"E" Ratings and Negative Environmental Performance[†]

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Abstract

We consider the extent to which the environmental ("E") ratings of eight different ESG rating companies predict future negative environmental performance. Ratings companies are focused on providing a broad representation of firm environmental performance. They consider a range of dimensions and do not claim to generate a proxy for any environmental outcome. Nonetheless, we suggest that stakeholders would expect firms with strong E ratings to be less likely to be represented in EPA enforcement actions and environmental lawsuits, and less likely to engage in toxic chemical releases. Our results indicate that none of the ratings consistently forecast EPA enforcement actions, environmental lawsuits, or toxic releases. However, large negative changes in Rep Risk, KLD, Sustainalytics, and S&P Trucost contain important information on future firm environmental performance. The E ratings of polluting firms are no more informative than the E ratings of non-polluting firms. Moreover, E ratings are no more accurate for firms with better information disclosures. Our results provide a useful addition to the current discussion around ESG measurement. Article 2 of the Paris Agreement has the objective of "making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development." However, investor surveys find that data quality is the biggest challenge to adopting sustainable investing Our paper should assist investors by providing them with evidence on the effectiveness of various popular environmental rating measures at capturing negative environmental performance.

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"McDonald's produced 54 million tons of [carbon] emissions that year [2019], an increase of about 7% in four years. Yet on April 23, MSCI gave McDonald's a ratings upgrade, citing the company's environmental practices"[1]

1. Introduction

Firm ESG (Environmental, Social, and Governance) ratings impact stakeholder decision-making (e.g., Hartzmark and Sussman, 2019).[2] However, there is substantial variation in these ratings across rating companies (e.g., Avramov, Cheng, Lioui, and Tarelli, 2021; Berg, Koelbel, and Rigobon, 2022). Furthermore, there are questions regarding the extent to which these ratings reflect actual ESG firm performance and stakeholder ESG concerns. Regulators around the world are now considering the countless practices and standards used to produce ESG ratings, with the chairman of the Sustainable Finance Task Force at the International Organization of Securities Commissions suggesting "we need to do some kind of rethinking here" (e.g., Schwartzkopff, 2022). In the U.S., the SEC is proposing rules requiring the standardization of company ESG information disclosure (e.g., Lainer, 2022).

We contribute to the literature by investigating the extent to which various rating companies' environmental ("E") ratings represent three measures of actual environmental performance. First, we consider Environmental Protection Agency (EPA) enforcement actions. Second, we include environmental lawsuits brought against firms by any party. Importantly, neither of these measures of environmental performance are based on firm reporting, which allays concerns

[1] https://www.bloomberg.com/graphics/2021-what-is-esg-investing-msci-ratings-focus-on-corporate-bottom-line/

[2] The Global Sustainable Investment Alliance estimates that over $25 trillion of AUM is based on ESG integration, which they define (p. 7) as "The systematic and explicit inclusion by investment managers of environmental, social and governance factors into financial analysis." Firms recognize the significance of third-party ratings to their reputation and have been known to take ESG rating companies to court when they are not satisfied with the rating they have been designated with https://www.globalelr.com/2020/04/esg-rating-on-trial-in-germany/

about self-reporting bias. As a robustness check, we use firm Toxic Release Inventory data as reported to the EPA. These data are self-reported but, as noted by Akey and Appel (2021), the EPA conducts audits of these data, and misreporting can lead to criminal or civil penalties, which mitigates concerns of misleading reporting.

Rating companies are focused on providing a broad representation of firm environmental performance. They consider a range of dimensions and do not claim to generate a proxy for any environmental outcome. Nonetheless, we suggest that stakeholders would expect firms with strong E ratings to be less likely to be represented in EPA enforcement actions and environmental lawsuits, and engage less in toxic chemical releases. Our approach to assessing the ability of ESG ratings to capture extremely negative environmental outcomes is similar to some work that considers the ability of ratings from credit rating agencies in predicting debt default (e.g., Guttler and Wahrenburg, 2007).

ESG rating agencies share similarities with credit rating agencies in that they both assess firm information and issue assessments that are used by other stakeholders. However, ESG rating agencies arguably face greater challenges in obtaining relevant information on which to form their ratings. Credit ratings are typically based on financial information that is standardized across firms, subject to external verification via audit, and generally available for long historical periods. ESG ratings on the other hand are either dependent on company self-reported information which is difficult to cross-check or derived from estimates. Given those credit ratings are often criticized as lacking in accuracy (e.g., Bar-Isaac and Shapiro, 2011), a reasonable prior is that ESG ratings will lack accuracy to an even greater degree due to the information challenges. On the other hand, ESG ratings, unlike many credit ratings, are not solicited and paid for by the companies being rated. Kashyap and Kovrijnykh (2016) suggest that credit ratings errors are larger when firms being rated

order the ratings, with Cornaggia and Cornaggia (2013) proposing that this is due to conflicts of interest in the compensation structure. Given that ESG ratings are free of this documented bias, an alternative prior is that they are less inaccurate.

We consider E ratings from Refinitiv Asset4 (hereafter *ASSET4*), MSCI KLD (*KLD*), MSCI IVA (*IVA*), Sustainalytics (*SUST*), RepRisk (*REPRISK*), Institutional Shareholder Services (*ISS*), Bloomberg (*BBG*), and S&P Trucost (*SPTC*). Our empirical analysis covers the 2002-2020 period. Our empirical results indicate that *REPRISK*, *KLD*, *BBG*, and *ISS* do respond to the past actual environmental performance of a firm (in terms of EPA enforcement actions, environmental lawsuits, and toxic chemical releases) in the expected directions in the short run and/or long run, while the other environmental ratings do not appear to respond to past actual environmental performance. In particular, the environmental rating that is most capable of reflecting actual past environmental performance promptly is *REPRISK*, which captures a firm's reputational risk based on the identified ESG incidents from various sources daily.

Our evidence further shows that the levels of environmental ratings generally lack predictive power on a rated firm's future environmental performance. Moreover, the environmental ratings of polluting firms are no more informative about short-run and long-run future actual environmental performance than the environmental ratings of non-polluting firms. Further, the levels of environmental ratings are no more informative about future actual environmental performance for firms with better information disclosures. However, we find that large negative changes in *REPRISK*, *KLD*, *SUST*, and *SPTC* (and *ISS* to some extent) do have significant information content on the firm's future environmental performance. By contrast, large positive changes in the environmental ratings of a firm at best carry mixed and inconsistent information about the firm's actual future environmental performance.

Thus, the empirical results suggest that *KLD* and *REPRISK* not only respond to the past actual environmental performance of a rated firm, but large negative changes in these environmental ratings are also informative about the firm's future environmental performance. That is, these ratings provide valuable and reliable information on rated firms' environmental footprint.

Finally, we show that larger firms, more profitable firms, firms with higher financial leverage, firms with lower cash holdings, firms with more capital expenditures, firms with higher asset tangibility, and firms with greater institutional ownership tend to have worse future actual environmental performance.

Our results provide a useful addition to the current heated discussion around ESG measurement. Article 2 of the Paris Agreement (United Nations, 2015) has the objective of "making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development." However, a recent investor survey found that "poor quality data/availability of data and analytics" is the biggest challenge to adopting sustainable investing (e.g., Blackrock, 2020). In 2020 the Investor Advisory Committee of the U.S. Securities and Exchange Commission (SEC) suggested that the SEC should begin mandating ESG disclosure requirements, while Murray (2021) notes that there is a renewed focus across various accounting bodies to standardize ESG reporting practices. Blackrock CEO Larry Fink comments that "all investors, along with regulators, insurers, and the public, need a clearer picture of how companies are managing sustainability-related questions".[3] Our paper should assist investors by providing them with evidence on the usefulness of various popular environmental rating measures.

[3] https://www.blackrock.com/corporate/investor-relations/2020-larry-fink-ceo-letter

We also contribute to several strands of the literature. First, we add to research that documents the impact of climate on firms and financial markets. Many researchers are making important discoveries in this area. For instance, Dessaint and Matray (2017) show that managers overreact to hurricane risk and hold excess cash. Flammer (2021) shows that the stock market reacts positively to announcements about the issue of "green" bonds tied to environmentally friendly policies. Bolton and Kacperczyk (2021) find high CO2 emitter firms generate higher stock returns, which is consistent with investors demanding compensation for carbon emission risk. Bauer, Ruof, and Smeets (2021) find that most pension fund members favor sustainable investment policy even if it hurts financial performance. While our research does not link environmental issues to financial markets, it provides a foundation for future work in this area by documenting the extent to which environmental ratings represent the actual environmental performance of the firm.

Second, we contribute to the literature that documents variation in ESG rankings across providers. Gibson, Krueger, and Schmidt (2021) suggest these issues stem from two sources: "the absence of common theorisation and commensurability", where the former means that "providers do not agree on a common definition of CSR" and the latter "captures the idea that different raters [providers] do not use the same measure when quantifying the same feature." They document that the average pairwise correlation between the overall ESG ratings from seven providers is only 0.45. Busch, Johnson, and Pioch (2020) compare reported CO2 emissions and find that company emissions reported by providers are similar when the companies themselves disclose this information, but material differences emerge when providers estimate these numbers. However, Kaspereit and Lopatta (2018) find that many firms manipulate their CO2 disclosure data, which suggests that the existence of similar numbers across providers may not be indicative of accurate information. Berg, Koelbel, and Rigobon (2022) suggest that the scope and measurement are the

main determinants of rating variation, with the weights assigned to various components contributing less.

Third, our work relates to other areas of the literature that document the ability of widely used proxies to represent key variables. Goyenko, Holden, and Trzcinka (2009), Hasbrouck (2009), Corwin and Schultz (2012), and Mancini and Ranaldo (2013) consider the effectiveness of liquidity proxies to represent the actual cost of transacting, as measured by high-frequency data. Other researchers, such as Chava and Jarrow (2004) and Jones (2017) compare the effectiveness of various approaches to predicting bankruptcy.

2. Data

2.1. Actual Environment Performance

We use three measures that we suggest are reasonable proxies for the actual environmental performance of a firm. First, we use the EPA enforcement cases. The facility-level EPA enforcement cases are sourced from the EPA's ICIS-FE&C dataset, which contains federal administrative and judicial enforcement cases dating back as early as 1971. We supplement the ICIS-FE&C enforcement data with other EPA enforcement cases at the federal and state levels under the Clean Air Act (i.e., the ICIS-Air dataset), the Clean Water Act (i.e., the ICIS-NPDES dataset), the Resource Conservation and Recovery Act (i.e., the RCRAInfo dataset), and the Safe Drinking Water Act (i.e., the SDWA dataset). For formal enforcement cases, the enforcement year is identified as the year when the case documents related to formal or judicial enforcement cases are formally signed. For informal cases, the enforcement year is identified as the year when the facility receives the notice or letter of violation from the EPA. For cases with missing information, the year of the settlement date is used as the enforcement year. We obtain the facility information

(including facility name and address etc.) for facilities involved in EPA enforcement from the EPA's Facility Registry Service (FRS) dataset. We then hand-match the facility names with Compustat company names to identify the parent firms of the facilities. We construct an EPA enforcement case indicator, *ENF*, which takes the value of one if the firm has one or more EPA enforcement cases in year *t* and zero otherwise.

Second, we obtain the data on environmental lawsuits from the Audit Analytics - Litigation database, which begins in 2000 and contains lawsuit information for US publicly listed firms. Although the database covers various types of corporate lawsuits, we mainly focus on those classified as being related to environmental law (type 21). We match a defendant firm involved in an environmental lawsuit to a Compustat GVKEY using CIK (i.e., Company FKEY in Audit Analytics). We identify the year of the case start date as the year of the environmental lawsuit. We create an environmental lawsuits indicator, *LAWSUITS*, which takes the value of 1 if the firm has an environment-related lawsuit in year *t* and takes the value of 0 otherwise.

Third, we use the toxic chemical releases data from the EPA's Toxic Release Inventory (TRI) Program. This program, created from the Emergency Planning and Community Right-to-Know Act (EPCRA), requires industrial entities to annually report data on toxic chemical releases as well as their practices to manage production waste and prevent pollution. Any facility that employs at least 10 full-time staff, operates in one of the 400 NAICS industries and emits one of the 770 TRI-listed chemicals to the environment (i.e., air, water, and ground) is required to report to the EPA under the TRI program. The EPA conducts regular audits of the reported data. Reporting facilities may be subject to criminal and civil penalties for falsified information submissions or reporting errors.[4] Every year, we aggregate all facilities' on-site and off-site TRI data to the parent

[4] The literature finds little evidence of misreporting (Akey & Appel, 2021; Xu & Kim, 2022) or systematic bias (Bui & Mayer, 2003) for the TRI data.

firm level to measure the firm's total amount of annual toxic chemical releases (in million pounds) and denote this sum as *TRI*.

2.2. Environmental Ratings

We use environmental rating data from eight databases: MSCI KLD, MSCI IVA, Refinitiv ESG, Morningstar Sustainalytics, Institutional Shareholder Services, Bloomberg, RepRisk, and S&P Trucost. The MSCI KLD database traces its origins to the Kinder, Lyndenberg, and Domini (KLD), while the MSCI IVA database was developed by Innovest. As pointed out by Gibson, Krueger, and Schmidt (2019), KLD and Innovest were both acquired by RiskMetrics in 2009 and in 2010 MSCI acquired RiskMetrics. Refinitiv ESG scores were initially calculated by ASSET4, which was founded in 2003 and purchased by Thomson Reuters in 2017 (e.g., Berg, Fabisik, and Sautner, 2021). Sustainalytics was created in 2009, with Morningstar purchasing a 40% stake in 2016 (e.g., Eccles and Stroehle, 2018). Institutional Shareholder Services (ISS) started as an organization that promoted good corporate governance practices in 1985. It purchased an ESG company in 2015 and has been developing its ESG data offerings ever since (e.g., Eccles and Stroehle, 2018). Bloomberg's ESG solutions provide ESG data going back to 2006. RepRisk is a Zurich-based data provider that records corporate ESG performance back to 2007 (e.g., Li and Wu, 2020). The final database is S&P Trucost. Rather than producing an overall environmental measure, it tracks firm carbon and other greenhouse gas emissions (e.g., Bolton and Kacperczyk, 2021).

The variables we use from each database[5] are as follows: *ASSET4* is the environment pillar score from the Refinitiv database. The *ASSET4* value ranges from 0 to 100 and covers from the

[5] Extraction dates of each database are as follow. ASSET4 is as of 6 October 2021; Bloomberg is as of 29 July 2021; ISS is as of 11 May 2022; KLD is as of 2 October 2021; MSCI IVA is as of 24 November 2021; Reprisk is as of 14

year 2002 to 2020. *BBG* is the Bloomberg environment disclosure score with a value ranging from 0 to 100 covering the years 2008 to 2020. *ISS* is the ISS environment rating numeric with the value ranging from 0 to 10 covering from the year 2007 to 2020. *IVA* is the MSCI ESG Intangible Value Assessment environmental pillar score ranging from 0 to 10 and covers the years 2007 to 2020. *KLD* is the MSCI ESG KLD statistics computed as the number of strengths minus the number of weaknesses, and the data starts from 1991 to 2018. *REPRISK* is the peak RepRisk index which is equal to the highest level of the reputational risk index (RRI) over the last two years with the value ranging from 0 to 100, and the data covers the years 2007 to 2020. *SPTC* is the S&P Trucost carbon intensity-scope 1 (tonnes CO2e/USD mn) covering the years 2005 to 2020. *SUST* is the Morningstar Sustainalytics environment risk score ranging from 0 to 100 covering the years 2009 to 2020.

2.3. Firm Characteristics

We obtain the data to construct various firm characteristics from the Compustat database and the Center for Research in Security Prices (CRSP). Specifically, *SIZE* is the natural logarithm of the total assets in million. *MTB* is the market-to-book equity ratio. *ROA* is the return on assets, which is measured as income before extraordinary items scaled by total assets. *CASH* is the ratio of cash to total assets. *LEV* is the ratio of long-term liability to total assets. *CAPX* is the ratio of capital expenditures to total assets. *SALEG* is annual sale growth. *TANG* is the ratio of tangible assets to total assets. *RND* is the ratio of research and development expenditures to total assets. *HHI* is the Herfindahl-Hirschman Index of industry market share concentration, which is calculated

October 2021; S&P Trucost is as of 28 October 2021; Sustainalytics is as of 6 October 2021; Compustat variables are as of 11 November 2021; EPA Enforcement is as of 16 October 2020; Audit Analytics Environmental Lawsuits are as of 16 August 2021; EPA TRI is as of 10 September 2021.

as the sum of the squared market share percentage of firms in the (2-digit SIC) industry. *AMIHUD* is the illiquidity ratio of absolute stock return to dollar volume multiplied by 1,000,000. *RETLAG1Y* is the buy-and-hold stock return over the year. *VOLAT* is stock return volatility based on the standard deviation of the daily return over the year multiplied with the squared root 252. *IO* is the institutional ownership, with the data sourced from Thomson Reuters Institutional Holdings (13-F) database.

2.4. Summary Statistics

Table 1 shows the descriptive statistics of actual environmental performances, environmental ratings, and firm characteristics for our sample of 175,775 firm-year observations, which covers the period from 1991 to 2020. We winzorize environmental performance, environmental rating, and firm characteristics variables in the regression at 1% and 99% each year to limit the influence of outliers except the *ENF*, *LAWSUITS*, and *KLD*). Panel A shows descriptive statistics of the three actual environmental performance measures. The mean *ENF* is 0.020, which suggests that 2% of the firm-year observations are subject to EPA enforcement. The mean of *LAWSUITS* is 0.008, which indicates that 0.8% of the firm-year observations are subject to environmental lawsuits (with the firm being the defendant). The mean of *TRI* is 1.467, which suggests that for the subset of sample firms covered by the TRI program, there are on average 1.467 million pounds of total toxic chemical releases per firm-year.

Panel B presents the descriptive statistics of the eight environmental rating measures, which have different data coverages and different value ranges (as discussed earlier). We find that compared with their respective means and medians, the standard deviations of the environmental rating measures are all relatively large, indicating significant variations of the rating scores in the

data.[6] Panel C provides the descriptive statistics of 14 firm characteristics. In particular, the sample mean is 6.084 (i.e., USD 438.78 million) for *SIZE*, 2.832 for *MTB*, -0.056 for *ROA*, 0.210 for *SALEG*, and 0.386 for *IO*, which are all comparable to those reported in the literature [cite?].

[Please Insert Table 1 Here]

Panel D reports the pairwise correlations among the environmental rating measures. We find that the correlations among the environmental rating measures are generally very low, with the highest correlations being 0.048 between *KLD* and *IVA*, 0.046 between *ASSET4* and *SUST*, and 0.043 between *KLD* and *ASSET4*. There can be a number of reasons for the inconsistent environmental ratings and low correlations among different ratings. First, up to date the SEC does not mandate specific environmental data be disclosed, but rather requires companies to report on items that they deem to be material (e.g., Rasmussen, 2020). Second, as El-Hage (2021) note, there are numerous ESG standard-setting initiatives which results in "option overload" for firms wanting to engage in ESG reporting. These two factors result in considerable variation in the data that rating companies have access to. Third, benchmarking of firm peer groups has an important bearing on firm ESG ratings, but ESG rating companies are often not transparent about these calculations (e.g., Kotsantonis and Serafeim, 2021). Fourth, ESG rating companies have different approaches to dealing with data gaps across companies and time periods (e.g., Kotsantonis and Serafeim, 2021). Fifth, ESG rating firm ownership matters. For example, Tang, Yan, and Yao (2021) show that firms owned by the same owners as the rating firm receive higher ESG ratings. Sixth, the timeframe in which ESG data are obtained from a rating firm is important. For example, Berg, Fabisik and

[6] Panel A of Table A1 in the Appendix provides the distribution of the number of our sample firms covered by each environmental rating in each year over the sample period. KLD has the longest history of data coverage (from 1991 to 2018) and covers the broadest set of firms, followed by ASSET4 and SPTC. Panel B of Table A1 shows the distribution of the number of the sample firms covered by at least N environmental rating(s) by year. On one hand, we observe that the number of sample firms covered by at least one environmental rating increases from 366 to 3,671 over the sample period. On the other hand, only a few hundred firms in the sample are covered by more than six environmental ratings.

Sautner (2021) provide evidence of large rewriting of ESG data across downloads in 2018 and 2020 which are related to past firm ESG performance. Finally, Eccles and Stroehele (2018) show that the origin of each rating company including their founding principles and purpose influences their views on what sustainability aspects are material.

Panel E presents the correlations of actual environmental performance measures. We find that *ENF* and *LAWSUITS* are positively correlated with the correlation coefficient being 0.095, which is not surprising. Interestingly, we find little correlation of *TRI* with *ENF* or *LAWSUITS*.

3. Do Environmental Ratings Respond to Past Environmental Performance?

We next investigate whether the environmental ratings respond to past actual environmental performance in the short run and long run. If the environmental ratings reflect actual environmental performance of firms, we expect a firm's past EPA enforcement actions, environmental lawsuits, and toxic chemical releases to negatively affect its environmental ratings sourced from different databases. We estimate the following regression equation:

$$E\text{-}RATING_{i,t} = \beta\, E\text{-}PERFORMANCE_{i,t\text{-}k} + \delta_i + \gamma_t + CONTROLS_{i,t} + \varepsilon_{i,t} \qquad (1)$$

In equation (1), the dependent variable, $E\text{-}RATING_{i,t}$ is one of the eight environmental ratings of firm *i*, being *ASSET4*, *BBG*, *ISS*, *IVA*, *KLD*, *REPRISK*, *SPTC*, or *SUST*, in year *t*. $E\text{-}PERFORMANCE_{i,t\text{-}k}$ is the *k*-year lagged actual environmental performance of firm *i*, being *ENF*, *LAWSUITS*, or *TRI*. We include (2-digit SIC) industry fixed effects (δ_i) and year fixed effects (γ_t) in the regression specification. $CONTROLS_{i,t}$ are 14 firm characteristics. Standard errors are double clustered at both the firm and year levels throughout. All winzorized variables except the *ENF* and *LAWSUITS* are converted to the cross-sectional percentile ranks by year to standardize the impact of different variables in the regression. The results are reported in Table 2.

Panels A and B of Table 2 show the short-run responses of the environmental ratings to the one-year-lagged actual environmental performance without control variables and with control variables, respectively. Consistent with our expectation, we find that past EPA enforcement actions and toxic chemical releases both lead to an increase in the *REPRISK* value at the 5% level, indicating greater reputational risk. Moreover, past EPA enforcement actions also lead to lower *BBG* and *ISS* values at the 10% level and 1% level, respectively, suggesting that BBG and ISS do respond to EPA enforcement actions. Interestingly, we find that the other five environmental ratings do not seem to respond to the one-year-lagged actual environmental performance. The results are qualitatively similar with and without controlling for the firm characteristics.

As it may take some time for the environmental ratings to reflect the past actual environmental performance of the firm, we further examine the long-run responses of the environmental ratings to the five-year-lagged actual environmental performance. The results with and without firm characteristics controls are reported in Panels C and D of Table 2, respectively. Panel C shows that as expected, past EPA enforcement actions and toxic chemical releases both lead to an increase in the five-year-ahead *REPRISK* value at the 10% level, while past toxic chemical releases lead to a decrease in the five-year-ahead *KLD* score at the 5% level. Panel D shows that when we control for firm characteristics in the regressions, the results on *REPRISK* disappear while the result on *KLD* remains robust. The other environmental ratings do not respond to the five-year-lagged actual environmental performance.

[Please Insert Table 2 Here]

To summarize, we find that *REPRISK*, *KLD*, *BBG* and *ISS* do respond to past actual environmental performance of a firm (in terms of EPA enforcement actions, environmental lawsuits and toxic chemical releases) in expected directions in the short run and/or long run, while

the other environmental ratings are apparently unresponsive. The environmental rating that is the most capable of reflecting actual past environmental performance in a timely manner appears to be *REPRISK*, which captures a firm's reputational risk based on the identified ESG incidents from various sources (e.g.,, media, social media, NGOs, governmental bodies, and think tanks, etc.) on a daily basis.

4. Do Environmental Ratings Predict Future Actual Environmental Performance?

In this section, we investigate whether the environmental ratings from various data providers predict future actual environmental performance in the short run and long run. If the environmental ratings are forward looking in nature and incorporate analysts' and market participants' rational expectations about the future environmental performance of a firm, then we expect the environmental ratings to predict the firm's likelihoods of being subject to future EPA enforcement actions, environmental lawsuits, and its future amount of toxic chemical releases. Thus, we estimate the following regression equation:

$$E\text{-}PERFORMANCE_{i,t+k} = \beta\, E\text{-}RATING_{i,t} + \delta_i + \gamma_{t+k} + CONTROLS_{i,t+k} + \varepsilon_{i,t+k} \qquad (2)$$

In equation (2), the dependent variable, $E\text{-}PERFORMANCE_{i,t+k}$, is firm i's k-year-ahead future actual environmental performance (i.e., one of *ENF*, *LAWSUITS* and *TRI*). $E\text{-}RATING_{i,t}$ is one of the eight current environmental ratings. The regression specification includes (2-digit SIC) industry fixed effects (δ_i) and year fixed effects (γ_{t+k}). $CONTROLS_{i,t+k}$ include 14 firm characteristics. The results are reported in Table 3.

Panels A show the predictive ability of the environmental ratings on one-year-ahead actual environmental performance (k=1) without and with control variables, respectively. Each column of Panel A represents one of the three future environmental performances while the row represents

one of the eight current environmental ratings. With the exception that greater value of *ISS* is marginally and negatively related to one-year-ahead EPA enforcement likelihood (*ENF*) and greater value of *IVA* is marginally and negatively related to one-year-ahead environmental lawsuit likelihood (*LAWSUITS*) at the 10% level, the regression results suggest that the environmental ratings generally lack predictive power on one-year-ahead actual environmental performance.

Panels B further show the predictive power of the environmental ratings on five-year-ahead actual environmental performance (k=5) without and with control variables, respectively. Except that greater *SUST* value seems to be able to predict lower EPA enforcement likelihood in the long run at the 5% level, we do not find any long-run predictive power for the other environmental ratings.

[Please Insert Table 3 Here]

Given that environmental rating agencies face significant challenges in obtaining relevant and accurate information on which to form their ratings, the weak predictive power of the environmental ratings on future actual environmental performance is more or less expected. We go a step further to examine whether large negative changes in the environmental ratings of a firm carry any valuable information about the firm's actual future environmental performance. Specifically, we estimate the following regression equation:

$$E\text{-}PERFORMANCE_{i,t+k} = \beta\, WORST\text{-}DOWNGRADE_{i,t} + \delta_i + \gamma_{t+k} + CONTROLS_{i,t+k} + \varepsilon_{i,t+k} \quad (3)$$

In equation (3), $E\text{-}PERFORMANCE_{i,t+k}$ is firm i's k-year-ahead future environmental performance (i.e., one of *ENF*, *LAWSUITS* and *TRI*). We define $WORST\text{-}DOWNGRADE_{i,t}$ as follows. In each year, for each environmental rating measure, we calculate the change in a firm's environmental rating and then classify firms into deciles based on their rating changes. The lowest (highest) decile represents the worst (best) environmental performance. We define $WORST\text{-}DOWNGRADE_{i,t}$ as an

indicator that equals one if firm i is in the worst decile and zero otherwise. The regression specification includes (2-digit SIC) industry fixed effects (δ_i) and year fixed effects (γ_{t+k}). $CONTROLS_{i,t+k}$ are 14 firm characteristics. The results are reported in Table 4.

Panels A of Table 4 show the impact of being in the worst decile in terms of the change in an environmental rating on a firm's one-year-ahead future environmental performance (k=1) without and with control variables, respectively. It shows that the indicators of being in the worst deciles of the changes in *REPRISK*, *KLD*, *SUST* and *SPTC* all have significant predictive power on short-run future environmental performance of the firm. Specifically, the *WORST-DOWNGRADE*$_{i,t}$ indicators of *REPRISK* and *KLD* are both associated with greater future risks of EPA enforcement actions and environmental lawsuits. The *WORST-DOWNGRADE*$_{i,t}$ indicator of *SUST* is related to higher future EPA enforcement and lawsuit likelihoods and larger amount of future toxic chemical releases. The *WORST-DOWNGRADE*$_{i,t}$ indicator of *SPTC* is associated with greater likelihood of being subject to future EPA enforcement actions. Panel B shows qualitatively similar, albeit weaker, results after we control for a variety of firm characteristics. In particular, The *WORST-DOWNGRADE*$_{i,t}$ indicators of *REPRISK* and *KLD* continue to be negatively related to greater future likelihood of being subject EPA enforcement actions, while the *WORST-DOWNGRADE*$_{i,t}$ indicator of *SUST* continues to be related to higher future environmental lawsuit likelihood and greater amount of future toxic chemical releases.

Panels B of Table 4 show the results on predicting five-year-ahead future environmental performance (k=5) without and with control variables, respectively. We find that similar to their predictive power on short-run future environmental performance, the indicators of being in the worst deciles of the changes in *REPRISK*, *KLD*, *SUST* and *SPTC* all have significant predictive ability on five-year-ahead long-run future environmental performance of the firm. Moreover, the

WORST-DOWNGRADE$_{i,t}$ indicator of *ISS* is also associated with higher five-year-ahead likelihood of being subject to environmental lawsuits as a defendant at the 5% level, both without and with firm characteristics controls.

[Please Insert Table 4 Here]

We further examine whether large positive changes in the environmental ratings of a firm (i.e., being in the best decile in terms of the change in a current environmental rating) carry any information about the firm's actual future environmental performance. We replace *WORST-DOWNGRADE*$_{i,t}$ with *BEST-UPGRADE*$_{i,t}$ which is an indicator that equals one if firm *i* is in the best environmental change decile in year *t* and zero otherwise. We then re-estimate equation (3) and report the results in Table 5. We find mixed and inconsistent results. For example, the indicators of being in the best deciles of the changes in *REPRISK*, *KLD* and *SPTC* are associated with greater short-run and long-run future likelihoods of being subject to EPA enforcement actions and environmental lawsuits, while the indicators of being in the best deciles of the changes in *BBG* and *IVA* (*ISS*) predict lower one-year-ahead (five-year-ahead) amount of toxic chemical releases from the firm.

[Please Insert Table 5 Here]

In summary, we find that the levels of environmental ratings generally lack predictive power on the future environmental performance of a firm. However, large negative changes in *REPRISK*, *KLD*, *SUST* and *SPTC* (and *ISS* to some extent) all have significant information content on the firm's future environmental performance. By contrast, large positive changes in the environmental ratings of a firm at best carry mixed and inconsistent information about the firm's actual future environmental performance.

5. Polluters versus Non-polluters

In the last section, we show that the levels of environmental ratings generally lack predictive ability on the future environmental performance of a firm. Compared with non-polluting firms, polluting firms may receive more monitoring attention from the environmental rating agencies. Thus, the environmental ratings of polluting firms may be more informative about future actual environmental performance of these firms. We next investigate whether the environmental ratings of polluting firms are better able to predict future actual environmental performance than the environmental ratings of non-polluting firms, by estimating the following regression equation:

$$E\text{-}PERFORMANCE_{i,t+k} = \beta_1 POLLUTER_{i,t} + \beta_2 E\text{-}RATING_{i,t} + \beta_3 POLLUTER_{i,t}*E\text{-}RATING_{i,t} + \delta_i + \gamma_{t+k} + CONTROLS_{i,t+k} + \varepsilon_{i,t+k} \quad (4)$$

In equation (4), the dependent variable, $E\text{-}PERFORMANCE_{i,t+k}$, is firm i's k-year-ahead future actual environmental performance (i.e., one of *ENF*, *LAWSUITS* and *TRI*). $E\text{-}RATING_{i,t}$ is one of the eight current environmental ratings. $POLLUTER_{i,t}$ is an indicator on whether firm i is a polluting firm.

We employ three different definitions of polluting firms as follows. First, we define a firm as a polluter if it has been subject to an EPA enforcement case up to current year *t*. Second, we define a firm as a polluter if it belongs to one of the following six industry subsectors including coal producers, unconventional oil producers, conventional oil producers, natural gas producers, iron and steel producers, and conventional electricity producers, which face significant stranded asset risks (Krueger, Sautner, and Starks, 2020). Third, we define a firm to be a polluter if it operates in the coal, oil and gas upstream, and oil and gas downstream industries (Shimbar, 2021).

Our regression specification includes (2-digit SIC) industry fixed effects (δ_i) and year fixed effects (γ_{t+k}). $CONTROLS_{i,t+k}$ include 14 firm characteristics. Our focus is on the coefficient estimates of the interaction term, $POLLUTER_{i,t}*E\text{-}RATING_{i,t}$, which should be statistically

significant with the expected signs if the environmental ratings of polluters are more informative on future actual environmental performance than those of non-polluters. The regression results using the first polluter definition (i.e., whether the firm has been subject to EPA enforcement up to year *t*) are reported in Table 6.

The left-hand side of Table 6 shows the results of predicting one-year-ahead *ENF*, *LAWSUITS* and *TRI*, respectively. Expectedly, the *POLLUTER* indicator strongly and positively predicts one-year-ahead EPA enforcement likelihood and environmental lawsuit likelihood (Panels A and B). The coefficient estimates of *POLLUTER* are also positive in all regressions of predicting one-year-ahead *TRI*, albeit only statistically significant in one out of the eight regressions. These results suggest that polluting firms have worse one-year-ahead actual environmental performance than non-polluting firms. However, we find that the coefficient estimates of the interaction term, $POLLUTER_{i,t}$*$E\text{-}RATING_{i,t}$, are generally insignificant across the regressions with only a few exceptions. Across 24 regressions of predicting one-year-ahead actual environmental performance, only the coefficient estimate of the interaction term using *SUST* in the predictive regression on one-year-ahead *ENF* shows the expected negative sign and is statistically significant only at the 10% level.

[Please Insert Table 6 Here]

The right-hand side of Table 6 shows the results of predicting five-year-ahead *ENF*, *LAWSUITS*, and *TRI*, respectively. The results are qualitatively similar to the one-year prediction. The coefficient estimates of the interaction term, $POLLUTER_{i,t}$*$E\text{-}RATING_{i,t}$, are generally insignificant across the 24 regressions of predicting five-year-ahead actual environmental performance, with only a few exceptions. In particular, the coefficient estimates of the interaction term using *SUST* in the predictive regressions on five-year-ahead *ENF* and five-year-ahead *TRI*

show the expected negative sign and are statistically significant at the 1% level and 10% level, respectively.

We further use the other two polluter definitions to repeat the analyses of Table 6. Tables A2 and A3 in the Appendix show that the results using these two alternative polluter definitions are again generally insignificant or inconsistent with our expectations. Thus, the results in this section clearly suggest that the environmental ratings of polluting firms are no more informative about short-run and long-run future actual environmental performance than the environmental ratings of non-polluting firms.

6. Information, Environmental Ratings, and Future Environmental Performance

When assessing and forming firms' environmental ratings, environmental rating agencies rely on the information disclosures from firms as crucial inputs. While we show that the levels of environmental ratings generally lack predictive power on the future actual environmental performance of firms, environmental ratings may carry more information content on future actual environmental performance for those firms with better information disclosures. In this section, we examine this conjecture using the following regression specification:

$$E\text{-}PERFORMANCE_{i,t+k} = \beta_1 INFO_{i,t} + \beta_2 E\text{-}RATING_{i,t} + \beta_3 INFO_{i,t}*E\text{-}RATING_{i,t} + \delta_i + \gamma_{t+k} + CONTROLS_{i,t+k} + \varepsilon_{i,t+k} \quad (5)$$

In equation (5), the dependent variable, $E\text{-}PERFORMANCE_{i,t+k}$, is firm i's k-year-ahead future actual environmental performance (i.e., one of *ENF*, *LAWSUITS* and *TRI*). $E\text{-}RATING_{i,t}$ is one of the eight current environmental ratings. $INFO_{i,t}$ is a proxy for the information disclosures of the firm. It is well known that large firms tend to be more transparent and provide more and better information disclosures than small firms (e.g., Diamond and Verrecchia, 1991). Thus, we use firm size, measured as the natural logarithm of total assets, as a proxy for information disclosures (i.e.,

information supply). It is also known that institutional investors demand more and better information disclosures than individual investors (Bird and Karolyi, 2016). They are also demanding of climate risk disclosures from firms (Ilhan, Krueger, Sautner and Starks, 2022). We hence use a firm's institutional ownership as another proxy for information disclosures (i.e., information demand). The regression results are reported in Table 7. For brevity, we only report the coefficient estimates of the interaction term, $INFO_{i,t}$*E-RATING$_{i,t}$, with $INFO_{i,t}$ being either firm size or institutional ownership.

For the prediction of the environmental performance over one year, the coefficient estimates of $INFO_{i,t}$*E-RATING$_{i,t}$ are generally insignificant or inconsistent in the regressions of predicting one-year-ahead *ENF*, *LAWSUITS* and *TRI*, with an exception being that greater value of *BBG* predicts lower one-year-ahead *ENF* for firms with higher institutional ownership. For the five-year prediction, the results are qualitatively similar for the regressions of predicting five-year-ahead actual environmental performance. Specifically, the coefficient estimates of the interaction terms are generally insignificant. The few exceptions are that greater value of *BBG* predicts lower five-year-ahead *ENF* for larger firms and firms with higher institutional ownership and that greater value of *REPRISK* predicts larger five-year-ahead *TRI* for firms with higher institutional ownership.

In summary, the empirical evidence in this section generally suggests that the levels of environmental ratings are no more informative about future actual environmental performance for firms with better information disclosures.

[Please Insert Table 7 Here]

7. Firm Characteristics and Future Environmental Performance

We further examine whether the firm-level characteristics are associated with future actual environmental performance. The regression results are reported in Table 8. We similarly include industry and year fixed effects.

In columns 1, 2 and 3 of Table 8, the dependent variables are one-year-ahead *ENF*, *LAWSUITS* and *TRI*, respectively. Column 1 shows that firm size (*SIZE*), profitability (*ROA*), financial leverage (*LEV*), capital expenditures (*CAPX*), industry-level sales concentration (*HHI*) and institutional ownership (*IO*) are significantly and positively related to one-year-ahead *ENF* (i.e., one-year-ahead EPA enforcement), while cash holdings (*CASH*) and sales growth (*SALEG*) are negatively associated with one-year-ahead *ENF*. Column 2 shows that results are qualitatively similar for one-year-ahead *LAWSUITS* (i.e., one-year-ahead environmental lawsuit likelihood with the firm being the defendant). Firm size (*SIZE*), profitability (*ROA*), financial leverage (*LEV*), capital expenditures (*CAPX*), asset tangibility (*TANG*), industry-level sales concentration (*HHI*), institutional ownership (*IO*) and past stock returns (*RETLAG1Y*) are significantly and positively related to one-year-ahead *LAWSUITS*, while cash holdings (*CASH*) and stock illiquidity (*AMIHUD*) are negatively associated with one-year-ahead *LAWSUITS*. Column 3 shows that none of these firm-specific characteristics can predict one-year-ahead *TRI* (i.e., one-year-ahead amount of total toxic chemical releases).

Columns 4, 5 and 6 of Table 8 show the regression results with the dependent variables being five-year-ahead *ENF*, *LAWSUITS* and *TRI*, respectively. The results are similar to those reported in the first three columns, with the following exceptions. We find that *ROA*, *SALEG* and *IO* are significantly and positively related to, while *HHI* and *RETLAG1Y* are significantly and negatively related to, five-year-ahead *TRI*.

To summarize, we find that larger firms, more profitable firms, firms with higher financial leverage, firms with lower cash holdings, firms with more capital expenditures, firms with higher asset tangibility and firms with greater institutional ownership, tend to have worse future actual environmental performance.

[Please Insert Table 8 Here]

8. Conclusion

There is substantial variation in different environmental ratings across rating agencies (e.g., Avramov, Cheng, Lioui, and Tarelli, 2021; Berg, Koelbel, and Rigobon, 2022). In this study, we investigate the extent to which various rating agencies' environmental ratings represent three measures of actual environmental performance: the likelihood of the firm being subject to the EPA environmental enforcement actions, the likelihood of the firm being involved in environmental lawsuits as a defendant, and the firm's total amount of toxic chemical releases.

We find that *REPRISK*, *KLD*, *BBG* and *ISS* do respond to past actual environmental performance of a firm (in terms of EPA enforcement actions, environmental lawsuits, and toxic chemical releases) in the expected directions in the short run and/or long run, while the other environmental ratings do not appear to respond to past actual environmental performance. The environmental rating that is the most capable of reflecting past actual environmental performance in a timely manner appears to be *REPRISK*, which captures a firm's reputational risk based on the identified ESG incidents from various sources on a daily basis.

Our empirical evidence further suggests that the levels of environmental ratings generally lack predictive power on the future environmental performance of a firm. Moreover, we find that the environmental ratings of polluting firms are no more informative about short-run and long-run

future actual environmental performance than the environmental ratings of non-polluting firms, and the levels of environmental ratings are also no more informative about future actual environmental performance for firms with better information disclosures. However, we find that large negative changes in *REPRISK, KLD, SUST* and *SPTC* (and *ISS* to some extent) do have significant information content on the firm's future environmental performance. By contrast, large positive changes in the environmental ratings of a firm at best carry mixed and inconsistent information about the firm's actual future environmental performance.

Finally, we show that larger firms, more profitable firms, firms with higher financial leverage, firms with lower cash holdings, firms with more capital expenditures, firms with higher asset tangibility and firms with greater institutional ownership, tend to have worse future actual environmental performance.

Our findings may be of interest to investors, academics, and regulators. In particular, our empirical results suggest that both *KLD* and *REPRISK* respond to past actual environmental performance of a rated firm and large negative changes in these ratings are also informative about the firm's future environmental performance. Thus, these environmental ratings do provide valuable information on rated firms' environmental footprints.

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Table 1
Descriptive Statistics

This Table shows the descriptive statistics of environmental performances, environmental ratings, and firm characteristics from 1991 to 2020. Panel A shows descriptive statistics of the three environmental performances. ENF is the EPA enforcement case indicator which has a value of 1 if the firm has one or more EPA enforcement cases in year t and 0 otherwise. LAWSUITS is the environmental lawsuits indicator which has a value of 1 if the firm has an environment-related lawsuit in year t and 0 otherwise. TRI is the amount of chemical toxicity released per million pounds per year including all chemicals released to the ground, water, and air, and combines the amount of toxicity released on-site and off-site. Panel B presents descriptive statistics of the eight environmental ratings. ASSET4 is the environment pillar score from the Refinitiv database. The ASSET4 value varies from 0 to 100 and covers from the year 2002 to 2020. The BBG is the Bloomberg environment disclosure score with a value ranging from 0 to 100 covering the years 2008 to 2020. The ISS is the Institutional Shareholder Services environment rating numeric with the value varying from 0 to 10 covering from the year 2007 to 2020. The IVA is the MSCI ESG Intangible Value Assessment environmental pillar score varying from 0 to 10 and covers the years 2007 to 2020. The KLD is the MSCI ESG KLD statistics computed as the number of strengths minus the number of weaknesses and the data starts from 1991 to 2018. REPRISK is the peak RepRisk index which is equal to the highest level of the reputational risk index (RRI) over the last two years with the value varying from 0 to 100 and the data covers the year 2007 to 2020. SPTC is the S&P Trucost carbon intensity-scope 1 (tonnes CO2e/USD mn) covering the year 2005 to 2020. SUST is the Morningstar Sustainalytics environment risk score varying from 0 to 100 covering the years 2009 to 2020. Panel C describes descriptive statistics of 14 firm characteristics. SIZE is the natural logarithm of the total asset in million. MTB is the ratio of the market capitalisation to the book value of equity ratio. ROA is the return on assets. CASH is the ratio of cash to the total asset. LEV is the ratio of the long-term liability to the total asset. CAPX is the ratio of capital expenditure to the total asset. SALEG is the annual sale growth. TANG is the ratio of a tangible asset to a total asset. RND is the ratio of research expenditure to the total asset. HHI is the Herfindahl-Hirschman Index which is a measure of market concentration calculated by the sum of the squared market share percentage of firms in the industry. IO is the institutional ownership. AMIHUD is the illiquidity ratio of absolute return to dollar volume multiplied 10^6. RETLAG1Y is the lag annual return. VOLAT is the stock return volatility. Panel D shows the correlations of environmental ratings. Panel E presents the correlations of environmental performance.

	N	MEAN	MED	SD	P25	P75	SKEW	KURT
Panel A: Environmental Performances								
ENF	175,775	0.020	0.000	0.138	0.000	0.000	6.824	45.482
LAWSUITS	175,775	0.008	0.000	0.086	0.000	0.000	13.210	209.031
TRI	19,075	1.467	0.051	5.242	0.006	0.392	5.277	30.002
Panel B: Environmental Ratings								
ASSET4	11,921	36.298	32.363	25.450	13.505	56.992	0.367	-1.037
BBG	10,991	20.057	14.023	17.682	4.433	33.677	0.742	-0.593
ISS	9,470	1.721	1.597	0.511	1.326	2.008	0.915	0.372
IVA	20,244	4.501	4.450	1.891	3.089	5.829	0.214	-0.345
KLD	28,769	-0.048	0.000	0.797	0.000	0.000	-0.996	7.620
REPRISK	11,798	2.939	0.000	6.698	0.000	0.557	2.458	5.354
SPTC	19,404	227.493	16.608	772.302	5.021	44.553	4.974	25.955
SUST	7,598	52.027	47.965	17.452	38.272	62.492	0.690	-0.162

	N	MEAN	MED	SD	P25	P75	SKEW	KURT
Panel C: Firm Characteristics								
SIZE	175,775	6.084	6.025	2.183	4.575	7.506	0.172	-0.199
MTB	175,775	2.832	1.816	6.472	1.079	3.307	1.907	34.160
ROA	175,775	-0.056	0.022	0.390	-0.037	0.065	-10.910	242.331
CASH	175,775	0.124	0.065	0.157	0.020	0.167	2.219	5.669
LEV	175,775	0.184	0.122	0.209	0.008	0.294	1.717	4.506
CAPX	175,775	0.050	0.031	0.061	0.012	0.063	2.907	11.543
SALEG	175,775	0.210	0.072	0.850	-0.037	0.224	6.630	55.924
TANG	175,775	0.255	0.164	0.248	0.059	0.386	1.076	0.119
RND	175,775	0.049	0.000	0.120	0.000	0.042	4.717	31.008
HHI	175,775	0.062	0.041	0.058	0.020	0.030	2.775	8.615
IO	175,775	0.386	0.374	0.320	0.000	0.047	0.245	-1.261
AMIHUD	175,775	5.277	0.130	19.308	0.010	1.377	5.774	36.908
RETLAG1Y	175,775	0.143	0.047	0.582	-0.202	0.339	1.500	4.202
VOLAT	175,775	0.592	0.504	0.351	0.349	0.725	1.876	4.830

Panel D: Correlation of Environmental Ratings

	ASSET4	BBG	ISS	IVA	KLD	REPRISK	SPTC	SUST
ASSET4	1.000							
BBG	-0.001	1.000						
ISS	0.011	0.002	1.000					
IVA	0.031	0.003	-0.003	1.000				
KLD	0.043	-0.010	0.013	0.048	1.000			
REPRISK	0.001	-0.007	0.001	-0.016	-0.006	1.000		
SPTC	0.022	-0.003	0.015	0.022	0.021	0.015	1.000	
SUST	0.046	0.009	0.024	0.006	-0.033	0.017	0.012	1.000

Panel E: Correlation of Environmental Performance

	ENF	LAWSUITS	TRI
ENF	1.000		
LAWSUITS	0.095	1.000	
TRI	-0.003	-0.007	1.000

Table 2
Does Environmental Rating Response to Past Environmental Performance?

This Table presents the response of the environmental ratings (*E-RATING*) to the environmental performance (*E-PERFORMANCE*).

$$E\text{-}RATING_{i,t} = \beta\, E\text{-}PERFORMANCE_{i,t-k} + \delta_i + \gamma_t + CONTROLS_{i,t} + \varepsilon_{i,t}$$

where $E\text{-}RATING_{i,t}$ is the environmental ratings of firm *i* including ASSET4, BBG, ISS, IVA, KLD, REPRISK, SPTC, SUST. $E\text{-}PERFORMANCE_{i,t-k}$ is the past *k* year of the environmental performances of firm *i* including ENF, LAWSUITS, and TRI. The regression includes the SIC-2 digits industry fixed effect (δ_i) and the year fixed effect (γ_t). $CONTROLS_{i,t}$ are 14 firm characteristics. Panel A and B show the response of the environmental rating to the past one-year environmental performance without a control variable in Panel A and with control variables in Panel B. Panel C and D show the response of the environmental rating to the past five-year environmental performance with no control variable in Panel C and with control variables in Panel D. ***, ** and * show the statistical significance at 99%, 95% and 90% correspondingly. Reported numbers are coefficients β and their two-way clustered standard errors by firm and year in parentheses. Both coefficients and their standard errors are bold when an environmental rating improves (worsens) significantly after an improving (worsening) of the past environmental performance.

Panel A: One Year No Controls

	ASSET4	BBG	ISS	IVA	KLD	REPRISK	SPTC	SUST
ENF	0.010	**-0.019***	**-0.032*****	-0.004	0.010	**0.032****	0.000	-0.017
	(0.008)	**(0.011)**	**(0.009)**	(0.015)	(0.009)	**(0.014)**	(0.011)	(0.012)
N	11,921	10,991	9,470	20,244	28,769	11,798	19,404	7,598
R2	0.77%	0.85%	1.03%	0.30%	0.43%	0.77%	0.54%	0.78%
LAWSUITS	0.000	0.006	0.008	0.016	-0.010	0.000	-0.008	0.020
	(0.014)	(0.015)	(0.022)	(0.016)	(0.010)	(0.016)	(0.016)	(0.014)
N	11,921	10,991	9,470	20,244	28,769	11,798	19,404	7,598
R2	0.77%	0.83%	0.99%	0.31%	0.42%	0.70%	0.55%	0.78%
TRI	0.007	-0.011	0.010	0.010	-0.005	**0.032****	0.002	0.063***
	(0.017)	(0.021)	(0.016)	(0.015)	(0.009)	**(0.015)**	(0.015)	(0.018)
N	3,997	3,598	2,520	4,746	6,828	2,190	4,774	2,480
R2	1.86%	1.46%	2.83%	1.30%	1.26%	3.12%	1.28%	2.23%

Panel B: One Year With Controls

	ASSET4	BBG	ISS	IVA	KLD	REPRISK	SPTC	SUST
ENF	0.008	**-0.020***	**-0.034*****	-0.003	0.010	**0.031****	-0.002	-0.019
	(0.008)	**(0.011)**	**(0.009)**	(0.015)	(0.009)	**(0.014)**	(0.011)	(0.013)
N	11,921	10,991	9,470	20,244	28,769	11,798	19,404	7,598
R2	1.05%	0.94%	1.26%	0.37%	0.47%	0.91%	0.65%	0.93%
LAWSUITS	-0.002	0.005	0.005	0.017	-0.010	0.000	-0.010	0.019
	(0.013)	(0.015)	(0.023)	(0.016)	(0.011)	(0.017)	(0.015)	(0.014)
N	11,921	10,991	9,470	20,244	28,769	11,798	19,404	7,598
R2	1.05%	0.92%	1.21%	0.38%	0.47%	0.85%	0.65%	0.92%
TRI	0.008	-0.013	0.007	0.010	-0.005	**0.032****	0.002	0.060***
	(0.017)	(0.021)	(0.015)	(0.015)	(0.009)	**(0.015)**	(0.015)	(0.018)
N	3,997	3,598	2,520	4,746	6,828	2,190	4,774	2,480
R2	2.75%	1.78%	3.72%	1.48%	1.38%	3.57%	1.53%	2.47%

Panel C: Five Years No Controls

	ASSET4	BBG	ISS	IVA	KLD	REPRISK	SPTC	SUST
ENF	0.002	-0.001	-0.009	0.000	0.002	**0.007***	-0.002	-0.003
	(0.003)	(0.003)	(0.006)	(0.003)	(0.003)	**(0.004)**	(0.003)	(0.003)
N	11,513	10,569	9,197	18,982	27,101	10,806	18,299	7,393
R2	0.79%	0.84%	1.02%	0.35%	0.41%	0.76%	0.59%	0.78%
LAWSUITS	-0.003	0.006	-0.007	0.000	0.001	0.000	0.003	0.006
	(0.005)	(0.008)	(0.012)	(0.008)	(0.003)	(0.008)	(0.006)	(0.007)
N	11,513	10,569	9,197	18,982	27,101	10,806	18,299	7,393
R2	0.78%	0.85%	0.97%	0.35%	0.40%	0.71%	0.58%	0.78%
TRI	0.068	-0.035	-0.050	-0.006	**-0.042****	**0.059***	-0.012	0.102*
	(0.046)	(0.047)	(0.059)	(0.029)	**(0.021)**	**(0.032)**	(0.035)	(0.053)
N	3,784	3,413	2,407	4,476	5,948	2,000	4,502	2,383
R2	1.94%	1.36%	2.73%	1.41%	1.53%	3.63%	1.38%	1.85%

Panel D: Five Years With Controls

	ASSET4	BBG	ISS	IVA	KLD	REPRISK	SPTC	SUST
ENF	0.001	-0.001	-0.010	0.000	0.002	0.000	-0.003	-0.004
	(0.002)	(0.003)	(0.007)	(0.003)	(0.003)	(0.004)	(0.003)	(0.004)
N	11,513	10,569	9,197	18,982	27,101	10,806	18,299	7,393
R2	1.07%	0.92%	1.24%	0.41%	0.46%	0.90%	0.71%	0.93%
LAWSUITS	-0.005	0.005	-0.008	0.001	0.001	0.000	0.002	0.005
	(0.005)	(0.008)	(0.012)	(0.007)	(0.003)	(0.008)	(0.006)	(0.006)
N	11,513	10,569	9,197	18,982	27,101	10,806	18,299	7,393
R2	1.07%	0.92%	1.18%	0.41%	0.46%	0.86%	0.71%	0.93%
TRI	0.066	-0.041	-0.059	-0.008	**-0.043****	0.000	-0.014	0.096*
	(0.045)	(0.047)	(0.056)	(0.030)	**(0.020)**	(0.036)	(0.035)	(0.053)
N	3,784	3,413	2,407	4,476	5,948	2,000	4,502	2,383
R2	2.82%	1.67%	3.75%	1.63%	1.71%	4.06%	1.65%	2.18%

Table 3
Does Environmental Rating Predict Future Environmental Performance?

This Table presents the predictability of environmental ratings ($E\text{-}RATING_{i,t}$) on future environmental performance ($E\text{-}PERFORMANCE_{i,t+k}$).

$$E\text{-}PERFORMANCE_{i,t+k} = \beta\, E\text{-}RATING_{i,t} + \delta_i + \gamma_{t+k} + CONTROLS_{i,t+k} + \varepsilon_{i,t+k}$$

where $E\text{-}PERFORMANCE_{i,t+k}$ is the firm i's future environmental performance. $E\text{-}RATING_{i,t}$ is the environmental ratings. The regression includes the SIC-2 digits industry fixed effect (δ_i) and the year fixed effect (γ_{t+k}). $CONTROLS_{i,t+k}$ are 14 firm characteristics. Panel A shows the predictive power of environmental rating on the one-year environmental performance (k=1) with no control variable and with 14 control variables. Panel B shows the environmental rating response to the five-year environmental performance (k=5) with no control variable and with 14 control variables. ***, **, and * denote statistical significance at 99%, 95%, and 90% respectively. Reported numbers are estimated coefficients β and their two-way clustered standard errors by firm and year are shown in parentheses. Both coefficients and their standard errors are bold when an improving (worsening) environmental rating predicts future improving (worsening) environmental performance.

Panel A: One Year

	No Controls			With Controls		
	ENF	LAWSUITS	TRI	ENF	LAWSUITS	TRI
ASSET4	-0.006	0.005	0.019	-0.008	0.004	0.019
	(0.005)	(0.004)	(0.019)	(0.005)	(0.004)	(0.019)
N	11,716	11,716	3,694	11,716	11,716	3,694
R2	12.01%	6.05%	1.39%	12.72%	6.84%	1.56%
BBG	0.001	-0.003	0.020	0.001	-0.002	0.019
	(0.006)	(0.004)	(0.017)	(0.006)	(0.004)	(0.017)
N	9,691	9,691	2,904	9,691	9,691	2,904
R2	10.13%	6.29%	1.63%	10.71%	7.09%	1.91%
ISS	**-0.019***	-0.003	-0.035	**-0.019***	-0.003	-0.037
	(0.010)	(0.005)	(0.024)	**(0.010)**	(0.005)	(0.024)
N	7,152	7,152	1,666	7,152	7,152	1,666
R2	12.12%	7.90%	3.88%	12.92%	8.60%	4.42%
IVA	0.008	**-0.006***	-0.008	0.008	**-0.006***	-0.008
	(0.006)	**(0.004)**	(0.017)	(0.006)	**(0.003)**	(0.017)
N	19,119	19,119	4,168	19,119	19,119	4,168
R2	6.41%	4.80%	1.76%	7.69%	5.56%	1.97%
KLD	0.004	-0.002	0.027**	0.004	-0.002	0.027**
	(0.007)	(0.004)	(0.012)	(0.007)	(0.004)	(0.011)
N	27,411	27,411	6,549	27,411	27,411	6,549
R2	7.99%	4.13%	1.11%	9.91%	5.30%	1.38%
REPRISK	0.000	0.000	0.000	0.000	0.000	0.000
	(0.010)	(0.005)	(0.025)	(0.010)	(0.005)	(0.025)
N	11,183	11,183	2,008	11,183	11,183	2,008
R2	6.62%	2.72%	3.35%	8.06%	3.64%	4.15%
SPTC	-0.005	0.002	-0.017	-0.006	0.002	-0.018
	(0.004)	(0.003)	(0.013)	(0.004)	(0.003)	(0.012)
N	18,782	18,782	4,521	18,782	18,782	4,521

R2	8.26%	4.73%	1.10%	9.40%	5.62%	1.38%
SUST	-0.005	-0.004	0.008	-0.006	-0.005	0.007
	(0.007)	(0.006)	(0.021)	(0.007)	(0.007)	(0.020)
N	7,538	7,538	2,237	7,538	7,538	2,237
R2	9.75%	6.39%	2.45%	10.56%	7.16%	3.26%

Panel B: Five Years

	No Controls			With Controls		
	ENF	LAWSUITS	TRI	ENF	LAWSUITS	TRI
ASSET4	-0.048	-0.011	0.031***	-0.049	-0.009	0.030***
	(0.042)	(0.018)	(0.011)	(0.040)	(0.017)	(0.010)
N	6,390	6,390	2,095	6,390	6,390	2,095
R2	25.60%	18.72%	7.28%	26.82%	21.53%	8.56%
BBG	-0.008	-0.027	-0.006	-0.003	-0.024	-0.006
	(0.024)	(0.031)	(0.004)	(0.026)	(0.032)	(0.004)
N	4,772	4,772	1,510	4,772	4,772	1,510
R2	22.86%	17.88%	11.38%	23.57%	19.84%	13.53%
ISS	-0.027	-0.017	0.016	-0.030	-0.020	0.019
	(0.051)	(0.044)	(0.017)	(0.048)	(0.044)	(0.020)
N	2,154	2,154	624	2,154	2,154	624
R2	31.25%	24.30%	12.47%	31.94%	25.60%	16.08%
IVA	0.008	-0.021	-0.001	0.010	-0.018	-0.002
	(0.036)	(0.019)	(0.011)	(0.035)	(0.018)	(0.011)
N	9,490	9,490	2,141	9,490	9,490	2,141
R2	15.06%	16.07%	7.93%	17.55%	18.39%	9.57%
KLD	0.002	-0.001	0.007	0.003	0.000	0.006
	(0.037)	(0.018)	(0.009)	(0.035)	(0.017)	(0.008)
N	22,154	22,154	5,517	22,154	22,154	5,517
R2	16.10%	12.57%	3.47%	19.27%	15.89%	4.00%
REPRISK	0.000	0.000	0.000	0.000	0.000	0.000
	(0.047)	(0.034)	(0.015)	(0.044)	(0.033)	(0.013)
N	6,680	6,680	1,202	6,680	6,680	1,202
R2	15.05%	9.67%	12.71%	17.77%	12.66%	15.01%
SPTC	-0.017	0.004	0.005	-0.016	0.004	0.004
	(0.027)	(0.016)	(0.010)	(0.027)	(0.016)	(0.010)
N	9,635	9,635	2,484	9,635	9,635	2,484
R2	18.55%	15.53%	6.70%	20.32%	18.35%	8.02%
SUST	**-0.015****	-0.008	0.013	**-0.024****	-0.013	0.013
	(0.006)	(0.008)	(0.011)	**(0.012)**	(0.009)	(0.012)
N	4,517	4,517	1,286	4,517	4,517	1,286
R2	21.25%	18.65%	11.98%	22.37%	20.82%	14.14%

Table 4
Worst Environmental Rating Downgrade and Future Environmental Performance

This Table presents the predictability of being in the bottom decile in the environmental rating change on future environmental performance.

$$E\text{-}PERFORMANCE_{i,t+k} = \beta\, WORST\text{-}DOWNGRADE_{i,t} + \delta_i + \gamma_{t+k} + CONTROLS_{i,t+k} + \varepsilon_{i,t+k}$$

where $E\text{-}PERFORMANCE_{i,t+k}$ is the firm i's future environmental performance. $WORST\text{-}DOWNGRADE_{i,t}$ is an indicator variable which is 1 if a firm i's is in the bottom decile in the environmental rating change and zero otherwise. The regression includes the SIC-2 digits industry fixed effect (δ_i) and the year fixed effect (γ_{t+k}). $CONTROLS_{i,t+k}$ are 14 firm characteristics. Panel A shows the predictability over one year with no control variable and with control variables. Panel B shows the predictability over five years with no control variable and with control variables. ***, **, and * show the statistical significance at 99%, 95%, and 90% correspondingly. The coefficients and their two-way clustered standard errors by firm and year in parentheses are bold when being in the bottom decile in the change in environmental rating significantly associates with the worsening in the future environmental performance.

Panel A: One Year

	No Controls			With Controls		
	ENF	LAWSUITS	TRI	ENF	LAWSUITS	TRI
ASSET4	0.004	0.001	-0.011	0.002	-0.001	-0.011
	(0.007)	(0.009)	(0.012)	(0.007)	(0.008)	(0.012)
N	9,957	9,957	3,270	9,957	9,957	3,270
R2	12.44%	6.37%	1.62%	13.12%	7.19%	1.79%
BBG	-0.001	0.002	0.005	-0.007	-0.003	0.009
	(0.008)	(0.007)	(0.021)	(0.008)	(0.008)	(0.023)
N	8,457	8,457	2,567	8,457	8,457	2,567
R2	10.23%	6.26%	2.15%	10.82%	6.98%	2.51%
ISS	0.011	0.008	0.001	0.009	0.006	0.003
	(0.010)	(0.012)	(0.039)	(0.010)	(0.011)	(0.038)
N	4,992	4,992	1,226	4,992	4,992	1,226
R2	14.09%	8.97%	3.39%	14.69%	9.55%	4.3%
IVA	-0.001	0.005	-0.009	-0.005	0.003	-0.008
	(0.005)	(0.005)	(0.013)	(0.004)	(0.004)	(0.013)
N	16,079	16,079	3,601	16,079	16,079	3,601
R2	6.71%	4.76%	1.62%	7.92%	5.59%	1.8%
KLD	**0.060*** **	**0.026*** **	-0.02	**0.043*** **	0.016	-0.017
	(0.015)	**(0.010)**	(0.013)	**(0.015)**	(0.010)	(0.013)
N	23,475	23,475	5,877	23,475	23,475	5,877
R2	8.82%	4.89%	1.21%	10.5%	5.97%	1.5%
REPRISK	0.034***	0.013**	0.000	0.023**	0.000	0.000
	(0.011)	(0.006)	(0.024)	(0.011)	(0.006)	(0.025)
N	10,410	10,410	1,865	10,410	10,410	1,865
R2	7%	2.96%	3.57%	8.28%	3.78%	4.72%
SPTC	0.014	0.020**	-0.014	0.01	0.016**	-0.015
	(0.010)	(0.008)	(0.016)	(0.009)	(0.007)	(0.016)
N	16,084	16,084	4,016	16,084	16,084	4,016
R2	8.3%	5.15%	1.26%	9.32%	6.07%	1.48%

SUST	**0.022***	**2.601*****	0.035*	0.016	**0.009****	**0.037***
	(0.011)	**(0.005)**	(0.021)	(0.011)	**(0.004)**	**(0.022)**
N	6,480	6,480	1,950	6,480	6,480	1,950
R2	9.95%	6.44%	2.5%	10.74%	7.1%	3.21%

Panel B: Five Years

	No Controls			With Controls		
	ENF	LAWSUITS	TRI	ENF	LAWSUITS	TRI
ASSET4	0.026	-0.017	-0.009	0.025	-0.017	-0.009
	(0.044)	(0.018)	(0.009)	(0.044)	(0.017)	(0.009)
N	5,361	5,361	1,801	5,361	5,361	1,801
R2	26.83%	19.35%	8.41%	28.03%	22.32%	10.24%
BBG	-0.027	0.03	-0.012	-0.052	0.011	-0.006
	(0.036)	(0.033)	(0.009)	(0.034)	(0.033)	(0.009)
N	3,919	3,919	1,241	3,919	3,919	1,241
R2	23.57%	18.12%	13.61%	24.49%	19.81%	15.48%
ISS	-0.021	**0.062****	-0.019	-0.03	**0.057*****	-0.019
	(0.038)	**(0.027)**	(0.017)	(0.037)	**(0.022)**	(0.015)
N	1,610	1,610	444	1,610	1,610	444
R2	32.82%	25.58%	14.31%	33.49%	26.7%	18.56%
IVA	0.031	0.025	0.012	0.001	0.009	0.015
	(0.039)	(0.015)	(0.014)	(0.019)	(0.008)	(0.012)
N	7,451	7,451	1,712	7,451	7,451	1,712
R2	15.81%	16.73%	8.65%	18.13%	18.97%	10.11%
KLD	**0.293*****	**0.152*****	-0.004	**0.209*****	**0.103*****	-0.003
	(0.065)	**(0.031)**	(0.007)	**(0.064)**	**(0.030)**	(0.007)
N	19,191	19,191	4,985	19,191	19,191	4,985
R2	17.72%	14.2%	3.85%	20.46%	17.2%	4.43%
REPRISK	0.162***	0.096***	0.000	0.097**	0.070**	0.000
	(0.055)	(0.035)	(0.014)	(0.048)	(0.032)	(0.014)
N	5,988	5,988	1,074	5,988	5,988	1,074
R2	15.51%	10.74%	13.12%	17.91%	13.15%	15.48%
SPTC	0.102*	0.092***	-0.015	0.084*	0.077***	-0.015
	(0.054)	(0.031)	(0.009)	(0.050)	(0.029)	(0.010)
N	7,665	7,665	2,207	7,665	7,665	2,207
R2	20.18%	16.13%	7.69%	21.66%	19.03%	9.16%
SUST	**0.047***	0.016	-0.002	0.035	0.013	-0.001
	(0.024)	(0.018)	(0.013)	(0.025)	(0.017)	(0.015)
N	3,664	3,664	1,051	3,664	3,664	1,051
R2	23.05%	18.4%	12.7%	24.16%	20.37%	14.61%

Table 5
Best Environmental Rating Upgrade and Future Environmental Performance

This Table presents the predictability of being in the top decile in the environmental rating change on future environmental performance.

$$E\text{-}PERFORMANCE_{i,t+k} = \beta\, BEST\text{-}UPGRADE_{i,t} + \delta_i + \gamma_{t+k} + CONTROLS_{i,t+k} + \varepsilon_{i,t+k}$$

where $E\text{-}PERFORMANCE_{i,t+k}$ is the firm i's future environmental performance. $BEST\text{-}UPGRADE_{i,t}$ is an indicator variable which is 1 if a firm i's is in the top decile in the environmental rating change and zero otherwise. The regression includes the SIC-2 digits industry fixed effect (δ_i) and the year fixed effect (γ_{t+k}). $CONTROLS_{i,t+k}$ are 14 firm characteristics. Panel A shows the predictability over one year with no control variable and with control variables. Panel B shows the predictability over five years with no control variable and with control variables. ***, **, and * show the statistical significance at 99%, 95%, and 90% correspondingly. The coefficients and their two-way clustered standard errors by firm and year in parentheses are bold when being in the top decile in the change in environmental rating significantly associates with an improvement in the future environmental performance.

Panel A: One Year

	No Controls			With Controls		
	ENF	LAWSUITS	TRI	ENF	LAWSUITS	TRI
ASSET4	-0.004	-0.006	0.001	-0.004	-0.006	0.000
	(0.007)	(0.006)	(0.010)	(0.008)	(0.006)	(0.010)
N	9,957	9,957	3,270	9,957	9,957	3,270
R2	12.44%	6.38%	1.61%	13.12%	7.2%	1.78%
BBG	0.01	0.013*	**-0.021****	0.009	0.012*	**-0.021****
	(0.013)	(0.007)	**(0.009)**	(0.013)	(0.007)	**(0.009)**
N	8,457	8,457	2,567	8,457	8,457	2,567
R2	10.25%	6.32%	2.21%	10.83%	7.02%	2.55%
ISS	-0.001	-0.004	-0.002	-0.004	-0.006	-0.004
	(0.010)	(0.004)	(0.025)	(0.011)	(0.005)	(0.025)
N	4,992	4,992	1,226	4,992	4,992	1,226
R2	14.07%	8.96%	3.39%	14.68%	9.55%	4.3%
IVA	-0.003	0.000	**-0.042*****	-0.007	-0.002	**-0.041*****
	(0.005)	(0.008)	**(0.010)**	(0.005)	(0.006)	**(0.010)**
N	16,079	16,079	3,601	16,079	16,079	3,601
R2	6.71%	4.74%	1.78%	7.93%	5.59%	1.96%
KLD	0.065***	0.027**	0.011	0.045***	0.015	0.015
	(0.012)	(0.011)	(0.013)	(0.010)	(0.010)	(0.013)
N	23,475	23,475	5,877	23,475	23,475	5,877
R2	8.88%	4.9%	1.19%	10.52%	5.97%	1.5%
REPRISK	0.034***	0.013**	0.000	0.023**	0.000	0.000
	(0.011)	(0.006)	(0.024)	(0.011)	(0.006)	(0.025)
N	10,410	10,410	1,865	10,410	10,410	1,865
R2	7%	2.96%	3.57%	8.28%	3.78%	4.72%
SPTC	0.014	0.020**	-0.014	0.01	0.016**	-0.015
	(0.010)	(0.008)	(0.016)	(0.009)	(0.007)	(0.016)
N	16,084	16,084	4,016	16,084	16,084	4,016

R2	8.3%	5.15%	1.26%	9.32%	6.07%	1.48%
SUST	0.013	-0.001	-0.012	0.01	-0.004	-0.013
	(0.015)	(0.010)	(0.031)	(0.013)	(0.010)	(0.031)
N	6,480	6,480	1,950	6,480	6,480	1,950
R2	9.89%	6.39%	2.37%	10.7%	7.08%	3.06%

Panel B: Five Years

	No Controls			With Controls		
	ENF	LAWSUITS	TRI	ENF	LAWSUITS	TRI
ASSET4	-0.016	-0.015	0.017*	-0.007	-0.014	0.017*
	(0.035)	(0.015)	(0.010)	(0.036)	(0.015)	(0.009)
N	5,361	5,361	1,801	5,361	5,361	1,801
R2	26.83%	19.35%	8.49%	28.02%	22.31%	10.35%
BBG	-0.012	0.029	-0.01	-0.018	0.016	-0.006
	(0.051)	(0.032)	(0.006)	(0.049)	(0.032)	(0.004)
N	3,919	3,919	1,241	3,919	3,919	1,241
R2	23.56%	18.12%	13.6%	24.46%	19.81%	15.48%
ISS	0.012	0.009	**-0.038*** **	0.006	-0.001	**-0.036** **
	(0.048)	(0.028)	**(0.013)**	(0.057)	(0.022)	**(0.017)**
N	1,610	1,610	444	1,610	1,610	444
R2	32.81%	25.46%	14.82%	33.48%	26.59%	18.97%
IVA	0.001	0.007	0.005	-0.032	-0.01	0.008
	(0.024)	(0.038)	(0.010)	(0.020)	(0.024)	(0.011)
N	7,451	7,451	1,712	7,451	7,451	1,712
R2	15.8%	16.7%	8.59%	18.15%	18.97%	10.03%
KLD	0.307***	0.192***	0.004	0.206***	0.133***	0.008
	(0.053)	(0.038)	(0.008)	(0.041)	(0.032)	(0.008)
N	19,191	19,191	4,985	19,191	19,191	4,985
R2	17.78%	14.48%	3.85%	20.46%	17.34%	4.45%
REPRISK	0.162***	0.096***	0.000	0.097**	0.070**	0.000
	(0.055)	(0.035)	(0.014)	(0.048)	(0.032)	(0.014)
N	5,988	5,988	1,074	5,988	5,988	1,074
R2	15.51%	10.74%	13.12%	17.91%	13.15%	15.48%
SPTC	0.102*	0.092***	-0.015	0.084*	0.077***	-0.015
	(0.054)	(0.031)	(0.009)	(0.050)	(0.029)	(0.010)
N	7,665	7,665	2,207	7,665	7,665	2,207
R2	20.18%	16.13%	7.69%	21.66%	19.03%	9.16%
SUST	0.076**	0.028**	0.014	0.047*	0.004	0.013**
	(0.033)	(0.013)	(0.010)	(0.027)	(0.014)	(0.006)
N	3,664	3,664	1,051	3,664	3,664	1,051
R2	23.1%	18.43%	12.77%	24.17%	20.36%	14.68%

Table 6
Polluter and Future Environmental Performance

This Table presents the impact of being a polluter on the future environmental performance.

$$E\text{-}PERFORMANCE_{i,t+k} = \beta_1 POLLUTER_{i,t} + \beta_2 E\text{-}RATING_{i,t} + \beta_3 POLLUTER_{i,t} * E\text{-}RATING_{i,t} + \delta_i + \gamma_{t+k} + CONTROLS_{i,t+k} + \varepsilon_{i,t+k}$$

Where $E\text{-}PERFORMANCE_{i,t+k}$ is the future environmental performance. $POLLUTER_{i,t}$ is an indicator variable which is one if a firm has been subject to the EPA enforcement case prior to time t and zero otherwise. The regression includes the SIC-2 digits industry fixed effect (δ_i) and the year fixed effect (γ_{t+k}). $CONTROLS_{i,t+k}$ are 14 firm characteristics. Panel A show the predictability of the polluter on the future one-year EPA enforcement, lawsuits, and the chemical toxic release inventory (TRI), while Panel B presents the results of the environmental performance predictability over the five-year period. ***, ** and * show the statistical significance at 99%, 95% and 90% correspondingly. The coefficients β_1, β_3, and their two-way clustered standard errors by firm and year in parentheses are bold when being a polluter significantly predicts the worsening of future environmental performance.

	One Year with Controls			Five Years with Controls		
	ENF	LAWSUITS	TRI	ENF	LAWSUITS	TRI
POLLUTER	**0.171*** **	**0.031*** **	0.016	**0.947*** **	**0.194*** **	-0.022
	(0.029)	**(0.008)**	(0.023)	**(0.116)**	**(0.051)**	(0.023)
ASSET4	0.007*	0.012*	0.007	-0.010	0.034	-0.019
	(0.004)	(0.007)	(0.045)	(0.056)	(0.033)	(0.030)
POLLUTER*ASSET4	-0.029	-0.005	-0.004	-0.037	-0.053	0.053
	(0.024)	(0.014)	(0.046)	(0.097)	(0.058)	(0.034)
N	5,922	5,922	2,500	3,245	3,245	1,416
R2	21.09%	11.43%	2.60%	40.61%	30.95%	10.34%
POLLUTER	**0.133*** **	0.028	0.005	**0.810*** **	**0.101***	-0.017
	(0.028)	(0.020)	(0.039)	**(0.119)**	**(0.053)**	(0.027)
BBG	-0.001	0.002	0.010	0.063**	-0.035	-0.036
	(0.007)	(0.004)	(0.042)	(0.027)	(0.030)	(0.030)
POLLUTER*BBG	0.000	-0.013	0.013	**-0.076***	0.020	0.026
	(0.012)	(0.020)	(0.057)	**(0.046)**	(0.050)	(0.040)
N	5,039	5,039	2,021	2,476	2,476	1,041
R2	19.30%	9.39%	2.61%	38.44%	26.80%	14.15%
POLLUTER	**0.157*** **	**0.034** **	0.067	**0.849*** **	**0.294*** **	-0.038
	(0.046)	**(0.017)**	(0.045)	**(0.182)**	**(0.078)**	(0.043)
ISS	0.002	-0.001	0.041	-0.024	0.040	-0.047
	(0.007)	(0.006)	(0.055)	(0.055)	(0.026)	(0.057)
POLLUTER*ISS	-0.059	-0.007	-0.075	-0.010	-0.156	0.076
	(0.049)	(0.018)	(0.072)	(0.123)	(0.117)	(0.069)
N	3,893	3,893	1,207	1,229	1,229	466
R2	21.98%	12.38%	4.18%	43.90%	37.71%	14.60%
POLLUTER	**0.099*** **	**0.026** **	0.019	**0.640*** **	**0.165*** **	0.004
	(0.019)	**(0.011)**	(0.020)	**(0.078)**	**(0.034)**	(0.021)
IVA	-0.001	-0.002	0.000	-0.027*	0.000	-0.028
	(0.003)	(0.002)	(0.028)	(0.015)	(0.012)	(0.025)
POLLUTER*IVA	0.057*	-0.005	0.003	0.152	**-0.077***	0.038

	(0.030)	(0.019)	(0.033)	(0.154)	**(0.044)**	(0.032)
N	10,097	10,097	2,865	4,951	4,951	1,485
R2	17.04%	8.45%	2.06%	34.91%	24.15%	9.58%
POLLUTER	**0.198*** **	**0.050*** **	0.004	**1.000*** **	**0.262*** **	0.007
	(0.026)	**(0.018)**	(0.018)	**(0.117)**	**(0.063)**	(0.011)
KLD	0.008*	-0.003	0.046**	0.028	0.000	0.014
	(0.004)	(0.005)	(0.018)	(0.020)	(0.012)	(0.013)
POLLUTER*KLD	-0.033	-0.010	-0.008	-0.174	-0.073	0.000
	(0.037)	(0.023)	(0.031)	(0.149)	(0.073)	(0.015)
N	14,692	14,692	4,544	11,703	11,703	3,874
R2	20.72%	7.97%	1.36%	37.84%	21.08%	3.69%
POLLUTER	**0.120*** **	**0.045** **	0.000	**0.679*** **	**0.119** **	0.000
	(0.036)	**(0.020)**	(0.038)	**(0.155)**	**(0.049)**	(0.030)
REPRISK	0.000	0.000	-0.068*	0.000	0.000	0.000
	(0.006)	(0.003)	(0.040)	(0.034)	(0.018)	(0.031)
POLLUTER*REPRISK	0.000	-0.043*	0.000	0.000	0.000	0.000
	(0.063)	(0.025)	(0.070)	(0.219)	(0.089)	(0.044)
N	5,737	5,737	1,322	3,367	3,367	798
R2	16.68%	4.94%	4.49%	34.86%	12.91%	18.14%
POLLUTER	**0.150*** **	**0.026** **	**0.060*** **	**0.846*** **	**0.126*** **	0.026
	(0.024)	**(0.011)**	**(0.017)**	**(0.126)**	**(0.042)**	(0.017)
SPTC	0.001	0.002	0.014	0.006	-0.005	0.017
	(0.004)	(0.003)	(0.018)	(0.021)	(0.017)	(0.020)
POLLUTER*SPTC	-0.009	-0.001	-0.063**	-0.060	0.003	-0.002
	(0.026)	(0.015)	(0.030)	(0.117)	(0.057)	(0.025)
N	9,815	9,815	3,130	4,918	4,918	1,735
R2	19.58%	8.11%	2.23%	38.35%	23.83%	8.54%
POLLUTER	**0.170*** **	**0.046** **	0.024	**0.951*** **	**0.194*** **	**0.046** **
	(0.029)	**(0.023)**	(0.022)	**(0.131)**	**(0.050)**	**(0.022)**
SUST	0.001	0.006	-0.009	0.017	0.030	0.044*
	(0.007)	(0.005)	(0.031)	(0.029)	(0.019)	(0.023)
POLLUTER*SUST	**-0.035***	-0.030	-0.003	**-0.204*** **	-0.061	**-0.042***
	(0.018)	(0.021)	(0.040)	**(0.078)**	(0.057)	**(0.025)**
N	3,968	3,968	1,571	2,343	2,343	897
R2	20.20%	9.26%	4.45%	38.01%	27.67%	12.96%

Table 7
Information and Environmental Performance Predictability

This Table presents the impact of information on the future environmental ratings.

$$E\text{-}PERFORMANCE_{i,t+k} = \beta_1 INFO_{i,t} + \beta_2 E\text{-}RATING_{i,t} + \beta_3 INFO_{i,t} * E\text{-}RATING_{i,t} + \delta_i + \gamma_{t+k} + CONTROLS_{i,t+k} + \varepsilon_{i,t+k}$$

where $E\text{-}PERFORMANCE_{i,t+k}$ is the future environmental performance. $INFO_{i,t}$ is a proxy of information demand and information supply. The natural logarithm of total asset (SIZE) is a proxy for the information supply. The institutional ownership (IO) is a proxy for the information demand. The regression includes the SIC-2 digits industry fixed effect (δ_i) and the year fixed effect (γ_t). $CONTROLS_{i,t+k}$ are 14 firm characteristics. Panel A, B, and C show the predictability of the polluter on the future one year EPA enforcement, lawsuits, and the chemical toxic release inventory (TRI), while panel D, E, and F present the predictability over the five-year period. ***, ** and * show the statistical significance at 99%, 95% and 90% correspondingly. The coefficients and their two-way clustered standard errors by firm and year in parentheses are bold when an information supply or demand significantly increases the ability of the environmental rating in predicting future environmental performance.

	One Year with Controls			Five Years with Controls		
	ENF	LAWSUITS	TRI	ENF	LAWSUITS	TRI
ASSET4*SIZE	-0.045	0.055	0.168	-0.022	0.198	-0.132
	(0.049)	(0.036)	(0.192)	(0.376)	(0.341)	(0.143)
ASSET4*IO	0.019	0.031	0.007	-0.273	-0.111	0.178
	(0.064)	(0.027)	(0.213)	(0.363)	(0.136)	(0.147)
BBG*SIZE	-0.018	0.006	-0.187	-0.710***	-0.291	0.029
	(0.053)	(0.010)	(0.263)	(0.245)	(0.195)	(0.140)
BBG*IO	-0.069***	-0.029	-0.129	-0.441***	-0.092	-0.058
	(0.024)	(0.024)	(0.125)	(0.068)	(0.117)	(0.080)
ISS*SIZE	-0.105	-0.031	-0.099	-0.404	-0.261	0.227
	(0.068)	(0.047)	(0.281)	(0.503)	(0.211)	(0.339)
ISS*IO	0.016	-0.015	0.151	0.368	0.126	-0.246*
	(0.077)	(0.049)	(0.348)	(1.144)	(0.343)	(0.145)
IVA*SIZE	0.073	-0.024	-0.026	0.429	-0.173	0.042
	(0.053)	(0.037)	(0.110)	(0.341)	(0.113)	(0.055)
IVA*IO	0.046	-0.006	-0.067	0.202	0.090	-0.065
	(0.036)	(0.030)	(0.165)	(0.241)	(0.097)	(0.115)
KLD*SIZE	-0.073	-0.043*	-0.043	-0.401	-0.151	-0.081*
	(0.060)	(0.026)	(0.115)	(0.252)	(0.121)	(0.049)
KLD*IO	-0.008	0.060**	-0.094	-0.202	-0.116	-0.010
	(0.046)	(0.029)	(0.123)	(0.171)	(0.092)	(0.085)
REPRISK*SIZE	0.000	0.000	0.000	0.000	0.000	0.000
	(0.079)	(0.031)	(0.198)	(0.304)	(0.155)	(0.132)
REPRISK*IO	0.000	0.000	0.000	0.000	0.000	0.288***
	(0.048)	(0.019)	(0.147)	(0.226)	(0.079)	(0.100)
SPTC*SIZE	0.007	0.000	0.030	-0.061	-0.018	-0.012
	(0.043)	(0.023)	(0.130)	(0.291)	(0.124)	(0.064)
SPTC*IO	0.000	-0.012	-0.259	0.043	-0.021	-0.160

	(0.033)	(0.013)	(0.192)	(0.210)	(0.103)	(0.106)
SUST*SIZE	-0.073	-0.094***	0.087	-0.216	0.052	-0.023
	(0.114)	(0.030)	(0.392)	(0.722)	(0.126)	(0.098)
SUST*IO	-0.045	-0.009	-0.046	-0.327	0.058	0.045
	(0.066)	(0.036)	(0.043)	(0.484)	(0.106)	(0.142)

Table 8
Firm Characteristics and Future Environmental Performance

This Table presents the impact of firm characteristics on the future environmental performance.

$$E\text{-}PERFORMANCE_{i,t+k} = \beta\, CHARACTERISTICS_{i,t} + \delta_i + \gamma_{t+k} + \varepsilon_{i,t+k}$$

where $E\text{-}PERFORMANCE_{i,t+k}$ is the future environmental performance. $CHARACTERISTICS_{i,t}$ is the firm characteristics. The regression includes the SIC-2 digits industry fixed effect (δ_i) and the year fixed effect (γ_{t+k}). ***, ** and * show the statistical significance at 99%, 95% and 90% correspondingly. Reported numbers are the coefficients β and their two-way clustered standard errors by firm and year in parentheses.

	One Year Enforcement	One Year Lawsuits	One Year TRI	Five Year Enforcement	Five Year Lawsuits	Five Year TRI
SIZE	0.054***	0.022***	0.010	0.302***	0.126***	0.012
	(0.005)	(0.003)	(0.017)	(0.029)	(0.014)	(0.019)
ROA	0.006***	0.003***	0.002	0.021**	0.013***	0.010*
	(0.002)	(0.001)	(0.009)	(0.008)	(0.004)	(0.006)
MTB	0.000	-0.001	0.008	0.001	-0.002	0.002
	(0.001)	(0.001)	(0.008)	(0.005)	(0.003)	(0.003)
CASH	-0.003***	-0.002**	0.007	-0.023***	-0.010***	-0.003
	(0.001)	(0.001)	(0.008)	(0.006)	(0.003)	(0.004)
LEV	0.006***	0.003***	-0.007	0.030***	0.018***	-0.002
	(0.001)	(0.001)	(0.008)	(0.007)	(0.003)	(0.006)
CAPX	0.003**	0.002**	-0.003	0.009*	0.008**	0.001
	(0.001)	(0.001)	(0.008)	(0.006)	(0.003)	(0.005)
SALEG	-0.002*	-0.001	-0.003	-0.010*	-0.006***	0.009**
	(0.001)	(0.001)	(0.007)	(0.005)	(0.002)	(0.004)
TANG	0.002	0.002*	0.004	0.015*	0.012***	0.003
	(0.002)	(0.001)	(0.007)	(0.008)	(0.004)	(0.005)
RND	0.000	0.003	-0.011	0.004	0.018*	-0.005
	(0.005)	(0.002)	(0.013)	(0.031)	(0.011)	(0.015)
HHI	0.012***	0.004**	-0.025	0.066***	0.018**	-0.032*
	(0.003)	(0.002)	(0.020)	(0.021)	(0.008)	(0.017)
IO	0.032***	0.009***	0.016	0.207***	0.058***	0.020*
	(0.004)	(0.002)	(0.011)	(0.023)	(0.011)	(0.012)
AMIHUD	0.000	-0.001**	-0.003	-0.008	-0.006**	-0.002
	(0.001)	(0.001)	(0.009)	(0.007)	(0.002)	(0.004)
RETLAG1Y	0.000	0.001**	0.005	-0.004	0.007***	-0.007*
	(0.001)	(0.001)	(0.008)	(0.005)	(0.002)	(0.004)
VOLAT	-0.001	-0.001	-0.009	-0.005	-0.005*	-0.004
	(0.001)	(0.001)	(0.008)	(0.006)	(0.003)	(0.004)
N	175,775	175,775	19,075	125,049	125,049	13,556
R2	4.95%	2.11%	0.64%	11.09%	6.97%	2.23%

APPENDIX

Table A1. Number of Firms in the Environmental Ratings

Panel A presents the number of firms in each environmental rating providers from 1991 to 2020. Panel B presents the number of firms in at least one to eight environmental rating providers from 1991 to 2020.

Panel A: Number of Firms in Each Environmental Ratings

Year	ASSET4	BBG	ISS	IVA	KLD	REPRISK	SPTC	SUST
2020	2,296	1,610	2,553	2,925	0	580	1,232	908
2019	2,987	1,531	2,095	2,988	0	433	2,747	892
2018	2,468	1,428	786	2,879	2,931	485	2,737	846
2017	2,238	1,326	653	2,905	2,615	479	2,802	908
2016	2,006	1,104	607	3,006	2,241	479	2,786	813
2015	1,666	983	609	2,897	2,251	485	1,014	773
2014	1,348	677	568	3,014	2,800	420	1,024	677
2013	1,305	619	440	3,092	2,847	376	1,010	575
2012	1,273	580	149	2,198	2,538	316	914	703
2011	1,239	526	132	523	2,551	289	912	686
2010	1,181	480	117	568	2,684	325	917	639
2009	1,065	419	106	609	2,572	315	928	436
2008	938	361	110	640	2,573	260	914	0
2007	735	0	134	613	2,548	154	912	0
2006	515	0	0	0	2,565	0	919	0
2005	441	0	0	0	2,599	0	915	0
2004	321	0	0	0	2,618	0	0	0
2003	244	0	0	0	2,543	0	0	0
2002	216	0	0	0	953	0	0	0
2001	0	0	0	0	939	0	0	0
2000	0	0	0	0	545	0	0	0
1999	0	0	0	0	541	0	0	0
1998	0	0	0	0	531	0	0	0
1997	0	0	0	0	518	0	0	0
1996	0	0	0	0	515	0	0	0
1995	0	0	0	0	502	0	0	0
1994	0	0	0	0	414	0	0	0
1993	0	0	0	0	413	0	0	0
1992	0	0	0	0	413	0	0	0
1991	0	0	0	0	408	0	0	0

Panel B: Number of Firms in at Least N Environmental Ratings

Year	N=1	N=2	N=3	N=4	N=5	N=6	N=7	N=8
2020	3,671	2,644	2,158	1,631	991	378	64	0
2019	3,960	2,714	2,212	1,759	1,331	845	200	0
2018	3,867	2,518	1,808	1,293	881	600	162	0
2017	3,906	2,527	1,762	1,220	826	533	132	0
2016	3,928	2,531	1,647	1,075	726	467	114	0
2015	3,490	1,813	1,081	791	586	423	104	0
2014	3,543	1,612	893	646	495	355	92	0
2013	3,859	2,561	1,411	774	558	421	304	77
2012	3,495	2,347	1,329	728	541	404	160	24
2011	3,422	1,456	833	602	443	305	128	17
2010	3,450	1,475	830	584	417	291	119	17
2009	3,284	1,443	767	508	346	246	104	18
2008	3,255	1,425	693	388	244	103	19	0
2007	3,202	1,377	581	315	128	21	0	0
2006	2,670	781	179	0	0	0	0	0
2005	2,700	767	148	0	0	0	0	0
2004	2,582	108	0	0	0	0	0	0
2003	2,488	94	0	0	0	0	0	0
2002	944	77	0	0	0	0	0	0
2001	902	0	0	0	0	0	0	0
2000	515	0	0	0	0	0	0	0
1999	509	0	0	0	0	0	0	0
1998	494	0	0	0	0	0	0	0
1997	488	0	0	0	0	0	0	0
1996	484	0	0	0	0	0	0	0
1995	461	0	0	0	0	0	0	0
1994	372	0	0	0	0	0	0	0
1993	367	0	0	0	0	0	0	0
1992	373	0	0	0	0	0	0	0
1991	366	0	0	0	0	0	0	0

Table A2. Could a Stranded Asset risk Polluter Affect Future Environmental Performance?

This Table presents the impact of a stranded asset risk polluter on the future environmental performance.

$$E\text{-}PERFORMANCE_{i,t+k} = \beta_1\, POLLUTER_{i,t} + \beta_2\, E\text{-}RATING_{i,t} + \beta_3\, POLLUTER_{i,t}{*}E\text{-}RATING_{i,t} + \delta_i + \gamma_{t+k} + CONTROLS_{i,t+k} + \varepsilon_{i,t+k}$$

*w*here $E\text{-}PERFORMANCE_{i,t+k}$ is the future one-year environmental performance. $POLLUTER_{i,t}$ is an indicator variable which is one if a firm has a stranded asset risk following Table 10 of Krueger et al (2020) which includes coal producers, unconventional oil producers, conventional oil producers, natural gas producers, iron and steel producers, and conventional electricity producers and zero otherwise. The regression includes the SIC-2 digits industry fixed effect (δ_i) and the year fixed effect (γ_{t+k}). $CONTROLS_{i,t+k}$ are 14 firm characteristics. ***, ** and * show the statistical significance at 99%, 95% and 90% correspondingly. Reported numbers are coefficients and their two-way clustered standard errors by firm and year in parentheses are bold when being a polluter significantly predicts the worsening of future environmental performance. Results of the coefficient β_1 are absorbed by the SIC-2 digits industry fixed effect.

	One Year with Controls		
	ENF	LAWSUITS	TRI
ASSET4	-0.003	0.010*	0.003
	(0.009)	(0.005)	(0.026)
POLLUTER*ASSET4	0.070	0.053	0.223*
	(0.085)	(0.046)	(0.115)
N	5,922	5,922	2,500
R2	15.64%	10.99%	2.59%
BBG	0.000	-0.003	0.018
	(0.014)	(0.006)	(0.018)
POLLUTER*BBG	-0.039***	0.011	-0.024
	(0.015)	(0.138)	(0.071)
N	5,039	5,039	2,021
R2	14.59%	9.05%	2.57%
ISS	-0.019	-0.005	-0.005
	(0.015)	(0.007)	(0.031)
POLLUTER*ISS	-0.151	0.117	-0.416***
	(0.230)	(0.103)	(0.124)
N	3,893	3,893	1,207
R2	17.79%	11.83%	3.89%
IVA	0.015*	-0.003	0.001
	(0.009)	(0.005)	(0.023)
POLLUTER*IVA	-0.071	-0.078	0.110
	(0.119)	(0.133)	(0.189)
N	10,097	10,097	2,865
R2	11.56%	8.00%	1.96%
KLD	0.001	-0.005	0.039***
	(0.011)	(0.006)	(0.014)
POLLUTER*KLD	-0.015	-0.028	0.173**
	(0.041)	(0.118)	(0.068)
N	14,692	14,692	4,544
R2	12.62%	6.79%	1.38%

REPRISK	0.000	0.000	0.000
	(0.015)	(0.004)	(0.032)
POLLUTER*REPRISK	-0.116*	0.000	-0.831***
	(0.060)	(0.023)	(0.037)
N	5,737	5,737	1,322
R2	9.11%	4.23%	4.41%
SPTC	0.000	0.001	-0.021
	(0.007)	(0.004)	(0.015)
POLLUTER*SPTC	-0.112	0.138	-0.148
	(0.118)	(0.089)	(0.217)
N	9,815	9,815	3,130
R2	13.86%	7.72%	1.96%
SUST	-0.012	-0.003	-0.011
	(0.011)	(0.007)	(0.016)
POLLUTER*SUST	0.211	-0.075	0.234***
	(0.239)	(0.151)	(0.005)
N	3,968	3,968	1,571
R2	14.60%	8.61%	4.36%

Table A3. Could a Fossil Fuel Polluter Affect Future Environmental Performance?

This Table presents the impact of a fossil fuel polluter on the future environmental performance.

$$E\text{-}PERFORMANCE_{i,t+k} = \beta_1 POLLUTER_{i,t} + \beta_2 E\text{-}RATING_{i,t} + \beta_3 POLLUTER_{i,t} * E\text{-}RATING_{i,t} + \delta_i + \gamma_{t+k} + CONTROLS_{i,t+k} + \varepsilon_{i,t+k}$$

*w*here $E\text{-}PERFORMANCE_{i,t+k}$ is the future one-year environmental performance. $POLLUTER_{i,t}$ is an indicator variable which is one if a firm is a fossil fuel polluter following Shimbar (2021) which firms in the coal, oil&gas upstream, and oil&gas downstream in standard industrial classification and zero otherwise. The regression includes the SIC-2 digits industry fixed effect (δ_i) and the year fixed effect (γ_{t+k}). $CONTROLS_{i,t+k}$ are 14 firm characteristics. ***, ** and * show the statistical significance at 99%, 95% and 90% correspondingly. Reported numbers are coefficients and their two-way clustered standard errors by firm and year in parentheses are bold when being a polluter significantly predicts the worsening of future environmental performance. Results of the coefficient β_1 are absorbed by the SIC-2 digits industry fixed effect.

	One Year with Controls		
	ENF	LAWSUITS	TRI
ASSET4	-0.006	0.007	0.004
	(0.010)	(0.005)	(0.025)
POLLUTER*ASSET4	0.123	0.121**	0.029
	(0.091)	(0.047)	(0.084)
N	5,922	5,922	2,500
R2	15.72%	11.20%	2.56%
BBG	-0.001	-0.006	0.016
	(0.009)	(0.007)	(0.017)
POLLUTER*BBG	0.055	0.147**	0.108
	(0.100)	(0.070)	(0.077)
N	5,039	5,039	2,021
R2	14.59%	9.24%	2.61%
ISS	-0.021	-0.005	-0.007
	(0.013)	(0.007)	(0.029)
POLLUTER*ISS	0.045	0.082	0.025
	(0.166)	(0.113)	(0.118)
N	3,893	3,893	1,207
R2	17.76%	11.86%	3.85%
IVA	0.011	-0.006	0.003
	(0.008)	(0.005)	(0.023)
POLLUTER*IVA	0.210*	0.146*	-0.048
	(0.113)	(0.083)	(0.062)
N	10,097	10,097	2,865
R2	11.83%	8.32%	1.97%
KLD	-0.003	-0.006	0.044***
	(0.011)	(0.006)	(0.016)
POLLUTER*KLD	0.166**	0.058	-0.049
	(0.077)	(0.058)	(0.046)
N	14,692	14,692	4,544
R2	12.75%	6.83%	1.37%

REPRISK	0.000	-0.007*	0.000
	(0.015)	(0.004)	(0.028)
POLLUTER*REPRISK	0.000	0.000	-0.366***
	(0.031)	(0.041)	(0.054)
N	5,737	5,737	1,322
R2	9.07%	4.24%	4.39%
SPTC	-0.004	0.000	-0.017
	(0.007)	(0.004)	(0.015)
POLLUTER*SPTC	0.135*	0.120*	-0.141*
	(0.081)	(0.068)	(0.080)
N	9,815	9,815	3,130
R2	13.97%	7.92%	2.12%
SUST	-0.016	-0.005	-0.010
	(0.011)	(0.008)	(0.016)
POLLUTER*SUST	0.333***	0.079***	-0.039
	(0.100)	(0.031)	(0.070)
N	3,968	3,968	1,571
R2	14.97%	8.65%	4.34%