# Consumer Interest and Peer Effect on Corporate Environmental Initiatives: Evidence from Web Search Volumes

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**Abstract**

With increasing consumer attention and information accessibility, firms lagging behind their peers on environmental initiatives have strong incentive to catch up. Focusing on the environmentally-sensitive industries in the U.S., we show that these "lagging" firms invest more aggressively in reducing emissions or finding eco-friendly uses of materials. Such peer pressure on CSR is not associated with a firm's relative market share. More interestingly, this article reveals that CSR peer effect is stronger for a firm exposed to high volumes of Internet searches by consumers. In contrast, a firm's exposure to investor interest does not have a similar impact. Finally, the relation between consumer interest and CSR peer effect is significantly weaker for a high-leverage firm. Our finding provides an additional support for the traditional theory that leverage mitigates the agency costs of overinvestment.

**Keywords**: Peer effect; $CO_2$ emission; Leverage, Agency costs; Consumer interest, Investor attention, Web scraping

**EFM Classification Codes:** 110, 150

This version: January 15, 2022

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# 1. Introduction

Peer effect plays a central role in a wide range of corporate investment decisions. The extant literature shows that a firm's peers influence various decisions, including capital budgeting and expenditures (e.g., Graham and Harvey, 2001; Foucault and Fresard, 2014), capital structure (e.g., Leary and Roberts, 2014), cash holdings (e.g., Hoberg et al., 2014), and dividend policies (e.g., Kaustia and Rantala, 2015; Grennan, 2019). Another dimension of corporate decisions significantly influenced by a firm's peers is corporate social responsibility (CSR).[1] CSR helps foster eco-efficient technologies and production processes and maintain a firm's competitiveness (Flammer, 2015; Liu and Wu, 2016). Any company lagging behind its peers on CSR (hereafter a "lagging firm") must be under pressure to catch up. Moreover, it is known that the effectiveness of CSR depends on a firm's ability to profit from stakeholder relationships (Barnett, 2007; Barnett and Salomon, 2012).[2] Given these notions, we expect a strong association between a firm's CSR performance relative to its peers and presence of stakeholders.

The main stakeholders of interest in this paper are consumers and investors. We use Internet search volume data collected through a web-scraping program as a direct measure of consumer or investor interest. While a consumer or an investor searching for a firm is undoubtedly interested in the firm's information (Da et al., 2011), it is rather difficult to use this approach for other types of stakeholders (e.g., managers, employees). Consumers have been increasingly vocal about corporate CSR efforts in recent years. The 2015 Nielsen Global Corporate Sustainability Report, which polled 30,000 consumers in 60 countries, shows that 66% of consumers are willing to pay more for sustainable brands.[3] This percentage is up from 50% in 2013 and 55% in 2014.

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[1] The term "ESG" (environmental, social, and governance) has been also used in literature to include corporate governance. In this paper, the terms CSR and ESG are used interchangeably.
[2] In Barnett (2007), such ability is referred to as stakeholder influence capacity.
[3] See https://engageforgood.com/2015-nielsen-global-sustainability-report/

Moreover, the literature shows that a firm's CSR effort serves as a device to signal otherwise unobservable quality of the firm's products (Fisman et al., 2007; Servaes and Tamayo, 2013).

The relation between a firm's CSR effort and investors has also received enormous attention in literature. The areas of recent research include the impact of a firm's social performance on its financial performance (e.g., Godfrey et al., 2009; Hong et al., 2012; Guiso et al., 2015) and the market trenches created by investors based on industry-specific CSR levels (Ding et al., 2016; Awaysheh et al., 2020). Nevertheless, the literature has not explored the exact relation between the CSR peer effect and influence of consumers or investors. In this paper, we attempt to answer the following questions: If a firm lagging behind its peers on CSR attempt to catch up aggressively, can such peer effect be stronger when a firm is exposed to high consumer interest? Can the same conclusion be drawn about investor interest?

To measure a company's CSR performance, our study utilizes Thomson Reuters ESG Scores for the period between 2010 and 2017.[4] Although these scores are based on a company's public disclosures across ten main themes, we specifically focus on environment-related categories. These are *Emissions*, *Resource Use*, and *Environmental Product Innovation*. Due to the nature of these ESG areas, we limit our sample to the firms in the 'environmentally-sensitive' industries. Following the previous studies (e.g., Cho and Patten, 2007; Freedman and Patten, 2004; Michelon et al., 2015), the environmentally-sensitive industries include *mining*, *oil and gas extraction*, *utilities*, *petroleum refining*, *chemical*, *paper*, and *metals*. As explained in Section 4, these firms contribute to a large portion of the total carbon dioxide ($CO_2$) emissions. As shown in the literature, a firm tends to be scrutinized more heavily by socially-conscious customers based

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[4] These scores were known as ASSET4 ESG ratings until Thomson Reuters' acquisition in 2009.

on the CSR dimension most relevant to its industry (Sharfman, 1996; Capelle-Blancard and Petit, 2017). Our sample selection approach is consistent with such notion.

The present article contributes to the existing body of literature on CSR peer effect in multiple ways. First, our study extends existing research by examining whether CSR peer effect can be amplified by strong presence of stakeholders. Our empirical analysis reveals that an environmentally-sensitive firm exposed to a high volume of Google search by consumers has more incentive to catch up with its peers in reducing overall emission levels. The same conclusion can be drawn on a firm under pressure to find eco-friendly uses of materials. In contrast, the web search frequency representing investor interest does not have a similar impact on a firm's environment-related spending.

Second, to the best of our knowledge, this is the first study in the CSR literature to attempt to compare consumer interest and investor interest using Internet search frequency. Specifically, we use the search volume indexes obtained from Google Trends. There are in general two ways to look for a firm's information in a search engine, firm name and ticker symbol. It has been suggested that an Internet user typing the 'ticker symbol' of a specific firm is interested in collecting the firm's financial information (Da et al., 2011; Drake et al., 2012) while search volume based on 'firm name' would capture the interest by consumers looking for general information about the firm's activities, products, services, etc. (Aouadi and Marsat, 2018). In our study, the search volume indexes based on both a firm's name and ticker symbol are collected.

Third, our additional analysis indicates that the relation between the consumer interest and the peer effect on a firm's environmental performance is significantly weaker for high-leverage firms. This seems reasonable as higher debt generally means increased monitoring by capital markets, resulting in less managerial discretion. According to Minor (2015), investing in charitable

CSR (vs. operational CSR) is not necessarily beneficial for a firm due to managerial moral hazard. Moreover, if CSR investments are driven by herd behavior of managers at competing firms as described in Cao et al. (2019), additional CSR effort could potentially lead to overinvestment. Higher leverage can therefore discourage lagging environmentally-sensitive firms from spending aggressively on CSR, unless they are required to do so. The traditional theory states that leverage mitigates the agency costs of overinvestment (e.g., Jensen, 1986; Stulz, 1990; Harvey et al., 2004). Our finding provides an additional support for this notion, in conjunction with the CSR literature.

The remainder of this paper is organized as follows. Section 2 provides a review of the extant literature on CSR peer effect and stakeholder impact on a firm's CSR. Section 3 describes Google search volume indexes while Section 4 shows the rest of the data obtained for this study. Section 5 presents the preliminary test on the CSR peer effect, and Section 6 shows our main analysis on the relations between the CSR peer effect and stakeholder interest. Section 7 concludes this study.

## 2. CSR Peer Effect and Stakeholders

### 2.1. Peer effect on corporate decisions

The literature shows empirical evidence of peer effect on various corporate investment decisions. For example, Foucault and Fresard (2014) report that a firm makes capital expenditures decisions based on the market valuation of its peers as it contains information about the future demand and growth opportunities in its industry. Similarly, Leary and Roberts (2014) analyze mimicking behavior of corporations, and show that a firm's capital structure decision is significantly influenced by peer firm equity shocks. Peer firms play a central role in a firm's CSR decisions.

Despite the voluminous literature on peer effect on various corporate decisions, there is relatively limited research focused on peer effect on CSR. Among a few studies are Bouwman (2011) reporting that a firm's governance practices can be driven by the network among common directors and Cao et al. (2019) describing managers' herd behavior possibly affecting the CSR strategies of competing firms. Research also indicates that a firm's CSR decisions are influenced by its CSR level relative to its peers. Liu and Wu (2016) suggest that, when a firm's direct competitors exhibit a higher CSR standard, the firm is likely to increase the level of its CSR activities in order to remain competitive. This paper extends their work by examining whether a firm's relative CSR position within its peer group is also associated with strong presence of stakeholders.

## 2.2. Stakeholder impact on CSR

Barnett (2007) and Barnett and Salomon (2012) argue that the effectiveness of CSR depends on a firm's ability to identify and profit from opportunities to improve its stakeholder relationships. Nevertheless, the exact mechanism of how a firm's stakeholders impact the peer effect on CSR has not received much attention in literature. This certainly motivates us to investigate the CSR peer effect from the perspectives of different stakeholders, namely consumers, investors, and managers.

## 2.2.1. Consumers and CSR

In recent years, the social and political climate in the U.S. has become increasingly more sensitive to environmental concerns, causing especially environmentally-sensitive firms to increase their efforts to reduce pollution. This phenomenon has been more prominent in recent years as social media has become ubiquitous among consumers. This also provides more

opportunity for firms to signal product quality. Examining the value of CSR expenditures, Fisman et al. (2008) show that CSR is beneficial particularly in highly competitive markets because CSR serves as a signal of product quality while not all the attributes of product quality are necessarily observable.

The primary means of signaling to consumers are advertising and news coverage. McWilliams and Siegel (2000) show that CSR-related advertising increases consumer awareness of CSR.[5] Following this notion, Servaes and Tamayo (2013) report that the benefit of CSR on a firm's value is positively related to consumer awareness measured by advertising expenditures, but the relation is only found for firms with reputation as good corporate citizens. Similarly, Gong et al. (2019) show that a firm's effort on brand value and customer communication policy have significantly positive effect on its sustainability capacity. These studies indicate that improving customer relations is crucial for the effectiveness of CSR. Nevertheless, advertising expenditures are controlled by firms while news is released by media organizations. Neither of them directly represents cognitive actions of or "information demand" (Drake et al., 2012) by the consumers interested in a specific firm. Our study introduces to the CSR literature an alternative way of measuring consumer awareness. It is discussed in Section 3.

### 2.2.2. Investors and CSR

Maximizing shareholder value is one crucial goal for a corporation. The vast majority of the existing empirical studies on the relation between a firm's CSR and financial performance examine a firm's own financial motives as the determinants of its CSR effort (Godfrey et al., 2009; Hong et al., 2012; Jo and Harjoto, 2012; Guiso et al., 2015; Ding et al., 2016 among others).

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[5] McWilliams and Siegel (2000) also suggest that the relation between a firm's CSR and financial performance is also correlated with R&D expenditures.

Nevertheless, the results in literature are rather mixed. This could be a result of information asymmetry between a firm and investors related to CSR investments (Luo et al., 2015). Another explanation for this is that investors evaluating a firm potentially create 'clientele effect' based on its relative level on CSR. Ding et al. (2016) document that a firm with an above-average, but not necessarily strongest, CSR profile relative to its peers most benefits from with the boosted firm value. A similar analysis by Awaysheh et al. (2020) compares best-in-class and worst-in-class firms, and conclude that best-in-class firms outperform their industry peers in terms of operating performance.

### 2.2.3. Management and CSR

The third type of stakeholder commonly studied in literature is management. It is crucial that a firm's management shows strong commitment on CSR and systematically discloses information to all other stakeholders. For example, Godfrey et al. (2009) shows that the CSR activities targeting a firm's secondary stakeholders provides an insurance-like benefit for legal or regulatory actions against firms. Likewise, Minor (2015) shows that firms with higher operational (vs. charitable) CSR investments save firm value when facing an adverse firm event. Our study examines the level of CSR disclosure by a firm as a proxy of management commitment. Previous research finds a relation between the degree of CSR disclosure and CSR performance (e.g. Al-Tuwaijri et al., 2004; Cho and Patten, 2007; Clarkson et al., 2008) although the sign of the association is mixed in literature.

## 3. Web Search Frequency and Stakeholder Interest

*3.1. Interpretations of Google search volumes*

Since a seminal paper by Da et al. (2011) introduced the use of the Internet search frequency to measure investor attention, a number of studies utilize the data from a search engine, such as Google (e.g., Drake et al., 2012; Aouadi and Marsat, 2018; Cziraki et al. , 2021).[6] There are generally two approaches to look for a firm's information in a search engine: 1) to type a firm's name and 2) to search for a firm's ticker symbol. Da et al., (2011) suggests that Google search frequency based on a ticker symbol represents investor interest, instead of consumer interest. Their study also indicates that web searches for ticker symbols capture investor attention in a more direct and timely fashion than existing proxies, such as news coverage or advertising expense.[7] Likewise, Drake et al. (2012) find that Google search for a ticker, instead of a company's name, indicates investors' demand for a firm's public information during a period surrounding the firm's earnings announcement. On the other hand, Aouadi and Marsat (2018) examine Google search on a firm's full name to analyze the visibility of a firm with high CSR controversies.

Based on the previous research, we postulate that an Internet user searching for the ticker symbol of a specific firm is interested in the firm's financial information, hence investors. Conversely, those looking for more general information about a firm's activities, products, or services would type a firm's name instead of its ticker. They therefore represent consumers or customers in general. If the name of any company is a combination of multiple English words, these words are included in double quotes (e.g., "Continental Resources"). When collecting the web search volumes on ticker symbols, we exclude the firms that fall under at least one of the

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[6] There are even earlier studies utilizing web search volumes. For example, Dahlsrud (2008) uses the search frequency counts for particular phrases to examine CSR definitions from five different perspectives.
[7] Servaes & Tamayo (2013) show that advertising expenditure improves consumer awareness.

following categories: 1) its ticker consists of only one or two letters, 2) its ticker is spelled like a commonly used English abbreviation (e.g., "IMO", "GRA"), and 3) its ticker is spelled like the abbreviation of a different well-known organization(s) (e.g., "CMS", "CRS"). Internet searches for these texts are very unlikely to be intended to look for the firms of interest.

*3.2. Search volume indexes*

We collect the Google search volume indexes (GSVIs) for firms from the Google Trends site as a proxy for consumer interest as well as investor interest. The GSVI is in the form of integers between 0 and 100, and indicates the relative popularity of a certain term over a specific period.[8] Google Trends limits the number of terms per query to five, which means that the GSVIs obtained through one query are not directly comparable to those in another query. To overcome this problem, we include ConocoPhillips as a 'benchmark firm' in every query, making the other firms' search volumes relative to the benchmark.[9] The daily GSVIs of each group of firms over the entire sample period are collected through a web-scraping program in Python.

$$\text{Standardized GSVI}_{i,g,t} = \frac{\text{GSVI}_{i,g,t}}{\text{GSVI}_{Bench,g,t}} \tag{1}$$

$\text{GSVI}_{i,g,t}$ is the GSVI of firm $i$ in group $g$ at time $t$ while $\text{GSVI}_{Bench,g,t}$ represents the GSVI associated specifically with the benchmark firm. Once the daily search volume indexes are obtained, the index for firm $i$ will be "standardized" relative to the benchmark in group $g$ in time period $t$. In each group, the ConocoPhillips's index is standardized to 1 while every other stock's GSVI is considered in proportion to the benchmark. Lastly, the yearly averages of the standardized GSVI is calculated for each firm-year.

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[8] See Stephens-Davidowitz and Varian (2014) for more details.
[9] Each group consists of 4 firms + the benchmark firm.

## 4. Data and Empirical Hypotheses

*4.1. Environmentally-sensitive industries*

The vast majority of the greenhouse gas (GHG) emissions are $CO_2$ emissions. According to Climate Watch, 85.97% of the total GHG emissions in the U.S. during 2018 can be attributed to $CO_2$ (Climate Watch, 2021).[10] The same report shows that the sectors related to electricity and heat production contribute to 42.22% of the $CO_2$ emissions in the U.S. during the same year.[11] In addition, manufacturing and construction sectors are responsible for 9.21% of the CO2 emissions. The report also indicates that 35.38% of the $CO_2$ emissions in the U.S. in 2018 is attributable to transportation; however, a large portion of this number is associated with passenger travels (e.g., cars, motorcycles). It is not surprising that these carbon polluting firms are overall consistent to the 'environmentally-sensitive' firms described in Section 1. In terms of the classifications by the North American Industry Classification System (NAICS), the environmentally-sensitive firms are associated with the industries, including *mining & extraction* (NAIC 21xx), *utilities* (NAIC 22xx), *paper* (NAIC 322x), *petroleum* (NAIC 324x), *chemical* (NAIC 325x), and *metals* (NAIC 331x).

*4.2. Peer groups*

Firms follow their direct competitors, not necessarily the firms within the same sector or industry, year to year. This study is distinguished from the previous work as we determine the relative position of each firm within its peer group in terms of the CSR performance. For this purpose, we obtain the similarity score for every pair of firms from the Hoberg-Phillips Data Library, and form a peer group for each firm. Each of the peer groups is then divided into three subgroups based on its CSR performance in the previous year.

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[10] Nitrous oxide ($HC_4$), methane ($NO_2$), and F-gases account for 9.8%, 4.6%, and 4.5%, respectively.
[11] This is separated from 11.05% attributed to energy-related emissions from residential and commercial buildings.

The pairwise similarity score captures the degree of product market overlap between two firms, and it is therefore indicates a firm's competition more directly than the conventional industry classification (e.g., SIC, NAICS). For example, the peer group of Firm A is not necessarily the same as that of Firm B, even if they are in the same SIC-defined industry. According to Hoberg et al. (2010), the size of each peer group based on text-based analyses of 10-K product descriptions is on average the same as the industry based on 3-digit SIC code.[12] The pairwise similarity ranges from 0 to 1.

*4.3. Measures of CSR performance and stakeholder presence*

To measure a firm's CSR performance, our study utilizes the Thomson Reuters ESG Scores from its DataStream system (TR ESG Scores). The TR ESG Scores cover more than 400 different firm-level metrics of public companies worldwide, and are classified into three major categories and a total of 10 subcategories within them: Environmental (*Emissions*, *Resource Use*, and *Environmental Product Innovation*), Social (*Workforce*, *Human Rights*, *Community*, and *Product Responsibility*) and Corporate Governance (*Management*, *Shareholders*, and *CSR Strategy*).[13] A score, which ranges from 0 to 100, is assigned to a firm under each of the subcategories to indicate the level of the firm's CSR performance. Scores are published annually.

As stated in Section 1, we focus on three environment-related dimensions of the TR ESG Scores (Emission, Resource Use, and Environmental Innovation). For example, the Emissions category pertains to a firm's effort and effectiveness in the reduction in carbon dioxide ($CO_2$) emissions. In order to avoid any statistical bias, we only include the firms that have TR ESG Scores available for the entire sample period. The sample period of this study is set to be between 2010

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[12] See Hoberg and Phillips (2010) and Hoberg and Phillips (2016) for details.
[13] Table A.1 provides the description of each of the subcategories.

and 2017. The first year of the period is 2010 because we do not have a sufficient number of environmentally-sensitive firms with TR ESG Scores reported prior. The end year of the sample period is dictated by the availability of the Hoberg-Phillips similarity scores. Our final sample includes 92 environmentally-sensitive U.S. firms.

The financial statement data of U.S. firms come from the Compustat North America. As an alternative measure of consumer awareness of a firm, advertising intensity is calculated for each firm-year based on the data obtained from financial statements. We also calculate its Tobin's q as a proxy for shareholder expectations of a firm's long-term value. The level of management commitment is measured by the ESG Disclosure Scores from Bloomberg's ESG Data Service, which indicate a firm's level of CSR disclosure rather than performance. The scores cover a wide range of areas from total $CO_2$ emissions to human right policy, and is determined based on each firm's disclosure of quantitative data as well as policy-related information in annual reports, CSR reports in corporate websites, and the Bloomberg survey. To our knowledge, Bloomberg's ESG Disclosure Scores have not been adopted in many empirical studies in literature.[14]

Panel A of Table 1 presents a sector/industry averages of the TR ESG Scores in three environment-related categories (Emission, Resource Use, and Environmental Product Innovation) during our sample period. Panel B of the table shows the variables of interest: GSVIs based on firm names (consumer interest), GSVIs based on ticker symbols (investor interest), advertising intensity (consumer awareness), and Bloomberg Disclosure Scores (management commitment). Note that the GSVIs are raw values (i.e., not standardized) in this table. Each of these represents the degree of stakeholder presence and is examined in more detail in Section 6.

[Insert Table 1 around here]

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[14] A few exceptions include Giannarakis et al. (2014) and Nollet et al. (2016).

Following Cao et al. (2019), our study includes several control variables to capture the effect of the preexisting differences among firms.[15] One of them is a firm's size approximated by its total assets. In general, large firms have more incentive to maintain CSR initiatives due to higher public expectations (Godfrey et al., 2008; Green and Peloza, 2014; Wickert et al., 2016). On the other hand, only 20% of the small or mid-sized companies allocate formal contribution budget for CSR to delegated departments (Burlingame and Frishkoff, 1996). Another control variable is a firm's leverage level, which is calculated as the firm's total liabilities divided by total assets. Our regression model also includes a firm's profitability approximated by its return on assets (ROA). Lastly, Tobin's q of each first is calculated as the market value of the firm divided by the replacement value of its assets. Tobin's q measures investors' long-term expectations on a firm's future cash flows, and is a commonly used measure in the economics, finance, and management literature (e.g., Morck et al., 1988; Servaes & Tamayo, 2013). It is also known to reflect the market adjustment to a firm's value with respect to its CSR effect (Ding et al., 2016). Panel C of Table 1 presents the summary statistics of firm characteristics during the sample period.

*4.4. Hypotheses*

The primary objective of this article is to investigate the relation between a firm's CSR level relative to its peers and the degree of stakeholder interest. Specifically, we hypothesize that the peer pressure on an environmentally-sensitive firm's CSR effort can be intensified by strong consumer interest or investor interest. The following testable hypotheses are examined.

*Hypothesis 1* (consumer interest): An environmentally-sensitive firm that lags behind its peers on environment-related effort and is exposed to higher web search volumes by

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[15] The study by Cao et al. (2019) includes the market-to-book ratio instead of Tobin's q.

consumers tends to increase its CSR investments at a faster pace than a similar firm with lower web search volumes.

*Hypothesis 2* (investor interest): An environmentally-sensitive firm that lags behind its peers on environment-related effort and is exposed to higher web search volumes by investors tends to increase its CSR investments at a faster pace than a similar firm with lower web search volumes.

Another type of stakeholder commonly studied in the CSR literature is management. Unfortunately, obtaining and analyzing web search volumes by managers is not easy or meaningful for the purpose of our research. As stated earlier, we instead examine a firm's level of CSR disclosure as a proxy of management commitment. The following hypothesis is tested.

*Hypothesis 3* (management commitment): An environmentally-sensitive firm that lags behind its peers on environment-related effort tends to increase its CSR investments at a faster pace when the firm demonstrates a higher level of CSR disclosure through its annual reports, corporate website, etc.

## 5. Peer Effect on Corporate Environmental Initiatives

We use the panel data regression analysis to examine whether the peer standard on CSR affects a firm's CSR investments. In this and subsequent sections, a firm's peer group is divided into three equal parts based on its CSR performance in order to classify the firm to be 1) lagging behind, 2) following, or 3) leading its peers. For example, if a firm is within the bottom one thirds (1/3) of its peer group in terms of the corporate effort in a certain environment-related category (e.g., Emission), it is considered to be a 'lagging' firm in the field. We estimate the regression models using the following equation.

$$\Delta \text{ESG}_{i,t} = \beta_0 + \beta_1 \text{D\_ESG}_{i,t-1} + \beta_2 \ln(\text{Size})_{i,t-1} + \beta_3 \text{Leverage}_{i,t-1} + \beta_4 \text{Profit}_{i,t-1}$$

$$+ \beta_5 Q_{i,t-1} + \Lambda + \varepsilon_{i,t} \tag{2}$$

$\Delta \text{ESG}_{i,t}$ is the year-to-year change in the TR ESG Scores of firm $i$ in one of the environmental categories (Emission, Resource Use, and Environmental Innovation) observed in year $t$. $\text{D\_ESG}_{i,t-1}$ is equal to '1' if firm $i$ is classified as a lagging firm in year $t-1$.

As described in Section 4, each of our regression models includes several control variables. $\ln(\text{Size})_{i,t-1}$ is the natural logarithm of the total assets of firm $i$ in year $t-1$. $\text{Leverage}_{i,t-1}$ is the book leverage of firm $i$ in year $t-1$. $\text{Profit}_{i,t-1}$ is the return on assets of firm $i$ in year $t-1$. $Q_{i,t-1}$ indicates Tobin's q of firm $i$ in year $t-1$. $\Lambda$ includes firm and year fixed effects. Firm fixed effects are included to control for unobserved heterogeneity in time-invariant firm characteristics.[16] Year fixed effects are included to mitigate the effect of exogenous factors, such as legislative changes, that could affect all firms in the same industry. Table 2 shows how a firm's relative position within its peer group on corporate environmental performance influences its CSR investment.

[Insert Table 2 around here]

The *Low ESG dummy* variable indicates whether a firm is lagging behind its peers on the respective category. For example, the second column of the table shows that the Emissions score for a lagging firm in the environmentally-sensitive sectors is on average 10.399 higher in the subsequent year than the score for a non-lagging counterpart. To get a sense of the magnitude, this is roughly equivalent to 85.3% of one standard deviation movement in the Emissions scores.[17] This result is well expected because a firm that belongs to these particular industries and is lagging behind its peers on emission-reducing initiatives must be under pressure to keep up.

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[16] We have also used industry fixed effects, which did not alter our main finding.
[17] The within standard deviation of the year-to-year changes in the Emissions scores in our sample is 12.195.

The CSR peer effect on these firms are equally significant with respect to the Resource Use (the third column) and the Environmental Innovation score (the fourth column). The coefficient estimate of *Low ESG dummy* is statistically significant at a 1% level with respect to all of the environment-related categories. On the other hand, none of the control variables is statistically significant when any of the environment-related categories is examined. The only exception is that the coefficient estimate, *Leverage*, is statistically significant at a 5% level with respect to the Emissions score.

## 6. Peer Effect and Stakeholder Presence

The preliminary analysis in Section 5 supports that there exists peer effect affecting firms in all of the three environment-related dimensions. While the result is consistent with the previous research (e.g., Liu and Wu, 2016; Cao et al., 2019), we are primarily interested in the relation between peer effect on a firm's CSR effort and strong presence of various stakeholders. In this section, we examine whether peer pressure on corporate environmental initiatives can be amplified when a firm is exposed to higher web search volumes by consumers or investors.

*6.1. Consumer interest vs. investor interest*

Section 3 of this paper explains that the GSVIs of each firm are obtained through a web-scraping program. To match the data frequency of a firm's annual ESG Scores, the yearly averages of the standardized GSVI is calculated for each firm-year. We estimate the regression model as following.

$$\Delta\text{ESG}_{i,t} = \beta_0 + \beta_1\text{D\_ESG}_{i,t-1} + \beta_2\text{GSVI}_{i,t-1} + \beta_3\left(\text{D\_ESG}_{i,t-1} \times \text{GSVI}_{i,t-1}\right)$$
$$+ \beta_4\ln(\text{Size})_{i,t-1} + \beta_5\text{Leverage}_{i,t-1} + \beta_6\text{Profit}_{i,t-1} + \beta_7Q_{i,t-1} + \Lambda + \varepsilon_{i,t}$$

(3)

$GSVI_{i,t-1}$ is a proxy for consumer interest for firm i. It is measured by the average of the firm's annual standardized GSVIs during year $t-1$, and its value ranges from 0 to 100. While $D\_ESG_{i,t-1}$ indicates the stand-alone effect of peer pressure for a lagging firm, $D\_ESG_{i,t-1} \times GSVI_{i,t-1}$ captures additional peer effect for a firm in proportion to consumer interest. The interaction term is necessary because, absent this, the model requires that the peer effect on a lagging firm's TR ESG Scores is the same regardless of the level of consumer attention. All other variables are the same as the ones included in Equation (2).

First, we follow Aouadi and Marsat (2018) to use the 'full name' of each firm in order to capture consumer interest (Hypothesis 1). Table 3 reports whether the peer effect on a firm's CSR level increases when a firm is exposed to strong consumer interest. Each of the panels pertains to a specific environment-related category of TR ESG Score: Emissions, Resource Use, and Environmental Innovation.

[Insert Table 3 around here]

The model (i) in Panel A shows that the increase in the Emissions score in the subsequent year is on average 7.703 higher for a lagging firm than the change in the score for a non-lagging counterpart (*Low ESG dummy*). While this is consistent with the result shown in the previous section, the primary purpose of this regression model is to examine whether such CSR peer effect actually increases with consumer interest. This is tested with the variable *Low ESG dummy × Google SVI (firm name)*, whose coefficient estimate is 3.906 with a significance level of 1%. If a lagging firm's standardized GSVIs is one standard deviation higher (= 3.430), the firm's Emissions score tends to improve by additional 13.399 in the subsequent year. This is equivalent to 55.2% of one standard deviation of the cross-firm variation of the Emissions scores (= 24.291). In contrast, the coefficient estimate of *Google SVI* is -0.161 and is statistically insignificant.

Comparing these two variables in the model (i) leads to an implication that the volume of Google search by consumers has significant impact on a lagging firm's emission-reducing effort while it does not affect a non-lagging firm. Likewise, the coefficient estimate of the same variable in the model (i) in Panel B is 2.733 with a significance level of 1%. This indicates that the Google search volume also affects a lagging firm's activities in eco-friendly uses of materials. It is clear that, at least in these two environment-related categories, there exist positive and strong relations between the CSR peer effect and a firm's exposure to consumer interest. On the other hand, the Google search volume seems to have little association with the peer effect on the Environment Innovation score (Panel C).

Next, we examine whether the same result still holds when we analyze the web search volumes representing investor interest (Hypothesis 2). As described in Section 3, we believe that the web search volume for the 'ticker symbol' of a firm is a direct and unambiguous measure of investor interest in the firm. The result is shown under the model (ii) in Panels A through C. The regression model (ii) in Panel A shows that the increase in the Emissions score in the subsequent year is on average 12.080 higher for a lagging firm than that for a non-lagging counterpart (*Low ESG dummy*). In contrast, the coefficient estimate of the *Low ESG dummy × Google SVI (ticker symbol)* in the same model is statistically insignificant. The table shows similar results in Panel B (Resource Use) and Panel C (Environmental Innovation). Overall, the volumes of web search by investors interested in a firm's financial information does not seem to strengthen the peer effect in any of the environmental categories.

In summary, an environmentally-sensitive firm exposed to a high volume of Google search by consumers has strong incentive to catch up with its peers on emission-reducing initiatives. A similar implication can be drawn on a firm under pressure to find eco-friendly solutions for the use

of materials. In contrast, the volume of web search by investors has virtually no impact on the firm's spending in these categories. We conclude that the peer effect on corporate environmental initiatives increases with the strong presence of consumers interested in a firm's general information, but not investors looking specifically for the firm's financial information.

## 6.2. Other measures of stakeholder awareness

For comparison purpose, we also examine a few alternative measures believed to indicate stakeholder interest or awareness. Three different measures of stakeholder awareness are examined in this subsection. These are 1) a firm's advertising effort, 2) the level of management's commitment to CSR disclosure, and 3) a firm's relative market share.

### 6.2.1. Advertising effort

Advertising intensity is often used as a measure of customer awareness of a firm (e.g., McWilliams and Siegel, 2000; Servaes and Tamayo, 2013). It is calculated as the firm's advertising expenditures divided by total sales. We estimate the following panel data regression model.

$$\Delta \text{ESG}_{i,t} = \beta_0 + \beta_1 \text{D\_ESG}_{i,t-1} + \beta_2 \text{Advertise}_{i,t-1} + \beta_3 \left( \text{D\_ESG}_{i,t-1} \times \text{Advertise}_{i,t-1} \right)$$
$$+ \beta_4 \text{Size}_{i,t-1} + \beta_5 \text{Leverage}_{i,t-1} + \beta_6 \text{Profit}_{i,t-1} + \beta_7 \text{Q}_{i,t-1} + \Lambda + \varepsilon_{i,t} \tag{4}$$

$\text{Advertise}_{i,t-1}$ indicates firm i's advertising intensity in terms of percentage point in year $t - 1$. While $\text{D\_ESG}_{i,t-1}$ indicates the stand-alone effect of peer pressure for a lagging firm, $\text{D\_ESG}_{i,t-1} \times \text{Advertise}_{i,t-1}$ captures additional peer effect for a firm based on its advertising expenditures. All other variables are the same as the ones in Equations (2) and (3).

Table 4 reports whether a firm's relative position in its peer group on environmental initiatives influences its CSR investments when combined with strong indication of stakeholder

awareness. Each of the models (i) – (iii) pertains to a specific measure of stakeholder awareness. Based on the result in Subsection 6.1, this table only presents the analysis on the Emissions and the Resource Use categories.[18]

[Insert Table 4 around here]

As shown in the model (i) in Panel A, the coefficient estimate of the *Low ESG dummy ×*
*Advertising Intensity* is 6.587 with a significance level of 1% while *Advertising Intensity*
standalone is not a statistically significant variable. This implies that a firm with relatively high advertising expenditures and lagging behind its peers in emission-reducing effort tends to have strong incentive to catch up with them. However, this result must be taken with a grain of salt. Firms often choose not to disclose their advertising expenses in their filings if the amount is immaterial. We follow the previous work (e.g., Hale and Santos, 2009; Servaes & Tamayo, 2013) and set a firm's advertising intensity equal to '0' if advertising expenses are not reported in its financial statement. We are aware that this could result in some statistical bias.[19] In Panel B, a firm's advertising effort does not seem to be associated with peer pressure in finding eco-friendly uses of materials.

### 6.2.2. Management's commitment to CSR disclosure

As stated in Section 4, an analysis regarding management commitment is also conducted (Hypothesis 3). The degree of management commitment to CSR disclosure is measured with Bloomberg's ESG Disclosure Score, which ranges from full disclosure with a score of 100 to no disclosure with a score of 0. We estimate the following regression model.

$$
\begin{aligned}
\Delta \mathrm{ESG}_{i,t} = {} & \beta_0 + \beta_1 \mathrm{D\_ESG}_{i,t-1} + \beta_2 \mathrm{Disclosure}_{i,t-1} + \beta_3 \left( \mathrm{D\_ESG}_{i,t-1} \times \mathrm{Disclosure}_{i,t-1} \right) \\
& + \beta_4 \ln(\mathrm{Size})_{i,t-1} + \beta_5 \mathrm{Leverage}_{i,t-1} + \beta_6 \mathrm{Profit}_{i,t-1} + \beta_7 Q_{i,t-1} + \Lambda + \varepsilon_{i,t}
\end{aligned}
$$

(5)

---

[18] The result on the other category is available upon request.
[19] A significant portion of the firms in our sample have 0 advertising intensity.

Disclosure$_{i,t-1}$ is the Bloomberg ESG Disclosure Score of firm $i$ in year $t - 1$. While D_ESG$_{i,t-1}$ indicates the standalone effect of peer pressure for a lagging firm, D_ESG$_{i,t-1}$ × Disclosure$_{i,t-1}$ captures additional peer effect for the firm. All other variables are the same as the ones in Equations (2) - (4).

Table 4 also reports whether the level of management's commitment to CSR disclosure affects CSR peer effect. As shown in the model (ii) in both Panels A and B, however, the coefficient estimate of *Low ESG dummy × Disclosure* is both economically and statistically insignificant. This suggests that the degree of a firm's CSR disclosure is unrelated with the peer pressure for reducing emissions or eco-friendly solutions of using materials.

### 6.2.3. Relative market share

Lastly, another criterion to determine whether a firm is an industry leader or follower is examined. Specifically, we determine whether a firm leading or following its peers in terms of the market share. Following Cao et al. (2019), a firm is classified as a market follower if its gross sales is within the bottom one thirds (1/3) of its peer group during the previous year. We use the following model.

$$\Delta \text{ESG}_{i,t} = \beta_0 + \beta_1 \text{D\_ESG}_{i,t-1} + \beta_2 \text{D\_Share}_{i,t-1} + \beta_3 \left( \text{D\_ESG}_{i,t-1} \times \text{D\_Share}_{i,t-1} \right)$$
$$+ \beta_4 \text{Size}_{i,t-1} + \beta_5 \text{Leverage}_{i,t-1} + \beta_6 \text{Profit}_{i,t-1} + \beta_7 Q_{i,t-1} + \Lambda + \varepsilon_{i,t} \tag{6}$$

D_Share$_{i,t-1}$ is equal to '1' if the gross sales of firm $i$ is within the bottom 1/3 of its peer group in year $t - 1$. While D_ESG$_{i,t-1}$ indicates the stand-alone effect of peer pressure for a lagging firm, D_ESG$_{i,t-1}$ × D_Share$_{i,t-1}$ captures additional peer effect for a firm that is a market follower. All other variables are the same as the ones in Equations (2) - (5). As shown in the model (iii) in both

Panels A and B, a firm's relative market share does not seem to affect the peer effect in the CSR categories of interest.

## 6.3. High-leverage vs. low-leverage firms

All the regression models shown in Subsections 6.1 and 6.2 include firm size, leverage level, return on assets, and Tobin's q as control variables to capture the effect of the preexisting differences among firms. Among these variables, a firm's leverage ratio is negatively and significantly associated with the year-to-year change in its Emissions and Resource Use scores. This leads to an additional hypothesis as following:

**Hypothesis 4** (leverage level): A high degree of consumer interest amplifies the peer effect

on a lagging firm's environmental initiatives, regardless of the firm's leverage level.

[Insert Table 5 around here]

The result of our empirical analysis is reported in Table 5. The regression models (i) and (ii) are both based on Equation (3). These models are identical, except that (i) pertains to the firms that are within the bottom half of their respective peer groups in terms of the leverage levels during the sample period while (ii) is associated with the other half of the firms. As indicated in the table, the impact of consumer interest on peer effect on corporate environmental initiatives depends on a firm's leverage level. For example, the model (i) of Panel A shows that the coefficient estimate of *Low ESG dummy × Google SVI (firm name)* is 9.763 with a 1% significance level. The same variable in the model (ii) has significantly less impact on CSR peer effect, both economically and statistically. Comparing these models, it is implied that the peer effect on emission-reducing initiatives is amplified by consumer interest more strongly for lower-leverage firms. Panel B shows a similar result in terms of the peer effect on finding eco-friendly use of materials although the difference between high-leverage and low-leverage firms is less notable.

Our final analysis confirms that the relation between the consumer interest and the CSR peer effect is significantly weaker for high-leverage firms. The most plausible explanation for this is that higher leverage could discourage lagging firms from spending on CSR aggressively to catch up with their peers, unless they are required to do so by regulations. Our finding is consistent with the notion that leverage mitigates the agency problem of overinvestment.

## 7. Conclusions

Peer firms' performance in the industry-relevant areas of corporate social responsibility is among the issues of utmost importance today for not only corporate managers but also the general public. The present article shows that the peer effect on a firm's CSR performance can be strengthened when there is a sign of strong consumer interest. Specifically, an environmentally-sensitive firm exposed to a high volume of Google search by consumers has stronger incentive to catch up with its peers on emission-reducing initiatives as well as finding eco-friendly uses of materials. In contrast, a firm's exposure to investor interest has little effect on CSR peer effect. Our additional analysis further reveals that the relation between the consumer interest and the peer effect on environmental effort is significantly weaker for the firms with relatively high leverage. Although regulations in environmentally-sensitive industries are likely to limit management discretion to some degree, higher leverage still has a conflict-mitigating role that prevents a lagging firm from spending aggressively on CSR. Such explanation echoes the traditional theory that leverage mitigates the agency problem of overinvestment.

Our study relates to two, often disjoint, strands of literature: peer effect on a firm's CSR and stakeholder impact on CSR. Although interesting implications can be drawn from our findings, it is not free from external validity problems. For example, our study analyzes environmentally-sensitive firms' effort in a few CSR areas, such as reducing emissions. Although limiting the scope

of the paper helps conduct a focused analysis, further research could expand the sample to include other sectors and present a comprehensive study involving all the CSR dimensions (e.g., financial institutions on data privacy issues). Moreover, our study presents a regression analysis with ESG scores with an annual frequency while Google search volume indexes are available on a daily basis. We are aware that this is potentially subject to temporal aggregation bias. Unfortunately, scores on corporate social performance with a higher frequency are not known to be readily available today. Finally, our study finds virtually no evidence to indicate any relation between the CSR peer effect and a firm's level of CSR disclosure. We believe that analyzing alternative measures of management commitment is a promising venue for future research.

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# TABLE 1: Summary Statistics

The table presents the summary statistics for the period between 2010 and 2017. The sample includes the U.S. firms in the environmentally-sensitive industries: *mining & extraction* (NAIC 21xx), *utilities* (NAIC 22xx), *paper* (NAIC 322x), *petroleum* (NAIC 324x), *chemical* (NAIC 325x), and *metals* (NAIC 331x). Panel A shows the sector/industry averages of TR ESG Scores in three environment-related categories (Emission, Resource Use, and Environmental Innovation). Panel B presents the measures of stakeholder interest used in this study. *Google search volume index* is each firm's yearly average of the (non-standardized) search volume indexes based on firm names as well as ticker symbols. *Advertising intensity* is defined as advertising expenditures divided by sales. *ESG disclosure* is Bloomberg's ESG Disclosure Scores. Panel C presents the summary of control variables. *Total assets* is a firm's total assets in millions of dollars. *Leverage* equals a firm's total debt divided by total assets. *Profitability* is a firm's net income divided by total assets. *Tobin's q* is the ratio of firm i's total debt plus market capitalization to the book value of assets in year $t - 1$.

*Panel A: Industry averages of environment-related ESG scores*

| Sector/industry (NAICS code) | # of firms | Emissions | Resource Use | Environmental Innovation |
|---|---|---|---|---|
| Mining, quarrying, and extraction | 33 | 51.39 | 54.27 | 46.69 |
| Utilities | 29 | 64.00 | 54.89 | 50.06 |
| Chemical & Paper | 19 | 58.83 | 57.37 | 44.34 |
| Petroleum & Coal | 5 | 77.51 | 60.98 | 73.47 |
| Metal | 6 | 48.08 | 47.69 | 49.84 |

Number of firm-years = 736

*Panel B: Stakeholder interest*

| Variables | Min | Max | Mean | St. deviation (cross-firm) |
|---|---|---|---|---|
| Google search volume index | | | | |
| Based on firm name (consumers) | 0.100 | 74.773 | 12.179 | 12.541 |
| Based on ticker symbol (investors) | 0.100 | 90.236 | 9.769 | 20.843 |
| Advertising intensity (consumers) | 0.000 | 0.275 | 0.005 | 0.028 |
| ESG Disclosure score (management) | 0.000 | 84.298 | 17.637 | 20.614 |

Number of firm-years = 736

*Panel B: Firm characteristics*

| Variables | Min | Max | Mean | St. deviation (cross-firm) |
|---|---|---|---|---|
| Total assets ($ in million) | 594 | 266.103 | 25,548 | 36,217 |
| Leverage | 0.000 | 1.151 | 0.271 | 0.110 |
| Profitability (ROA) | -0.748 | 1.024 | 0.033 | 0.066 |
| Tobin's q | 0.417 | 10.971 | 1.463 | 1.247 |

Number of firm-years = 736

**TABLE 2: Corporate Environmental Performance and Firm's Relative CSR Level**

The table reports the coefficient estimates with the corresponding test statistics in parentheses. The asterisks represent the significance level of 1% (***), 5% (**), and 10% (*). The dependent variable (DV) is the year-to-year change in firm i's average TR ESG Scores in one of the environment-related categories (*Emission*, *Resource Use*, and *Environmental Innovation*) observed in year t. *Low ESG dummy* is equal to '1' if firm i is classified as a lagging firm in year t – 1. *In(Size)* is the natural logarithm of firm i's total assets in year t – 1. *Leverage* equals firm i's total debt divided by total assets in year t – 1. *Profitability* is firm i's net income divided by total assets in year t – 1. *Tobin's q* is the ratio of firm i's total debt plus market capitalization to the book value of assets in year t – 1. Standard errors are clustered at the firm level.

| DV: Δ in ESG score | Emissions | Resource Use | Environmental Innovation |
|---|---|---|---|
| Low ESG dummy | 10.399 (5.94)*** | 12.929 (5.49)*** | 16.595 (4.38)*** |
| ln(Size) | 3.006 (1.22) | -2.628 (-1.12) | -1.531 (-0.64) |
| Leverage | -15.564 (-2.12)** | -12.632 (-1.71)* | -7.397 (-0.66) |
| Profitability (ROA) | -3.871 (-1.38) | 0.176 (0.06) | -1.024 (-0.24) |
| Tobin's q | 1.695 (2.48)** | 0.737 (1.28) | -0.794 (-0.67) |
| Firm fixed effects | Yes | Yes | Yes |
| Year fixed effects | Yes | Yes | Yes |
| R-squared | 0.132 | 0.166 | 0.127 |
| Number of firms | 92 | 92 | 92 |

## TABLE 3: Impact of Consumer/Investor Interest on CSR Peer Effect

The table reports the coefficient estimates with the corresponding test statistics in parentheses. The asterisks represent the significance level of 1% (***), 5% (**), and 10% (*). The dependent variable (DV) is the year-to-year change in firm i's TR ESG Scores in one of the environment-related categories (*Emission*, *Resource Use*, and *Environmental Innovation*) observed in year t. *Low ESG dummy* is equal to '1' if firm i is classified as a lagging firm in year t – 1. *Google SVI (firm name)* is the standardized Google search volume index on firm i's name in year t – 1 as a proxy of 'consumer' interest in the firm's general information. *Google SVI (ticker symbol)* is the standardized Google search volume index on firm i's ticker symbol in year t – 1 as a proxy of 'investor' interest in the firm's financial information. *ln(Size)* is the natural logarithm of firm i's total assets in year t – 1. *Leverage* equals firm i's total debt divided by total assets in year t – 1. *Profitability* is firm i's net income divided by total assets in year t – 1. *Tobin's q* is the ratio of firm i's total debt plus market capitalization to the book value of assets in year t – 1. Standard errors are clustered at the firm level.

*Panel A: Impact on emission-reducing effort*

| DV: Δ in 'Emissions' score | (i)<br>Consumer interest | (ii)<br>Investor interest |
|---|---|---|
| Low ESG dummy | 7.703 (3.96)*** | 12.080 (5.31)*** |
| Google SVI (firm name) | -0.161 (-1.31) | |
| Low ESG dummy × Google SVI (firm name) | 3.906 (2.70)*** | |
| Google SVI (ticker symbol) | | -3.662 (-0.25) |
| Low ESG dummy × Google SVI (ticker symbol) | | -1.757 (-0.10) |
| ln(Size) | 3.053 (1.49) | 2.737 (1.08) |
| Leverage | -16.052 (-2.23)** | -21.835 (-3.27)*** |
| Profitability (ROA) | -3.596 (-1.29) | -4.264 (-1.46) |
| Tobin's q | 1.498 (2.29)** | 1.674 (2.41)** |
| Firm fixed effects | Yes | Yes |
| Year fixed effects | Yes | Yes |
| R-squared | 0.147 | 0.170 |
| Number of firms | 92 | 72 |

*Panel B: Impact on finding eco-friendly materials*

| DV: Δ in 'Resource Use' score | (i)<br>Consumer interest | (ii)<br>Investor interest |
|---|---|---|
| Low ESG dummy | 11.099 (4.59)*** | 12.245 (4.07)*** |
| Google SVI (firm name) | -0.123 (-0.67) | |
| Low ESG dummy × Google SVI (firm name) | 2.733 (2.56)** | |
| Google SVI (ticker symbol) | | -4.391 (-0.70) |
| Low ESG dummy × Google SVI (ticker symbol) | | 22.837 (1.49) |
| ln(Size) | -2.359 (-1.01) | -6.047 (-2.10)** |
| Leverage | -12.548 (-1.71)* | -22.483 (-2.76)*** |
| Profitability (ROA) | 0.194 (0.06) | 1.976 (0.77) |
| Tobin's q | 0.722 (1.28) | 0.641 (1.23) |
| Firm fixed effects | Yes | Yes |
| Year fixed effects | Yes | Yes |
| R-squared | 0.180 | 0.212 |
| Number of firms | 92 | 72 |

**TABLE 3 (cont.)**

*Panel C: Impact on environmental product innovation*

| DV: Δ in 'Environmental Innovation' score | (i) Consumer interest | (ii) Investor interest |
|---|---|---|
| Low ESG dummy | 16.716 (3.85)*** | 17.880 (3.55)*** |
| Google SVI (firm name) | -0.166 (-1.01) | |
| Low ESG dummy × Google SVI (firm name) | -0.046 (-0.08) | |
| Google SVI (ticker symbol) | | -3.775 (-0.15) |
| Low ESG dummy × Google SVI (ticker symbol) | | 7.890 (0.37) |
| ln(Size) | -1.447 (-0.60) | -1.827 (-0.59) |
| Leverage | -7.386 (-0.66) | 2.228 (0.21) |
| Profitability (ROA) | -0.984 (-0.23) | 1.393 (0.35) |
| Tobin's q | -0.785 (-0.67) | -0.615 (-0.51)** |
| Firm fixed effects | Yes | Yes |
| Year fixed effects | Yes | Yes |
| R-squared | 0.128 | 0.158 |
| Number of firms | 92 | 72 |

## TABLE 4: Peer Effect on Environmental Performance – Alternative Measures

The table reports the coefficient estimates with the corresponding test statistics in parentheses. The asterisks represent the significance level of 1% (***), 5% (**), and 10% (*). The dependent variable (DV) is the year-to-year change in firm i's TR ESG Scores in one of the environment-related categories (*Emissions* and *Resource Use*) observed in year t. *Low ESG dummy* is equal to '1' if firm i is classified as a lagging firm in year t – 1. *Advertising Intensity* is firm i's advertising expenditures divided by total sales. *Low Mkt. share dummy* is equal to '1' if firm i's market share measured by gross sales is within the bottom 1/3 of its peer group in year t – 1. *Disclosure* is firm i's level of CSR disclosure in year t – 1 measured by Bloomberg ESG Disclosure Scores. *ln(Size)* is the natural logarithm of firm i's total assets in year t – 1. *Leverage* equals firm i's total debt divided by total assets in year t – 1. *Profitability* is firm i's net income divided by total assets in year t – 1. *Tobin's q* is the ratio of firm i's total debt plus market capitalization to the book value of assets in year t – 1. Standard errors are clustered at the firm level.

*Panel A: Impact on emission-reducing effort*

| DV: Δ in 'Emissions' score | (i) Advertising effort | (ii) CSR disclosure | (iii) Market share |
|---|---|---|---|
| Low ESG dummy | 10.025 (5.75)*** | 9.561 (4.67)*** | 10.603 (3.84)*** |
| Advertising Intensity | 1.530 (1.34) | | |
| Low ESG dummy × Advertising Intensity | 6.587 (3.71)*** | | |
| Disclosure | | -0.010 (-0.11) | |
| Low ESG dummy × Disclosure | | 0.082 (0.86) | |
| Low Mkt. share dummy | | | 0.681 (0.28) |
| Low ESG dummy × Low Mkt. share dummy | | | -0.829 (-0.26) |
| ln(Size) | 2.800 (1.36) | 3.009 (1.45) | 2.987 (1.46)* |
| Leverage | -15.940 (-2.17)** | -15.428 (-2.10)*** | -15.695 (-2.11)** |
| Profitability (ROA) | -3.584 (-1.26) | -3.854 (-1.38) | -3.913 (-1.40) |
| Tobin's q | 1.255 (1.80)* | 1.700 (2.40)** | 1.720 (2.50)** |
| Firm fixed effects | Yes | Yes | Yes |
| Year fixed effects | Yes | Yes | Yes |
| R-squared | 0.134 | 0.134 | 0.132 |
| Number of firms | 92 | 92 | 92 |

*Panel B: Impact on finding eco-friendly materials*

| DV: Δ in 'Resource Use' score | (i) Advertising effort | (ii) CSR disclosure | (iii) Market share |
|---|---|---|---|
| Low ESG dummy | 12.928 (5.48)*** | 11.337 (4.63)*** | 12.403 (4.60)*** |
| Advertising Intensity | -1.003 (-1.60) | | |
| Low ESG dummy × Advertising Intensity | 2.091 (1.64) | | |
| Disclosure | | 0.101 (1.48) | |
| Low ESG dummy × Disclosure | | 0.193 (1.48) | |
| Low Mkt. share dummy | | | 3.941 (1.65) |
| Low ESG dummy × Low Mkt. share dummy | | | 0.163 (0.06) |
| ln(Size) | -2.650 (-1.13) | -2.766 (-1.17) | -1.914 (-0.84) |
| Leverage | -12.628 (-1.70)* | -12.907 (-1.75)* | -13.939 (-1.90)* |
| Profitability (ROA) | 0.182 (0.06) | -0.035 (0.01) | -0.069 (-0.02) |
| Tobin's q | 0.752 (1.31) | 0.822 (1.43) | 0.851 (1.38) |
| Firm fixed effects | Yes | Yes | Yes |
| Year fixed effects | Yes | Yes | Yes |
| R-squared | 0.166 | 0.184 | 0.176 |
| Number of firms | 92 | 92 | 92 |

**TABLE 5: Impact of Consumer Interest on CSR Peer Effect (Low-Leverage vs. High-Leverage Firms)**

The table reports the coefficient estimates with the corresponding test statistics in parentheses. The asterisks represent the significance level of 1% (***), 5% (**), and 10% (*). *Low-leverage firms* are within the bottom half of their respective peer groups in terms of the leverage level during the sample period while *High-leverage firms* are within the upper half of their peer groups. The dependent variable (DV) is the year-to-year change in firm i's TR ESG Score in one of the environment-related categories (*Emissions* and *Resource Use*) observed in year t. *Low ESG dummy* is equal to '1' if firm i is classified as a lagging firm in year t – 1. *Google SVI (firm name)* is the standardized Google search volume index on firm i's name in year t – 1 as a proxy of 'consumer' interest in the firm's general information. *In(Size)* is the natural logarithm of firm i's total assets in year t – 1. *Profitability* is firm i's net income divided by total assets in year t – 1. *Tobin's q* is the ratio of firm i's total debt plus market capitalization to the book value of assets in year t – 1. Standard errors are clustered at the firm level.

*Panel A: Impact on emission-reducing effort*

| DV: Δ in 'Emissions' score | (i)<br>Low-leverage firms | (ii)<br>High-leverage firms |
|---|---|---|
| Low ESG dummy | 2.688 (0.92) | 9.596 (4.08)*** |
| Google SVI (firm name) | -0.089 (-0.31) | -0.171 (-1.10) |
| Low ESG dummy × Google SVI (firm name) | 9.763 (2.75)*** | 2.819 (1.80)* |
| ln(Size) | 3.624 (1.12) | 5.428 (1.87)* |
| Profitability (ROA) | -10.108 (-1.38) | 2.040 (0.90) |
| Tobin's q | 1.191 (1.78)* | 1.479 (0.95) |
| Firm fixed effects | Yes | Yes |
| Year fixed effects | Yes | Yes |
| R-squared | 0.120 | 0.170 |
| Number of firms | 46 | 46 |

*Panel B: Impact on finding eco-friendly materials*

| DV: Δ in 'Resource Use' score | (i)<br>Low-leverage firms | (ii)<br>High-leverage firms |
|---|---|---|
| Low ESG dummy | 9.685 (2.36)** | 12.188 (4.13)*** |
| Google SVI (firm name) | -0.679 (-2.50)** | 0.115 (0.36) |
| Low ESG dummy × Google SVI (firm name) | 4.721 (3.90)*** | 2.350 (2.17)** |
| ln(Size) | -0.112 (-0.03) | -1.289 (-0.45) |
| Profitability (ROA) | -0.928 (-0.21) | 3.707 (1.55) |
| Tobin's q | 0.421 (0.77) | 0.872 (0.38) |
| Firm fixed effects | Yes | Yes |
| Year fixed effects | Yes | Yes |
| R-squared | 0.187 | 0.191 |
| Number of firms | 46 | 46 |

**TABLE A.1: Description of Thomson Reuters ESG Scores**

Each category of Thomson Reuters ESG Scores consists of a different number of indicators. *Weights* represents the proportion of each category of the TR ESG Scores to formulate the total ESG score. *Description of score* indicates the area(s), in which a firm's commitment, capacity, effectiveness, and performance are measured for the corresponding TR ESG Score.

| Pillar/Category | # of indicators | Weights | Description of score |
|---|---|---|---|
| **Environmental** | | | |
| Emissions | 22 | 12.0% | Reducing environmental emission in production and operational processes |
| Environmental Innovation | 20 | 11.0% | Reducing the environmental costs and burdens for its customers |
| Resource Use | 19 | 11.0% | Reducing the use of materials and finding eco-efficient solutions via supply chain management |
| **Social** | | | |
| Workforce | 29 | 16.0% | Job satisfaction, healthy and safe workplace, maintaining diversity and equal opportunities, etc. |
| Human Rights | 8 | 4.5% | Respecting the fundamental human rights conventions |
| Community | 14 | 8.0% | Being a good citizen, protecting public health and respecting business ethics |
| Product Responsibility | 12 | 7.0% | Producing quality goods and services, incorporating the customer's health and safety, and data privacy |
| **Corporate Governance** | | | |
| Management | 34 | 19.0% | Following best practice corporate governance principles |
| Shareholders | 12 | 7.0% | Equal treatment of shareholders and the use of anti-takeover devices |
| CSR Strategy | 8 | 4.5% | Economic/financial, social, and environmental dimensions in its day-to-day decision-making processes |
| | 178 | 100.0% | |
| Total score | | | Overall score based on the environmental, social, and corporate governance scores shown above |
| Controversies score | | | Exposure to environmental, social and governance controversies and negative events reflected in media |
| Combined score | | | Total score with a Controversies overlay |