Environment and Health reports that 54% of respondents had participated in a boycott of Oxy Reckitt Benckiser products and 83% expressed their unwillingness to purchase them.

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disinfectants in the first half of 2016. Table A.1 summarizes major associated events.

3. Data Description

Our sample comprises 634 non-financial KSE-listed firms with ESG ratings in 2015 from Korea Institute of Corporate Governance and Sustainability. Its firm-level ESG score and each component score range from 0 to 6 and from 0 to 100, respectively. We define ES Score as the average of E and S scores divided by 100 and High ES as an indicator set equal to one if a firm's ES Score ranks in the top quartile and zero otherwise, following Albuquerque et al. (2020). We similarly define High E, High S, High G, and High ESG. Tables A.2 and A.3 define variables and summarize their statistics, respectively. Stock returns and accounting information are from DataGuide.

4. Empirical Results

4.1 Market valuation of CSR

We estimate cumulative abnormal returns (CARs) by the standard market model approach using KOSPI as a market portfolio and 200 days up to 21 days before the scandal as the estimation period. We exclude firms with non-missing returns fewer than 150 in the estimation period or fewer than half days in each event window.

Fig. 2 reveals sharply different CARs between high- and low-ES firms during the first half of 2016. While CARs continuously increase for high-ES firms, those of low-ES firms drop substantially after entering the scandal. Our untabulated results find that mean CARs during the scandal period are 6.1% and -2.6% for high- and low-ES firms, respectively, and they statistically differ at the 1% level. Although post-scandal CARs decline for both sub-samples, the difference between them remains similar, suggesting a lasting impact of CSR.

4.2 Regression estimates

We further analyze CSR valuation employing same specifications as in Lins et al. (2017) and Bae et al. (2021) and estimate the following firm-level cross-sectional regression:

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$$CAR_i = \beta_0 + \beta_1 CSR + \Sigma\beta_k Control\ Variables + \Sigma\beta_m Factor\ loadings + \Sigma\beta_n Industry\ FE + \varepsilon_i \quad \text{---(1)}$$

where dependent variables are CAR (0, 2) focusing on the initial three days and CAR (0, 65) covering the entire scandal.[2] The factor loadings are the Fama-French three factors and momentum factor, and industry-fixed effects are defined using two-digit KSIC codes. All variables are winsorized at the 1% levels of both distribution tails.

Table 1 shows that the coefficients on both ES Score and High ES are positive and significant, except for Column (2), irrespective of whether control variables are included. Columns (4) and (8) indicate that one standard deviation increase in ES Score and High ES becoming one are associated with 2.4 and 4.7 percentage point stock return increases, respectively, suggesting economically significant outperformance of high-ES stocks.

4.3 CSR components and industrial effects

The first four columns in Table 2 investigate the respective impact of environmental and social performances and indicate that stock-return-increasing effects of CSR are mainly derived from social performance, consistent with a view that people were mainly concerned about product safety during the scandal. Furthermore, employing High ESG, the last two columns show that our results remain similar when additionally considering governance in measuring CSR.[3]

Second, we conjecture that investors value CSR more for firms in scandal-related industries. Since the humidifier disinfectant sellers belong to the industries of chemicals and chemical products manufacture, wholesale trade on own account or on a fee or contract basis, or retail trade, we classify these as scandal-related industries. Moreover, as Oxy Reckitt Benckiser Korea with the largest humidifier disinfectant sales sold pharmaceutical products and the boycott encompassed these products, we additionally include the industry of medicinal chemical and botanical products. Table 3 finds more pronounced results for firms in the scandal-related industries with 49% to 188% larger coefficient

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[2] The results remain similar when estimating CARs from *day -1*.
[3] Replacing High ESG with High G, we find that governance performance does not independently affect stock performance.

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magnitudes of CSR variables.

5. Additional Evidence: The Volkswagen Scandal

We exploit another corporate scandal likely associated with CSR intensity. On September 18, 2015, U.S. Environmental Protection Agency revealed that Volkswagen had illegally installed defeat devices with their engines. On November 26, Korean Ministry of Environment ordered Volkswagen to recall over 125,000 vehicles. We find high-CSR firms' outperformance, reinforcing our main findings, using a sample of KSE-listed firms with CSR ratings from September 18 to November 27, 2015. Table A.4 presents these results.

6. Conclusion

Exploiting the humidifier disinfectant scandal, we find that higher-ES-rating firms are valued more favorably in the stock market than lower-ES-rating firms when strong attention is paid to social capital. Especially, a firm's social performance appears highly valuable when customers are concerned about product safety and firm trustworthiness. Our quasi-natural experiments suggest that active investments in CSR attenuate a firm's nonfinancial risk.

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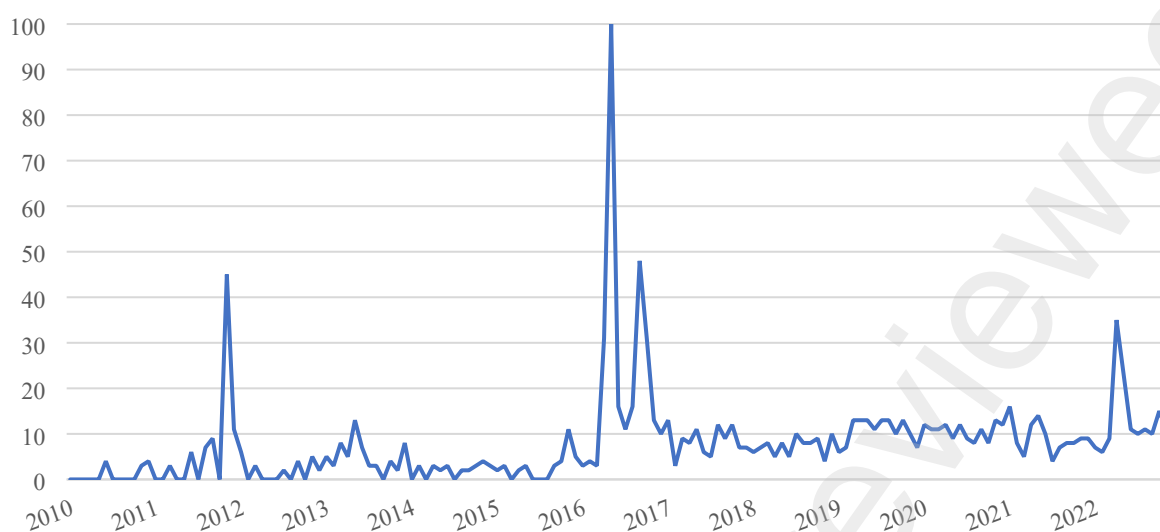   https://doi.org/10.1111/jofi.12505

Fig. 1. Interest Levels in humidifier disinfectants: Google Trend Scores (0-100)

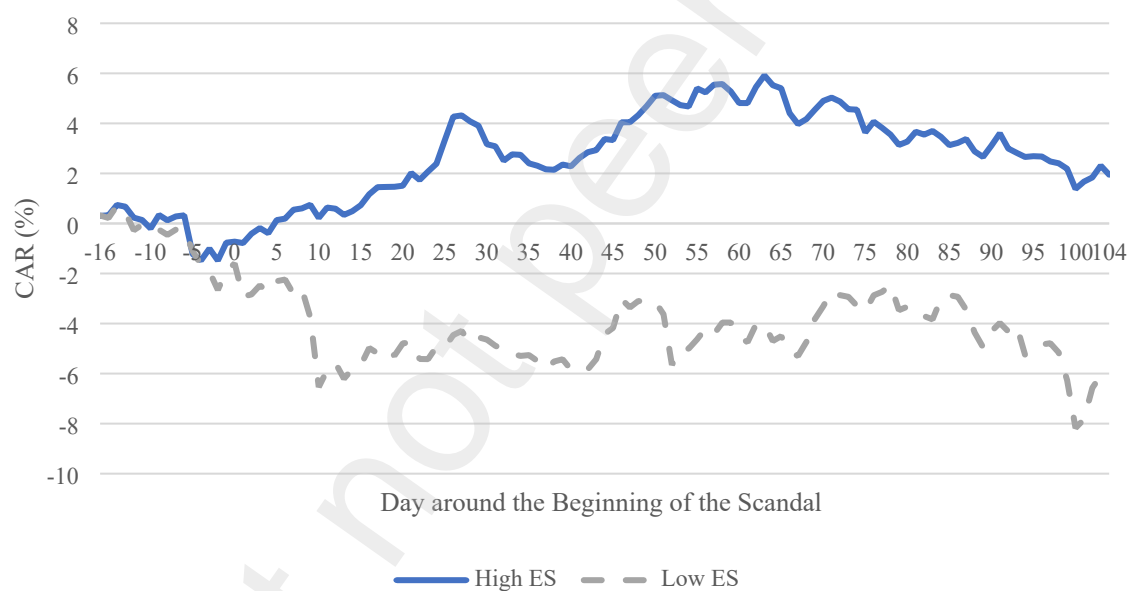Day around the Beginning of the Scandal

High ES — — Low ES

Fig. 2. Stock Performance: High vs. Low ES Firms (January-June 2016)

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Table 1 Regression Estimates of CARs on CSR

Variables	CAR(0, 2)		CAR(0, 65)		CAR(0, 2)		CAR(0, 65)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ES Score	0.032***	0.018	0.137**	0.142**				
	(0.011)	(0.013)	(0.068)	(0.063)				
High ES					0.013***	0.007*	0.058**	0.047**
					(0.004)	(0.004)	(0.024)	(0.019)
Control Variables	YES	YES	YES	YES	YES	YES	YES	YES
Factor loadings	No	YES	No	YES	No	YES	No	YES
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES
Observations	634	634	634	634	634	634	634	634
Adj. R^2	0.027	0.177	0.079	0.568	0.029	0.179	0.081	0.569

Heteroscedasticity robust standard errors are in parentheses; ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table 2 Regression Estimates of CARs on CSR Components

Variables	CAR(0, 2)	CAR(0, 65)	CAR(0, 2)	CAR(0, 65)	CAR(0, 2)	CAR(0, 65)
	(1)	(2)	(3)	(4)	(5)	(6)
High E	0.005	0.028				
	(0.004)	(0.019)				
High S			0.013***	0.057***		
			(0.004)	(0.020)		
High ESG					0.011***	0.032*
					(0.004)	(0.018)
Control Variables	YES	YES	YES	YES	YES	YES
Factor loadings	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES
Observations	634	634	634	634	634	634
Adj. R^2	0.177	0.566	0.079	0.569	0.029	0.179

Heteroscedasticity robust standard errors are in parentheses; ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table 3 Regression Estimates of CARs on CSR: Industrial Effects

Variables	CAR(0, 65)									
	Related Industry					Unrelated Industry				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
ES Score	0.209*					0.139*				
	(0.122)					(0.075)				
High ES		0.077**					0.037*			
		(0.038)					(0.022)			
High E			0.020					0.026		
			(0.044)					(0.021)		
High S				0.082**					0.055**	
				(0.040)					(0.025)	
High ESG					0.069*					0.024
					(0.036)					(0.022)
Control variables	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Factor loadings	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	159	159	159	159	159	475	475	475	475	475
Adj. R^2	0.554	0.557	0.548	0.558	0.556	0.582	0.581	0.580	0.584	0.580

Heteroscedasticity robust standard errors are in parentheses; ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

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Appendix

Table A.1 Important Events of the Humidifier Disinfectant Scandal

Date	Humidifier Disinfectant Scandal Events
Nov. 16, 1994	The first product of humidifier disinfectant was launched.
Apr. 25, 2011	Asan Medical Center in Seoul requested Korea Centers for Disease Control and Prevention (KCDC) to investigate an unidentified cause of lung diseases, of which four pregnant women died.
Aug. 31, 2011	KCDC reported epidemiologic investigation results and announced that the fatal lung diseases were due to the inhalation of humidifier disinfectants.
Nov. 11, 2011	Korean government reported a link between toxic chemicals in humidifier disinfectants, PHMG and PGH, and lung damages and ordered the withdrawal of six humidifier disinfectant products from the market.
2013 - 2015	KCDC and the Ministry of Environment investigated and confirmed victims of health damage due to exposure to humidifier disinfectants.
Jan. 26, 2016	Supreme Prosecutors' Office of Korea expanded the special investigation team for the humidifier disinfectant damage cases.
Apr. 15, 2016	A professor at Seoul National University was investigated for manipulation of animal test results associated with humidifier disinfectants.
Apr. 18, 2016	Lotte Mart officially apologized to the victims of the humidifier disinfectant incident, being the first manufacturer to offer a public apology and compensation plan.
Apr. 25, 2016	Civic groups and victims of the incident urged a nationwide boycott of products manufactured by the firms involved with the scandal.
May 2, 2016	Oxy Reckitt Benckiser Korea made an official apology.
May 14, 2016	Prosecutors arrested people associated with the case.
Jan. 6, 2017	The court sentenced defendants involved in the humidifier disinfectant scandal to 5 to 7 years in prison in the first trial.
Feb. 8, 2017	Special Act on Remedy for Damages Caused by Humidifier Disinfectants was promulgated.

Table A.2 Variable Definitions

Variables	Description
ESG Variables:	
ES Score	The average of the E and S scores divided by 100. The scores of E and S are continuous and range from 0 to 100.
High ES	An indicator set equal to one if a firm's ES Score is ranked in the top quartile, and zero otherwise.
High E	An indicator set equal to one if a firm is ranked in the top quartile of E scores, and zero otherwise. The score of E is continuous and ranges from 0 to 100.
High S	An indicator set equal to one if a firm is ranked in the top quartile of S scores, and zero otherwise. The score of S is continuous and ranges from 0 to 100.
High ESG	An indicator set equal to one if a firm's ESG score is ranked in the top quartile, and zero otherwise. The score of ESG is continuous score and ranges from 0 to 6.
Control Variables:	
Firm Size	Logarithm of the market value of a firm's equity.
Short-Term Debt	Debt in current liabilities divided by total assets.
Long-Term Debt	Long-term debt divided by total assets.
Cash Holdings	Cash and marketable securities divided by total assets.
Profitability	Operating income divided by total assets.
Book-to-Market	Book value of equity divided by market value of equity.
Momentum	Sum of a firm's raw returns over the 200 trading days ending 21 days before the scandal.
Idiosyncratic Risk	Variance of residuals from the market model estimated during the 200-trading-day period that ends 21 days before the scandal period.

Table A.3 Descriptive Statistics

Variables	N	Mean	SD	25%	Median	75%
ES score	634	0.291	0.170	0.16	0.263	0.38
E score	634	0.316	0.222	0.12	0.313	0.483
S score	634	0.266	0.153	0.167	0.228	0.323
ESG Score	634	2.761	0.727	2.300	2.700	3.100
Firm size	634	26.414	1.529	25.274	26.097	27.278
Short-Term debt	634	0.030	0.05	0.000	0.004	0.044
Long-Term debt	634	0.117	0.105	0.033	0.087	0.176
Cash holdings	634	0.057	0.063	0.012	0.037	0.08
Profitability	634	0.032	0.055	0.009	0.03	0.058
Book-to-Market	634	1.072	0.698	0.539	0.906	1.459
Momentum	634	0.159	0.393	-0.106	0.109	0.371
Idiosyncratic volatility	634	0.030	0.012	0.021	0.027	0.037

The sample consists of 634 non-financial KOSPI firms listed from January to May 2016 and for which ES ratings are available in 2015. All other variables are measured at the end of 2015.

Table A.4 Regression Estimates of CARs during the Volkswagen Scandal

Variables	CAR (-1, 2)	CAR (-1, 46)	CAR (-1, 2)	CAR (-1, 46)	CAR (-1, 2)	CAR (-1, 46)
	(1)	(2)	(3)	(4)	(5)	(6)
ES Score	0.014	0.109				
	(0.020)	(0.074)				
High ES			0.010*	0.041**		
			(0.006)	(0.021)		
High ESG					0.013**	0.038*
					(0.006)	(0.023)
Control variables	YES	YES	YES	YES	YES	YES
Factor loadings	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES
Observations	629	629	629	629	629	629
Adj. R2	0.127	0.332	0.129	0.334	0.131	0.332

The sample consists of 629 non-financial KOSPI firms listed during the Volkswagen scandal and for which ES ratings are available in 2014. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

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