Sustainability or Greenwashing: Evidence from the Asset Market for Industrial Pollution*

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Abstract

This paper studies the divestiture market for pollutive industrial plants. We find that firms divest pollutive plants following scrutinized environmental risk incidents. Following these divestitures, however, total pollution levels at the sold plants do not decline, and per-employee pollution levels increase. The buyers of pollutive plants tend to be private, non-ESG-rated, and with supply chain relationships or joint ventures with the sellers. After divesting, the sellers earn higher environmental, social, and governance (ESG) ratings, reduce regulatory compliance costs, and improve their access to government resources. Overall, the evidence suggests that the asset market allows firms to redraw their boundaries in a manner perceived as environmentally friendly without real consequences for pollution levels or production processes and with substantial gains from trade.

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1 Introduction

A growing trend in corporate finance, a result of pressure from activists, regulators, and governments, is the divestment of polluting assets. A recent article in the Economist, for example, reports that: "the West's six biggest oil companies have shed $44bn of mostly fossil-fuel assets since the start of 2018."[1] Consistent with this trend, Figure 1 shows that the average value of divestitures of polluting assets has increased considerably since 2015.

While this trend reflects mounting concerns about climate change, it has raised the question of how effective such divestments are. On the one hand, Environmental, Social, and Governance (ESG) supporters can point to successful pressures that have encouraged many firms to sell off dirty assets. On the other hand, as a recent article by James Mackintosh in the Wall Street Journal concludes: "Sadly, selling off assets or shares by itself does nothing to save the planet, because someone else bought them."[2] This view further raises concerns that the divestment of polluting assets is a "greenwashing" strategy through which firms convey a false impression that they are more environmentally sound. Indeed, as Figure 2 shows, attention to "greenwashing" has risen more than eight-fold since 2004 based on Google Trends.

In this paper, we aim to shed new light on this question by studying the reallocation of industrial pollution through acquisitions and sales of divested assets in the real asset market. Specifically, we examine what triggers the divestitures of pollutive assets, how toxic releases change around the transfer of ownership, who acquires pollutive assets, and how sellers can benefit from those transactions. The goal of these analyses is to help unveil the motives and economic forces behind the movement to divest pollution.

We consider two possibilities. The first possibility is that divestitures of pollutive assets reallocate assets to owners most capable of treating pollution (Jovanovic and Rousseau 2002). Under this view, the divested assets will generate less toxic release after the transfer of ownership. The second possibility is that divestitures of pollutive assets respond to external environmental pressures by transferring ownership from firms

[1] "Who buys the dirty energy assets public companies no longer want?" The Economist, February 12th, 2022 edition.

[2] "Why the Sustainable Investment Craze Is Flawed?" The Wall Street Journal, January 23rd, 2022.

that face stronger pressures to firms that face weaker pressures (or are better at addressing them). Under this view, divestitures allow sellers to enjoy disproportionate benefits by offloading pollutive assets to less scrutinized firms without having an impact on toxic release levels - a view typically labelled as "greenwashing."

To evaluate these issues, we compile a novel dataset of 719 divestitures of pollutive plants from 2000 to 2020, and investigate their determinants and consequences across buyers and sellers. We hand-collect and merge data from several databases, including divestiture data from the Securities Data Company (SDC) database, plants' toxic release levels from the Environmental Protection Agency's (EPA) Toxic Release Inventory (TRI) database, plant-level employment data from the National Establishment Time-Series (NETS) database, ESG ratings from the Kinder, Lydenberg, and Domini (KLD) company, Refinitive and MSCI. ESG-related incidents from Factset's RepRisk ESG Business Intelligence database, U.S. federal government procurement contract-level data from the Federal Procurement Data System (FPDS), and supply-chain and joint ventures information from the Compustat Segment, Factset, and SDC databases.

We begin the empirical analyses by investigating the determinants of pollutive asset divestitures. These analyses provide two key findings. First, parent firms are more likely to divest an asset if it pollutes more. Plant-level pollution is measured both by the total amount of toxic releases and by their emission intensity, i.e., the ratio of total releases over the number of workers employed in the establishment. Our estimates suggest that an inter-quartile change in a plant's total toxic release (from the least pollutive to the most pollutive quartile) leads to an increase of 45% in the likelihood of divestment relative to the average divestment rate in our sample. The same increase in a plant's emission intensity is associated with a 28% relative increase in divestment likelihood. These estimates are robust to the inclusion of plant fixed effects, industry-by-year, and state-by-year fixed effects.

Second, we show that firms divest pollutive assets following incidents related to ESG risks, and particularly incidents related to environmental risks. We measure ESG risks based on public criticisms related to a firm's business conduct, gathered by RepRisk.

We also separately measure environmental risk events. These incidents typically involve criticisms and fines related to climate change, greenhouse gas emissions, coal-fired power plants, gas flaring, carbon credits, etc. Gantchev et al. (2019) show that Reprisk events put pressure on management and influence corporate policies. Our estimates indicate that the occurrence of environmental risk incidents increases the likelihood of divesting a pollutive asset by 1.3 percentage points, or 92% relative to the sample mean. These estimates continue to hold after including firm fixed effects and industry-by-year fixed effects. Importantly, we find that divestitures of non-pollutive assets, which do not release toxic substances, are uncorrelated with the occurrence of ESG risk incidents. This finding mitigates concerns about a mechanical relation between ESG risk incidents and divestitures that could be driven by confounding effects unrelated to environmental risks.

Overall, the above findings suggest that both pollution and a firm's ESG reputation play an important role in asset divestitures. Firms are more likely to divest their most pollutive assets, and such asset divestitures tend to follow negative incidents of environmental risks and consequent pressures from activists, investors and regulators. Importantly, these findings can be consistent with the reallocation of pollutive plants to owners that reduce pollution levels as well as greenwashing divestment strategies that do not lead to reductions in pollution. In the next set of analyses, we attempt to distinguish between these two hypotheses by tracking the changes in plant-level pollution around their divestment, and comparing the changes to contemporaneous changes in pollution levels of similar plants that were not divested.

In difference-in-difference tests, we find no difference between the change in total toxic release at divested plants compared to plants that were not divested. The estimates are statistically indistinguishable from zero, hold in different test windows, and remain largely unchanged after the inclusion of plant, industry-by-year, and state-by-year fixed effects. In contrast, we find that the intensity of toxic release, measured as the amount of toxic release per employee, increases at divested plants by 11-14% following their divestment (compared to plants that were not divested). These estimates continue to hold after the inclusion of similar sets of fixed effects and are statistically significant. Together, these estimates indicate that, on average, buyers of pollutive plants reduce employment levels at the acquired plants while maintaining toxic release levels similar to pre-divestment levels. These results are less consistent with the hypothesis that buyers of pollutive assets have a comparative advantage at reducing and treating pollution.

If the buyers of pollutive plants aren't better at reducing/treating pollution compared to the sellers, why are they buying them in the first place? In other words, what are the gains from trading these assets? To answer these questions, we start by investigating the exposure of buyers and sellers to environmental scrutiny and pressures from investors, regulators, and the media. In particular, we examine whether pollutive assets are more likely to be transferred to private firms or non-ESG-rated firms (Becker 2005; Hartzmark and Sussman 2019; Zaccone and Pedrini 2020; Krueger et al. 2020). We find that, compared to the sellers, buyers of pollutive plants are 6 percentage points more likely to be private and 5 percentage points less likely to be covered by ESG ratings. Furthermore, plants with greater emission intensity are significantly more likely to be sold to private or non-ESG-rated firms. Collectively, these results seem more consistent with greenwashing strategies, whereby divestitures transfer dirty assets to less scrutinized owners.

Next, we consider the gains from trade for the sellers, by investigating the consequences of divestitures for the sellers. These analyses provide four main results. First, following the divestment of pollutive assets, the ESG ratings of sellers increase by roughly 22% (relative to the sample standard deviation), and the improvement is particularly strong for environmental ratings (27% relative to the sample standard deviation). Second, following divestments, the likelihood of being hit with an EPA enforcement action drops by about 6 percentage points (a large magnitude compared to a sample mean of 6 percentage points). Moreover, the costs of regulatory enforcement, including fines and cleanup costs, decline by over 70%. Third, following the divestment of pollutive assets, sellers receive on average $23.5 million more in government contracts due to eligibility criteria tied to regulatory compliance that the federal government imposes. Fourth, we find that the divested assets are sold to firms that have business ties with the sellers. Specifically, the buyers of divested assets tend to be firms with pre-existing supply chain relationships or joint ventures with the sellers. Such pre-existing connections likely reduce counter-party risk and information asymmetries, allowing sellers to maintain their access to the sold assets. Furthermore, the sellers are also likely to develop additional business relationships with the buyers. These newly formed connections suggest that the sellers begin transacting with the buyers following the divestitures.

Importantly, we show that the changes in ESG ratings, EPA enforcement actions, and government procurement contracts can be tied directly to the divestment of pollutive assets. First, these effects only follow the divestment of pollutive assets and are nonexistent following the divestment of non-pollutive assets. Second, we do not detect a change in the levels of pollution for the remaining assets of the seller following divestitures, which indicates that the effects are not driven by changes in the unsold, remaining plants.

Taken together, these findings suggest that following the divestment of polluting assets, firms enjoy several benefits, including an increase in their ESG ratings, a reduction in environmental disciplinary actions and compliance costs, and an increase in the amount of procurement contracts they receive. Nevertheless, the assets are reallocated to other industrial firms that maintain customer-supplier relations with the seller and remain connected through joint ventures. As such, our findings indicate that divestitures of pollutive assets convey various benefits to the sellers without having to give up their access to those assets.

Do shareholders recognize the above benefits of divesting pollutive assets? To answer this question, we estimate sellers' cumulative abnormal returns (CAR) around the announcement of divestitures of pollutive assets. We find that the average CAR ranges from 1.6% to 1.8%, depending on the empirical specification, and is statistically significant at conventional levels. Moreover, the average CAR is significantly higher when the divested plant is more pollutive. Our estimates suggest that an inter-quartile increase in pollution is associated with a 3-4 percentage-point increase in the CAR.

We find that buyers also benefit from acquiring divested assets. In particular, following the acquisition of a divested asset, acquirers experience significant increases in market share and sales growth. Our estimates suggest that acquirers' market share increases by 0.3 percentage points, a 15% growth relative to the average pre-transaction level of 2 percentage points, and their sales expand by nearly 10% relative to pre-transaction levels.

The central contribution of this article is to provide new evidence on the reallocation of industrial pollution through the divestment of pollutive assets. Our findings suggest that the real asset market allows companies to sell off their pollutive assets, thereby improving their environmental ratings, regulatory compliance, and access to government resources, without losing access to these assets. Overall pollution levels, however, do not decline following divestitures. As such, our findings are more consistent with greenwashing, suggesting that ESG rating agencies, environmental regulators, and ESG-minded investors fail to recognize that divestitures are ineffective conduits to reduce industrial pollution. These findings are consistent with Broccardo et al. (2020), who show that exit is less efficient than voice when firms generate externalities.

A policy implication of our findings is that regulators and ESG ratings should consider Scope 3 pollution, that is, pollution generated by assets along the firm's value chain such as suppliers and strategic partners. This can prevent regulatory and ESG-rating arbitrage through asset transfers along a firm's value chain.[3]

Overall, our findings extend prior research on (1) industrial pollution, (2) ESG, and (3) divestitures. The literature on industrial pollution studies its determinants, which range from legal liability (e.g., Alberini and Austin 2002, Stafford 2002, Shapira and Zingales 2017, Akey and Appel 2021) to third-party auditors (Duflo et al. 2013), reputational penalties (Karpoff et al. 2005), financial attributes (Chang et al. 2021, Xu and Kim 2022), imports and exports (Holladay 2016, Li and Zhou 2017), competition (Simon and Prince 2016), and ownership structure (Shive and Forster 2020). We add to this literature by showing that industrial firms react to scrutinized environmental risks by divesting their pollutive assets in a concerted effort to improve their ESG ratings, lower their regulatory compliance costs, and increase their access to government resources.

We also add to the growing literature on ESG (see Hong et al. 2020 and Gillan et al. 2021 for a review). One strand of this literature studies the benefits that better ESG

[3]Currently, the EPA does not require organizations to quantify scope 3 emissions. See: https://www.epa.gov/climateleadership/ghg-inventory-development-process-and-guidance

performance helps firms mitigate downside risks (e.g., Lins et al. 2017, Hoepner et al. 2018, Albuquerque et al. 2020, Ding et al. 2021). A second strand of this literature studies ESG monitoring and its effect on corporate ESG performance (e.g., Dimson et al. 2015, Akey and Appel 2019, Dyck et al. 2019, Barko et al. 2021, Heath et al. 2021, Naaraayanan et al. 2021). A third strand of this literature focuses on impact investing, emphasizing the role of ESG performance in capital market allocation (e.g., Starks et al. 2017; Barber et al. 2021; Hartzmark and Sussman 2019; Zaccone and Pedrini 2020; Krueger et al. 2020; Ľuboš Pástor et al. 2021; Bolton and Kacperczyk 2021; Hong et al. 2021). We contribute to this literature by showing that the monitoring of ESG-related incidents pushes firms to divest pollutive assets in an attempt to improve their ESG ratings and enjoy their potential benefits, without fundamental changes to operation and environmental pollution. As such, our evidence complements several recent studies revealing the drawbacks of outstanding ESG rating schemes by showing that ratings from different agencies do not agree with one another, and do not reflect the true ESG initiatives of corporations (Chatterji et al. 2016, Gibson et al. 2019, Dimson et al. 2020, Berg et al. 2020).

Lastly, our paper also contributes to the literature on divestitures. Several papers have studied the market for real assets and the resulting efficiency gains and resource allocation (e.g., Mulherin and Boone 2000, Maksimovic and Phillips 2001, Schlingemann et al. 2002, Bates 2005). Other studies have focused on divestitures that follow acquisitions as an ex-post measure of acquisition success (e.g., Kaplan and Weisbach 1992, Capron et al. 2001, Maksimovic et al. 2011, Arcot et al. 2020, Mavis et al. 2020). We add to this literature by documenting the important role of pollution in the divestiture market.

2 Data

2.1 Toxic Release Inventory (TRI) Data

We obtain data on plant-level toxic emissions from the EPA's Toxic Release Inventory (TRI) Program over the period 2000-2020. Section 313 of the Emergency Planning and

Community Right-to-Know Act (EPCRA), which created the TRI program, requires industrial facilities to disclose the release of toxic chemicals. Toxic chemicals are defined as ones that cause one or more of the following: (a) cancer or other chronic human health effects, (b) significant adverse acute human health effects, and (c) significant adverse environmental effects.[4] The resultant list contains over 600 individually listed chemicals and chemical categories as of 2020, the last year of our data period. Reporting is mandatory if an establishment has at least 10 employees, operates in a specific list of NAICS codes, and emits one or more specified chemicals above a certain quantity threshold.

The TRI Program provides information regarding the level of each type of chemical released by a plant during a given year. It also provides plant address and NAICS industry classification code. We supplement the plant-level toxic release information from TRI with additional facility information from the National Establishment Time-Series (NETS) database using a crosswalk provided in the TRI program. The NETS database provides plant-level longitudinal data, including facility production measures such as the number of employees and the dollar amount of sales. We first extract the total toxic emissions from a plant in a given year (Xu and Kim, 2022) to capture the aggregate impact of a plant's production activities on the environment and public health. Total emissions are then converted to log terms (*log(Release)*) as well as through IHS transformation (*IHS(Release)*). In addition, we examine a plant's toxic emissions intensity (Copeland and Taylor, 2003; Shapiro and Walker, 2018), defined as the amount of toxic release per employee (*Release/Emp*). Per-employee toxic release is also transformed in both log terms and IHS function.

In addition to monitoring toxic releases, the EPA also records pollution abatement activities. Appendix A provides an overview of the abatement process. We measure abatement in two ways. The first measure considers source reduction practices, which reduce or eliminate pollutants by modifying the production processes, promoting the use of non-toxic or less toxic substances, etc. To construct this measure, we count the total number of source reduction practices (*# Source Reduction*) across all chemicals in a plant-year

[4]For more information regarding the TRI program: https://www.epa.gov/toxics-release-inventory-tri-program

based on the EPA's Pollution Prevention (P2) database. The second measure considers post-production waste management activities, which are used to manage pollutants after they were created. To assess plants' engagement in post-production activities, we trace the percentage of total generated toxic waste that is reduced through recycling (*% Recycling*), energy recovery (*% Recovery*), and treatment (*% Treatment*), respectively.

We use a string-matching algorithm to link TRI establishments operated by public parent companies to the Compustat database to extract accounting information. The TRI database records the ultimate parent company name for each establishment every year, which can change over time following incidents such as ownership changes and parent company name changes. To map TRI plants to their owners at every point in time, we obtain historical names of publicly listed companies from CRSP and match those names to the names of plant owners.[5]

2.2 Divestitures

We collect data on divestiture transactions completed between 2000 and 2020 from the SDC M&A database. For each transaction, SDC provides the effective date, the names of the buyer and the seller, and the percentage of stakes transferred, among other details. In cases where the buyer or the seller is recorded at the subsidiary firm level, SDC also reports the ultimate parent company's names and CUSIP identifiers. We only retain deals classified as "divestiture" or "spin-off" by SDC. We also require the deal to represent a significant transfer of control rights. In other words, the buyer must own more than 50% of the stake after the transaction. Next, we remove deals involving financial firms, either as buyers or sellers. To do so, we read through the synopsis of each individual deal and exclude deals where the buyer or the seller is a financial company, including private equity firms, banks, investment firms, funds, etc. We also exclude cases where the buyer or the seller is majority-owned by a financial firm.

[5] We remove all punctuation marks, delete corporate designators such as "corporation," "company," "inc," or "llc," standardize the most common words to a consistent format, and generate a similarity score between the deduplicated TRI parent names and Compustat/CRSP company names using a string-matching algorithm. For instance, "United States" is simplified to "US," "Manufacturing" to "MFG," and "Internationals" to "INTL." We then manually go through the matches to verify whether they are correct.

We identify TRI plants sold in divestitures and spinoffs by matching plants' parent names to acquirer and target names in SDC. Appendix B describes the matching procedure in detail. Our final sample contains 719 deals involving 1,105 unique plants. Section Appendix D presents an industry composition of the divested plants. The vast majority of divested plants are located in a few manufacturing sectors known to be heavy polluters: chemical manufacturing, fabricated metal product manufacturing, among others.

In addition, we collect data on 41,001 divestitures of non-pollutive assets over the period 2000–2020. We follow the same approach and remove all transactions between financial buyers and sellers. Using these data, we compare between the effects of divesting pollutive plants and the effects of divesting non-pollutive assets.

2.3 RepRisk

RepRisk provides data on business-conduct risk by combining machine-learning and human analysis. It collects and screens data from over 100,000 public sources and various stakeholders to identify whether a firm has had an ESG risk incident. RepRisk classifies these events into 28 categories such as pollution, waste management issues, human rights abuses, occupational health issues, child labor, and discrimination in social and employment settings. It also assigns each event into one of three broad categories: "environmental", "social", or "governance."

Using these data, we define an indicator variable *Have ESG Event*, which equals one if RepRisk reports an ESG risk event for a given firm in a given year, and zero otherwise. Similarly, we also define *Have Environmental Event* to be an indicator for a firm having an environment-related risk event in a year. Analogously, *Have Social, Governance Event* is an indicator variable that equals one for a firm with a social or governance issue in a given year.

2.4 EPA Enforcement Actions and Compliance Costs

In addition to toxic emissions data from the TRI program, the EPA also records government agency investigations and enforcement activities in its comprehensive Enforcement and Compliance History Online (ECHO) database. ECHO provides exact filing dates, detailed violation information, milestone dates, and final enforcement actions for each investigation initiated by the EPA or by state and local agencies. Further, it also reports the dollar amount of federal and local penalties, compliance actions, cost recovery, and supplemental environmental projects. We aggregate these items to evaluate the total legal liability and compliance costs for each case. Using these estimates, we analyze the changes in enforcement actions and compliance costs for sellers of pollutive plants.

2.5 Government Contracts

We collect federal government procurement contract data from www.usaspending.gov. This website provides detailed information on government contracts awarded to individual firms, including the recipient name, location, and contract dollar amount. We match contract recipients to Compustat firms based on company names and locations. Using these data, we measure the dollar amount of awarded contracts to a firm, and analyze the effect of divesting pollutive plants on the allocation of government contracts.

2.6 ESG Ratings

We obtain ESG ratings of U.S. public firms from the Kinder, Lydenberg, and Domini (KLD) database to empirically examine the effects of divestitures on sellers' (parent-level) ESG performance. KLD evaluates each firm along the following six categories: community, diversity, employee relations, environment, human rights, and product. For each category, it counts the number of strengths and weaknesses for the firm. Following Cronqvist and Yu (2017), among others, we create an aggregate *CSR score* by netting the total number of strengths and the total number of weaknesses across all categories. In other words, each strength adds one point while each weakness subtracts one point from the aggregate CSR score. Similar to the RepRisk event measure, we also separately compute the net strength in the environment category and create *Environmental Score* to track firms' environmental ratings.

2.7 Supply-Chain and Joint Venture Relationships

We examine whether firms with prior business connections are more likely to offload polluting plants to each other, and whether divestitures of pollutive plants lead to the establishment of future business connections. Business connections refer to supply-chain relations and joint venture partnerships. We obtain supply-chain relations data from Factset and Compustat Segment databases. We obtain Information on joint ventures from SDC (see also Allen and Phillips 2000 and Schilling 2009). As explained in Section 4.6, we compile a matched sample of acquirer-target pairs and define a pair to be "operationally related" if the acquirer and the target shared either a supply-chain connection or a joint venture connection in the past.

3 Empirical Strategy

We perform two types of analyses, one at the plant level and one at the parent firm level. In the plant-level analysis, we examine whether a plant generates less pollutants after being sold to another firm. In the firm-level analysis, we investigate whether the sellers and buyers experience changes in ESG ratings, EPA enforcement costs, government contract amounts, and operating performance.

3.1 Plant-level Analysis

We compile a plant-year panel that contains all plants reported in the TRI database. The key variable of interest is *Divested* × *Post*, which equals one if a plant has been sold through a divestiture, and zero for observations related to the sold plant prior to the transaction as well as for plants that are never sold.

We estimate the following regression:

$$Y_{i,t} = \beta Divested_i \times Post_{i,t} + \alpha_i + \tau_t + \epsilon_{i,t}, \tag{1}$$

where i represents a plant and t represents a year. $Y_{i,t}$ includes total release and toxic emissions intensity. We control for plant fixed effects (α_i) and year fixed effects (τ_t). In more rigorous specifications, we also control for industry-year interactive fixed effects and state-year interactive fixed effects. These controls help rule out confounding explanations related to industry dynamics, local economic conditions, or state-level policies.

3.2 Firm-level Analysis

The firm-level analysis primarily centers around sellers. We construct a sample including all ultimate parent firms of TRI plants. For some analyses where the dependent variable is available only for public firms, we restrict the sample to publicly traded parents. We estimate the following regression:

$$Y_{f,t} = \beta Seller\,(Pollutive)_f \times Post_{f,t} + \gamma \cdot \mathbf{X}_{f,t} + \theta_f + \tau_t + \nu_{f,t}, \quad (2)$$

where f represents a parent firm and t represents a year. $Y_{f,t}$ includes ESG scores, enforcement actions, having a RepRisk event, etc. $Seller\,(Pollutive)_f$ equals one if firm f sells any pollutive plant over our sample period, and zero otherwise. $Post_{f,t}$ equals one starting from the year of the transaction. $\mathbf{X}_{f,t}$ represents an array of firm characteristics, including firm size, leverage, profitability, and tangibility. Our estimation includes firm fixed effects (θ_f) and year fixed effects (τ_t). More rigorous specifications also include industry-year fixed effects.

We use the divestiture of non-pollutive assets as a benchmark of comparison, and repeat the seller-level tests above. Specifically, we examine:

$$Y_{f,t} = \beta Seller\,(NonPollutive)_f \times Post_{f,t} + \gamma \cdot \mathbf{X}_{f,t} + \theta_f + \tau_t + \nu_{f,t}, \quad (3)$$

where $Seller\,(NonPollutive)_f$ equals one if firm f sells any non-pollutive asset over our sample period, and zero otherwise. In this analysis, we utilize a firm-year panel that includes all observations for publicly traded firms, except for ones that sold TRI plants. This filter helps remove from our control group firms experiencing the treatment effect of selling pollutive plants.

We also analyze the performance of buyers using a similar framework. The analysis includes all publicly traded firms. We evaluate the changes in market share and sales after a firm purchases a polluting plant.

$$Y_{b,t} = \beta Buyer_b \times Post_{b,t} + \gamma \cdot \mathbf{X}_{b,t} + \theta_b + \tau_t + v_{b,t}, \quad (4)$$

where b represents a firm. $Buyer_b$ is an indicator that equals one if firm b is the buyer of at least one TRI plant during our sample period, and zero otherwise.

4 Results

4.1 Univariate Analysis

Table 1 presents summary statistics for the variables used in our paper. Appendix C provides detailed definitions of the variables. Panel A provides statistics for the plant-level sample. Our TRI sample consists of 37,564 unique plants with 352,938 plant-year observations. At the plant level, the distribution of pollution emission is skewed. The average toxic emission of our sample plant-year is around 58,528 pounds with the median being 1,687 pounds. On average, each plant-year is associated with 258 employees and generates $74 million dollars in sales revenue. On pollution abatement, an average plant-year adopts 9.3 source reduction practices, and the percentage of total generated toxic chemicals reduced through recycling, recovery, and treatment is 31.2%, 5.4%, and 21.4%, respectively.

Table 1 About Here

Panel B provides information for the parent firm-level sample. In this sample, the average firm in our sample emit 625,496 pounds of toxic chemicals, with the median being 22,479 pounds. The average firm also has an employment count of around 2,364 with the median being around 600. When combined with the non-sellers, the average firm has a market-to-book ratio of 3.17, leverage ratio of 0.39, cash-to-asset ratio of 0.21, and tangibility ratio of 0.25.

The average firm in our sample faces around a 7% probability of ESG risk incidents and 4% of environmental risk incidents. It also faces a 1% likelihood of being targeted for EPA regulatory enforcement. The associated enforcement cost is about $4 million on average. The average size of government contracts is $30 million per year. Notably, the distribution of government contract amounts is highly skewed, where the median amount is $2.2 million per year.

Panel C provides statistics for the announcement cumulative abnormal returns (CARs) for the divestiture deals in our sample. We compute the CARs during a 3-day window centered around the announcement date. We define abnormal returns both relative to the market benchmark (*CAR, Market*) and relative to the Fama-French 3-factor benchmark (*CAR, FF*). the average CAR for sellers is around 3% under both benchmarks. These variables follow a skewed distribution, as the median value is much lower, less than 1%. Buyers experience a slightly lower announcement return compared to buyers, with the average being 2%.

In Table 2, we compare various characteristics of buyers and sellers of the divestiture deals in our sample. To start, we look at the public trading status as well as ESG rating coverage for all buyers and sellers involved in our sample deals. Relative to sellers, buyers are 6% less likely to be publicly traded and 5% less likely to be covered by ESG ratings, suggesting pollutive assets are more likely to be transferred to firms facing less ESG pressure. Next, we restrict the comparison among publicly traded buyers and sellers, for whom more detailed information on firm characteristics is available. Interestingly, buyers are significantly smaller than sellers, either in terms of asset size and employment count, or sales and market share. These statistics suggest that the divestiture deals in our sample represent smaller firms purchasing assets from larger ones. Buyers also generate lower quantities of toxic releases than sellers and have higher environmental pillar ratings based on the KLD database. However, buyers' plants have similar toxic emissions intensity as sellers.

TABLE 2 ABOUT HERE

4.2 The Determinants of Divestitures

We begin our analyses by examining the triggers of plant divestitures. These analyses seek to shed light on the incentives underlying the divestitures of pollutive assets. Specifically, we ask two questions: (1) Are more pollutive plants more likely to be divested? (2) Does public attention to a firm's ESG risks push it to divest its pollutive plants?

4.2.1 Plant Emission and The Likelihood of Being Sold

To answer the first question, we estimate regressions explaining the likelihood of plant divestitures. We estimate the regressions in a plant-year panel that keeps observations for a plant only up to the year of its divestiture. We retain all observations related to plants that are never divested in our sample years. The key outcome variable in this analysis is $Divested_{i,t}$, an indicator for whether plant i is divested in year t. We multiply this indicator by 100 so the coefficients directly correspond to the percentage likelihood of a divestiture. A plant's emission level is measured in two ways. First, we compute the total volume of toxic release from the plant during the current and the previous year ($[t-1,t]$). Second, we calculate pollution intensity, which is the ratio of total release volume to the number of employees in the firm over $[t-1,t]$. Due to skewness in the distribution of toxic release, and for ease of interpretation, we group both total toxic release and per-employee toxic release into quartile index, where 1 represents the lowest pollution level, and 4 represents the highest.

Panel A of Table 3 reports results from this analysis. Columns (1) through (4) present results related to total pollution; Columns (5) through (8) present results related to pollution on a per-employee basis. We start by presenting the univariate association between plant pollution and divestment likelihood (Columns (1) and (5)). We then add control in stages. In Columns (2) and (6), we include industry and year fixed effects. Industry fixed effects help us compare plants with similar production technologies and year fixed effects help remove macroeconomic dynamics. In Columns (3) and (7), we impose industry-by-year interactive effects, which allow us to narrow down the comparison to industry-peer plants at the same point in time. Finally, we layer on state-by-year interactive effects, which help remove effects from state policies regulations. Across all measures and specifications, past pollution yields significant, positive coefficients for the likelihood of divestiture, suggesting that more pollutive plants are more likely to be sold to another firm. The estimate in Column (3) implies that an inter-quartile increase in pollution volume (quartile number from 1 to 4) increases the likelihood of the plant being sold by about 0.13 percentage point ($= 0.043 \times 3$). This represents a 45% increase relative to the average likelihood of plant divestiture (0.29 percentage points). Asset pollution intensity generates a similar magnitude, with an inter-quartile increase in pollution intensity associated with about 28% increase in its divestiture likelihood ($= 0.027 \times 3/0.29$).

Table 3 About Here

4.2.2 ESG Risk Exposure and Asset Divestiture

We next examine whether firms divest pollutive plants when they incur publicly known negative incidences of ESG risk. As an initial proxy, we use the incidence of a negative ESG event as indication of public ESG exposure. Next, we focus on events specifically related to environmental risk, and test whether these events motivate firms to dissociate from plants that produce toxic emissions. We implement this analysis by regressing *Sell (Pollutive)*, an indicator variable for whether a firm sells a pollutive plant in a year, on indicators for negative ESG exposure in the current or the previous year. *Sell (Pollutive)* is multiplied by 100 so that the coefficients can be intepreted as the percentage likelihood of divestment. The regression is performed on a sample of public firms covered by RepRisk, who own at least one TRI plant in our sample period. In other words, we exclude firms that do not have a choice to sell pollutive assets. Again, we track each firm up to the year of its divestiture.

Results are presented in Panel A of Table 4. Columns (1) through (3) report results related to any ESG incidences, and Columns (4) through (6) present results related only to environmental risk events. In Columns (7) through (9), we include environmental events and non-environmental events (social and governance events) side by side, to compare their influence on firms' tendency to divest assets. Similar to Table 3, we include fixed effects in stages, starting with industry and year fixed effects, and in the end including both industry-year interactive fixed effects and state-year interactive fixed effects. Standard errors are clustered by firm.

Table 4 About Here

We first document that firms facing negative ESG events are more likely to divest pollutive plants. Having an ESG risk event leads to a 0.7 percentage point greater likelihood that the firm sells a pollutive plant. Column (6) suggests that having an environmental risk event generates a much larger effect, reaching 1.3 percentage points. These are substantial magnitudes compared to the sample average of having a divestiture of 1.3 percentage points. Importantly, as we include environment-related events and non-environment-related events, we find that the effect on divestiture is concentrated on environmental issues. The coefficient on social and governance issues is small and indistinguishable from zero.

For context, we examine whether selling assets is a common response of all firms facing negative press exposure. It is possible that the negative ESG incidences simply represent inefficient operations or financial difficulties, which also force firms to sell productive assets. Under this explanation, we should expect ESG risk exposure to also be followed by divestitures of other, non-pollutive assets. However, results in Panel B suggest this is unlikely to be the case. In Columns (1) through (3), we do not find any positive association between ESG risk events and the likelihood of divesting non-pollutive assets. Results in Columns (4) through (9) indicate that having an environmental exposure event is negatively associated with future divestitures. This might be due to such exposure revealing risks embedded in firms' operations and increasing the difficulty for firms to attract buyers. In untabulated analysis, we repeat the analysis on a full sample of public firms (and not just owners of TRI plants). We do not find any association between ESG events and the likelihood of divesting non-pollutive assets.

4.3 Changes in Pollution Around Divestitures

The findings in the previous section suggest that pollution plays an important role in driving asset divestitures. In particular, firms are more likely to divest pollutive assets than non-pollutive assets following negative incidents of environmental risks, which likely trigger pressure from activists, investors, and regulators alike. In light of these findings, a natural question that arises is whether such divestitures are followed by changes in the pollution levels of the transacted plants.

We examine the changes in plant-level pollution by estimating Equation (1). Table 5 presents the results from this analysis. In Panel A, we examine the total emission volume of a plant, while in Panel B we consider toxic emissions intensity, measured as the amount of toxic release per-employee. In each panel, we add controls in stages, first including plant and year fixed effects (Column (1)), next adding industry-year interactive fixed effects (Column (2)) to remove potential effects from industry conditions, and finally including state-year fixed effects (Columns (3) and (4)). In Column (5), we repeat the test using the IHS transformation of emission levels to address potential concerns related to the log transformation of dependent variables (Cohn et al., 2021).

<u>Table 5 About Here</u>

Based on the estimates in Panel A, there are no significant differences between the change in total toxic release at the divested plant and contemporaneous changes in total toxic release at plants that were not divested. The coefficient estimates on the interaction term *Divested* × *Post* are statistically indistinguishable from zero, and remain largely unchanged across the different specifications. In contrast, the results in Panel B show that the pollution intensity of divested plants not only does not decrease, but in fact increases significantly, compared to plants that were not divested.

In Figure 3, we trace how the pollution level of sold plants evolves around the transfer of ownership. To do so, we repeat regressions in Column (4) of Table 5, while adding separate indicators for each year in the event window. In this analysis, the "control group" includes all plants that have not been sold as of the year of observation. The event year (time 0) is absorbed as the benchmark year, so that coefficients represent the gap in the pollution level between treated and control plants relative to that year. Panel A reports coefficients for the log of total release and Panel B plots coefficient for the log of toxic emissions intensity. Consistent with the result in Table 5, we do not observe any decrease in the emission produced by sold plants. If anything, emissions intensity increases in a few years after the transaction.

In Panel C of Table 5, we examine pollution abatement efforts, including source reduction activities and post-production waste management. The estimates indicate that plants' pollution abatement activities do not change following their divestitures. These estimates are consistent with the findings in Panel A — plants do not experience meaningful changes in their total toxic release levels as they do not materially change their pollution abatement processes.

Together, these estimates indicate that, on average, buyers of pollutive plants reduce employment levels at the acquired plants while maintaining toxic release levels similar to pre-divestment levels. As such, they suggest that divested plants do not become "cleaner" under the new parent. Instead, they become dirtier on a per-employee basis. These results do not support the hypothesis that through divestitures, pollutive assets are transferred to new owners with higher capacity and better technology to abate emissions. They are consistent with the idea that the market for divestitures allows firms to shed dirty assets and reshape their image as low-environmental-impact companies.

4.4 The Buyers of Pollutive Assets

Our results so far indicate that plants do not emit less toxic chemicals when sold to other firms. If pollution levels remain unchanged, divestitures of pollutive assets can generate gains from trade by transferring to buyers that have a comparative advantage at handling ESG pressures from various stakeholders, such as investors and regulators. To explore this possibility, we investigate whether buyers of pollutive assets tend to be private firms or non-ESG-rated firms.

We conjecture that private firms are subject to less scrutiny and disclosure requirements compared to public firms. For example, in 2010, the Securities and Exchange Commission (SEC) provided guidance regarding public firms' disclosure related to climate change. And, in 2022, the SEC enforced ESG disclosure requirements for investment funds and other investment companies, whose portfolios largely comprise publicly traded firms.

Similarly, firms whose ESG practices are not rated by any of the ESG rating agencies face weaker ESG pressures. Accordingly, prior studies show that ESG ratings provide signals about firms' sustainability practices, and generate value-relevant responses from investors (see Hartzmark and Sussman 2019; Zaccone and Pedrini 2020; Krueger et al. 2020, among others).

We start the analyses by constructing a deal-by-firm sample that pools together all sellers and buyers involved in divestitures of pollutive assets, and examine whether buyers are more likely than sellers to be private or ESG-unrated firms. In particular, we regress each of the two indicator variables, *Private Firm* and *Unrated Firm*, on the indicator variable *Buyer* in each deal:

$$Private/Unrated_{k,i} = \beta_0 + \beta_1 \times Buyer_{k,i} + \epsilon_{k,i}, \tag{5}$$

where k indicates a divestiture deal, and i indicates either the buyer or the seller in the deal. *Private Firm* is an indicator that equals 1 if the firm is private, and 0 if it is public, and *Unrated Firm* is an indicator that equals 1 if a firm is not covered by the KLD, Refinitive, or MSCI ESG ratings, and 0 otherwise. $Buyer_{k,t}$ equals one if firm i is a buyer in deal k. In this test, we are interested in β_1. If $\beta_1 > 0$ ($\beta_1 < 0$), buyers are more (less) likely to be private and unrated firms than sellers.

Columns (1) and (2) in Table 6 report the results. We find that relative to sellers, buyers of pollutive plants are 6 percentage points more likely to be private firms and 5 percentage points more likely to be unrated by any of the ESG rating agencies. These findings suggest that more scrutinized firms tend to offload their pollutive assets to less scrutinized firms.

Table 6 About Here

In Columns (3) through (6), we examine whether plants generating more pollution are more likely to be sold to a private or an ESG-unrated buyer. The results suggest that plants with greater pollution intensity are significantly more likely to be sold to private or unrated firms. The estimate in Column (4) implies that an inter-quartile increase in pollution intensity (from the lowest quartile to the highest quartile) increases the likelihood of being sold to private buyers by 15% ($= 0.049 \times 3$), which represents a 28% increase relative to the sample average of 54%. Column (6) implies that a similar inter-quartile increase in pollution intensity increases the likelihood of being sold to private buyers by 12.6% ($= 0.042 \times 3$), which represents a 19% increase relative to the sample average of 66%. We find a similar pattern for total pollution levels, although the coefficients are not statistically significant at conventional levels.

Taken together, the results in this section show that pollutive assets are often transferred from publicly listed firms to private firms, and from firms with ESG ratings to firms not covered by any of the ESG rating agencies. This evidence sheds light on the motivation behind the divestiture of pollutive assets. While the divested plants produce similar levels of pollution, the new owners face lower ESG compliance costs, leading to gains from trading pollutive assets.

4.5 Implications for Sellers

We explore firms' motives to sell pollutive assets by investigating the changes they experience following such divestitures. We provide three main analyses of the consequences of divestitures: (1) The ESG ratings of the sellers; (2) The environmental regulatory compliance costs of the sellers; and (3) The allocation of government procurement contracts to the sellers due to eligibility criteria tied to pollution levels. These analyses utilize the framework laid out in Equation (2). Tables 7 through 9 present these results. In each test, we not only examine the consequences of firms selling pollutive assets, but also compare such consequences to those of firms selling non-pollutive assets. This comparison is useful because it sheds light on the mechanism underlying our results. If our results are driven by divestitures allowing firms to reduce the scale of its operations and enhancing their financial resources, those effects should show up for both divestitures of pollutive and non-pollutive assets. If our findings capture firms' intention to unload dirty assets, we expect effects to be concentrated on divestitures of pollutive assets.

Table 7 presents results on the changes in ESG ratings around divestitures for the sellers. The sample includes all firms with available ESG scores from the KLD database. Panel A reports effects for sellers of pollutive assets, and Panel B examines effects for firms that sell non-pollutive assets. Within each panel, the dependent variable is a firm's overall ESG score in Columns (1) through (3), and environment-specific ratings in Columns (4) through (6). The regression specifications gradually add fixed effects and control variables. Column (1) includes firm and year fixed effects; Column (2) adds industry-year interactive fixed effects; and Column (3) adds firm characteristics, including the log of total assets, the market-to-book ratio, leverage, cash holdings, and asset tangibility.

TABLE 7 ABOUT HERE

The results in Panel A show that sellers of pollutive plants experience a significant improvement in their ESG ratings following divestitures. Based on the estimates in Column (3), sellers' overall ESG scores increase by around 0.5 relative to non-sellers, a substantial change compared to the sample mean of 0.32 and the sample standard deviation of 2.31. Furthermore, Columns (4)–(6) show that divestment of pollutive plants improves the environmental scores of sellers. In Column (6), the coefficient estimate on the interaction term $Sell \times Post$ is positive and statistically significant, and its magnitude suggests that sellers' environmental scores increase by around 0.22, or 27% of the sample standard deviation.

In Panel B, we provide results from the same set of analyses for sellers of non-pollutive assets. The estimates suggest that these sellers do not experience a major change in their ESG scores. The coefficient estimates on the interaction term $Sell \times Post$ are mostly negative but statistically insignificant.[6]

Together, these findings indicate that ESG rating agencies respond to divestitures of pollutive plants by increasing the ESG scores of the sellers. Hence, these divestitures potentially benefit the sellers through the implications of higher ESG ratings. In what follows, we consider two such potential benefits: lower regulatory compliance costs and better access to government resources.

In Table 8, we analyze changes in the likelihood of EPA violations and in sellers' compliance costs surrounding the divestitures of pollutive assets. Again, Panel A reports the results for sellers of pollutive assets, whereas Panel B reports the results for the benchmark group of sellers of non-pollutive assets.

Table 8 About Here

The estimates in Panel A suggest that pollutive asset divestitures are associated with significant reductions in sellers' regulatory compliance costs. The effects are economically large. Based on Column (3), following the divestiture of a pollutive plant, the seller is roughly 6 percentage points less likely to receive an EPA enforcement action. This decline is on par with the sample standard deviation of 8 percentage points. Moreover, the estimates in Panel A further show that conditional on an EPA enforcement action, enforcement costs decrease by over 60% following the divestment of pollutive assets.

In contrast, the estimates in Panel B indicate that sellers of non-pollutive assets experience only a minimal decline in the likelihood of an EPA enforcement action, with the magnitude being around 0.3 percentage points. There is no evidence of a decline in enforcement costs.

Collectively, these results provide evidence that selling pollutive plants enables sellers to increase their compliance with environmental regulations and to reduce the costs associated with enforcement actions. Such decline in compliance burden is likely a direct

[6] In Appendix E, we consider alternative ESG ratings from Refinitive and MSCI. We compare between the coverage of the different ESG ratings, and show that our results are robust to the inclusion of alternative ESG ratings.

result of divesting pollutive assets and is not a general byproduct of asset divestitures.

Table 8 About Here

Next, we study the allocation of Federal government procurement contracts to firms that divested pollutive assets. The difference-in-differences regression specifications compare changes in the allocation of contracts across firms that divested pollutive assets and firms that did not divest those assets.

We present the results in Table 9. The estimates indicate that the amount of won government contracts increases substantially following the divestment of pollutive assets. Based on column (6), which includes firm fixed effects, industry-by-year fixed effects, and firm-level control variables, contract dollar amounts increase by roughly 77%, or $23.5 million given a sample average contract amount of $30.5 million. In Panel B, we repeat the above test specifications for sellers of non-pollutive assets. The estimates in Panel B do not reveal meaningful changes in the allocation of government contracts.

Collectively, these findings suggest that divestitures of pollutive plants benefit government contractors by improving their compliance with pollution-related eligibility criteria that accompany procurement contracts. Such compliance increases the dollar volume of won contracts. Again, such effects are unlikely to be a mechanical result of divestitures in general.

Table 9 About Here

Since divestitures are nonrandom, a possible concern is that they tend to coincide with other changes or improvements at the selling firm that can explain the changes in its ESG ratings, environmental compliance costs, and the allocation of government procurement contracts. These concerns are mitigated by our findings that these effects only follow the divestment of pollutive assets and are nonexistent following the divestment of non-pollutive assets. Still, an alternative explanation remains, suggesting that firms may sell the plants that they fail to improve, but focus their resources to reduce pollution from other plants. The various improvement we documented could simply result from the "cleaning up" of remaining plants. We evaluate this argument by examining concurrent changes in the pollution levels of the remaining plants of the seller around divestitures.

To this end, we directly track the pollution levels of sellers' undivested plants. Specifically, for all plants that did not go through a divestiture, we define an indicator variable *Peer Divestiture* × *Post*, which equals one if its parent company has divested at least one plant by the year of observation. Table 10 reports the results. Similar to Table 5, Panel A provides the results for the total amount of toxic release whereas Panel B presents the results for pollution intensity, defined as the amount of toxic release per employee.

Table 10 About Here

The estimates in Table 10 indicate that the remaining (undivested) plants do not exhibit meaningful declines in toxic release. Specifically, the coefficients on the interaction term *Peer Divestiture* × *Post* are relatively small, statistically insignificant at conventional levels, and switch signs across Panels A and B. This suggests that pollution levels do not change at the remaining plants of divesting companies. These findings lend further support to the notion that firms can achieve various benefits from selling off pollutive assets without having to abate emission in their production process. In other words, agencies in both private and public sectors reward firms for asset divestitures even though such activities bear no implications for total pollution.

4.6 Business Ties Between Buyers and Sellers

The evidence thus far suggests that firms divest pollutive assets and consequently enjoy several benefits, including higher ESG ratings, lower regulatory compliance costs, and better access to government contracts. In this subsection, we investigate the existence of business ties between the selling firm and the buyer of its pollutive plants, which may provide the seller with continued access to the plants that it divested. These analyses are motivated by ample anecdotal evidence suggesting that the divestitures of pollutive assets tend to occur between operationally related firms. For example, in 2002, Genencor

International Inc acquired Enzyme Bio-System Ltd from its joint venture partners, CPC International Inc and Texaco Inc. US Premium Beef acquired 71% of the shares in Farmland National Beef Packing Co (FN) from its joint venture partner Farmland Industries Inc (FI) in 2003. Others deals signal the start of cooperative relations between the buyer and the seller. For example, Outokumpu Oyj (OO) acquired the majority interest in the heat transfer business of Lennox International Inc (LI) in 2002 to form a joint venture.

Motivated by the above real-world examples, we next investigate the nature of the relationship between sellers and buyers of pollutive assets to shed light on the incentives of the buyers and on the ability of the sellers to access the divested plants and their products after the divestiture.

Specifically, in these analyses we test whether firms that share business ties with the sellers are more likely to purchase pollutive plants from the sellers. We consider two types of relationships: (1) customer-supplier relations; and (2) joint venture partnerships. These relationships may increase the likelihood of purchasing a divested pollutive asset for several reasons. First, both types of relationships imply operational and technological complementarities between the seller and the buyer. Hence, related buyers are better positioned to utilize the divested asset, and will therefore offer a higher price. Second, existing business relationships help firms during the negotiation process and promote the likelihood of a divestment agreement. Third, the existence of a business relationship facilitates the access of the seller to the plant's output even when it is operated by a different parent company, allowing the seller to maintain its current operation and production processes.

We design these analyses following the matching approach introduced by Bena and Li (2014). For each divestiture deal, we find five "pseudo buyers," who operate in the same industry as the buyer. Pseudo buyers are sampled with replacement from a list of SDC acquirers. Such acquirers have both the propensity and the capacity to purchase assets from other firms. This matching approach generates six buyer-seller pairs for each deal, including five pseudo buyers and one actual buyer for the seller. Accordingly, we code *Buyer of Divested Plants* to be one for the actual buyer, and zero for the pseudo buyers.

Next, we investigate whether each pair of firms shares an ongoing supply-chain relation at the time of the deal or has started a joint venture prior to the deal. If so, we set the indicator variable *Operationally Related* to be one for this pair of firms.

We also consider the possibility that sellers maintain their access to products or services of divested plants after the transaction by examining whether buyers are more likely to start a new business relationship with the actual buyer than with pseudo buyers after the year of the deal. This investigation helps reveal whether the divestiture indeed represents a material operational or production change for the seller, or simply reflects a change in the boundary of the firm without material operational shifts.

Table 11 reports the results from this analysis. In Column (1), we regress the indicator for the real buyer, *Buyer of Divested Plants* on the indicator for shared business relations, *Operationally Related*. The regression controls for match group fixed effects, which is an indicator for each individual divestiture transaction. This stringent set of fixed effects allows us to compare each buyer-seller pair to its matched pseudo buyer-seller pairs. These fixed effects also absorb any variation at the deal level, or broader than the deal level, including macroeconomic trends, seller characteristics, and industry dynamics.

The estimates in Table 11 suggest that operationally related firms are 46 percent more likely to purchase a pollutive plant from the seller, compared to unrelated firms. This magnitude is substantially larger than the sample average for *Buyer*, which is 0.167 (1/6) by construction.

<u>TABLE 11 ABOUT HERE</u>

In Column (2), we examine whether following divestitures, sellers are more likely to establish business relations with the buyer to maintain access to their divested plants. Our results are consistent with this conjecture. Our estimates suggest that sellers are around 7 percent more likely to establish a supply-chain or joint venture partnership with the buyers than with other firms. The magnitude of this estimate is economically large since the average probability of establishing new business relationships in our matched sample is slightly above 2 percent.

All in all, our findings suggest that following the divestment of polluting assets, firms enjoy several benefits, including an increase in their ESG ratings, a reduction in environmental disciplinary actions and compliance costs, and better access to government procurement contracts. Nevertheless, the assets are reallocated to other industrial firms that maintain customer-supplier relations with the seller and remain connected through joint ventures. As such, our findings indicate that divestitures of pollutive assets convey various benefits to the sellers without having to give up their access to those assets.

4.7 Analysis of Divestiture Announcement Returns

As sellers obtain various benefits from offloading pollution, it is natural to ask whether shareholders recognize these benefits and adjust their valuation of the divesting firms. To answer this question, we examine equity returns around the announcement of divestitures of pollutive plants. We compute the cumulative abnormal return (CAR) in the 3-day window around the announcement date ($CAR[-1,+1]$). We use two measures of abnormal returns. First, we look at market-adjusted returns (total return − market return). Second, we extract the residual return after removing the the variation explained by the Fama-French 3 factor model.

In Table 12, we study the relationship between deal announcement CARs and the pollution level of the sold plants. Since we measure CARs at the deal level, we compute the total amount of pollution and pollution intensity across all plants sold in a given deal. As before, we sort the pollution levels into quartiles. We regress sellers' CARs on the pollution level of each deal, controlling for sellers' industry fixed effects and year fixed effects.

Panel A of Table 12 reports the results. Across both definitions of abnormal returns and both pollution measures, we observe a significant, positive relation between the level of pollution of the sold plants and announcement returns. The estimates suggest that an inter-quartile increase in pollution is associated with a 3- to 4-percentage-point higher CAR. These magnitudes are economically large, comparing to the sample average returns of 2 percent.

Table 12 About Here

5 Effects on Buyers

In the final set of analyses, we seek to provide evidence on the consequences of acquiring pollutive assets. In particular, we explore the effects of acquiring pollutive assets on acquirers' revenue and market share.

We investigate how buyers' sales and market shares change around the acquisition of pollutive plants. The analysis follows the same framework as described in Equation (2). The results are provided in Table 13. The estimates suggest that following a divestiture, buyers of divested plants experience a significant increase in market share and sales growth. Our estimates in Column (2) suggest that buyers' market share increases by 0.3 percentage points, a 15% growth relative to the pre-transaction level (0.02, as reported in Table 2). Column (4) further shows that after purchasing the divested plants, buyers' sales expanded by around 10% relative to pre-transaction levels.

Table 13 About Here

To corroborate these findings, we also read the merger announcements and deal synopses that accompany these divestitures. Consistent with our results, we often observe that buyers declare that the purchase of plants should significantly increase their production capacity, improve their presence in a market segment, and even open the opportunity for them to become industry leaders.

It is interesting to consider these findings in light of the statistics reported in Table 2. These statistics suggest that the buyers generally have modest market shares and generate lower sales compared to the sellers. At the same time, our findings suggest that the buyers face less scrutiny and weaker ESG pressures. This comparative advantage potentially allows buyers to absorb the high-pollution assets from sellers, which can boost buyers' production capacity and market share.

6 Conclusion

In this paper, we investigate the motivations behind, and implications of, divestitures of pollutive assets. We find that sellers of pollutive assets benefit from divestitures in several ways. They receive higher ESG ratings, face lower environmental compliance costs and enforcement risks, and obtain better access to government procurement contracts.

At the same time, pollution levels do not decline. Divested plants generate similar amounts of toxic release under the new owners, and even higher levels of toxic release per employee. Furthermore, plants that remain under the ownership of sellers do not experience a reduction in pollution either.

Moreover, we find suggestive evidence that sellers maintain access to the sold plants as they are more likely to sell their pollutive assets to joint-venture or supply-chain partners. After the sale, the seller and the buyer are also more likely to develop new business relations.

Combined, these findings suggest that regulators, rating agencies, and government procurement agencies reward the divestment of pollutive assets, even though these divestitures only reflect a cosmetic redrawing of the boundaries of the firm without any real effects on abatement efforts or overall pollution levels. This evidence seems more consistent with the view that the divestment of polluting assets is a "greenwashing" strategy through which firms convey a false impression that they are more environmentally sound to obtain the benefits associated with a stronger environmental image. As such, our findings provide novel evidence on the role that the real asset market plays in firms' greenwashing strategies.

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Figure 1. The Average Value of Pollutive Plant Divestitures
This figure reports the average deal value (in $millions) of divestitures involving TRI plants in each year.

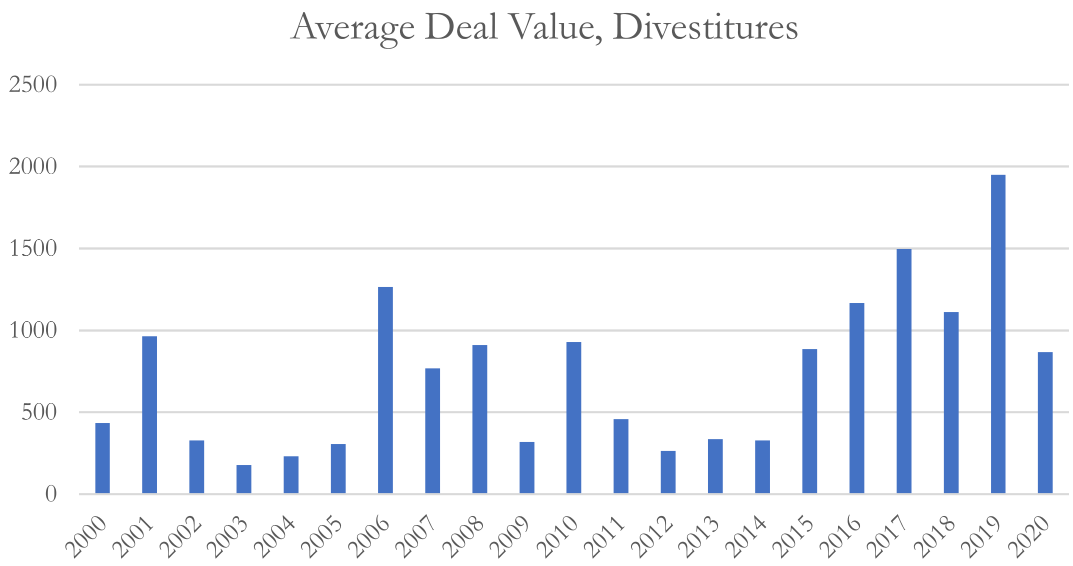
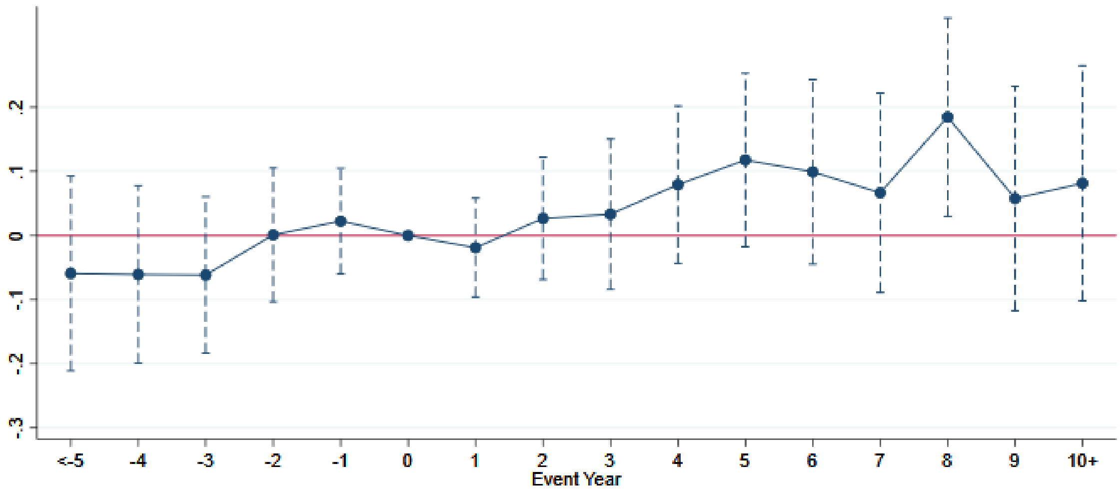


Figure 2. Google Search Volume of "Green Wash"
This figure reports the average google search volume of the phrase "green wash" in each year.

Figure 3. Changes in Plant-level Pollution Following Divestitures
This figure presents the dynamics of plant-level pollution around divestitures, measured as log of the total toxic releases in panel (a) and log of the total toxic releases divided by employment count in panel (b). Regression specification includes plant fixed effects, industry-year fixed effects, and state-year fixed effects. 95% confidence intervals are included.

(a) Log(Release)



(b) Log(Release/Emp)

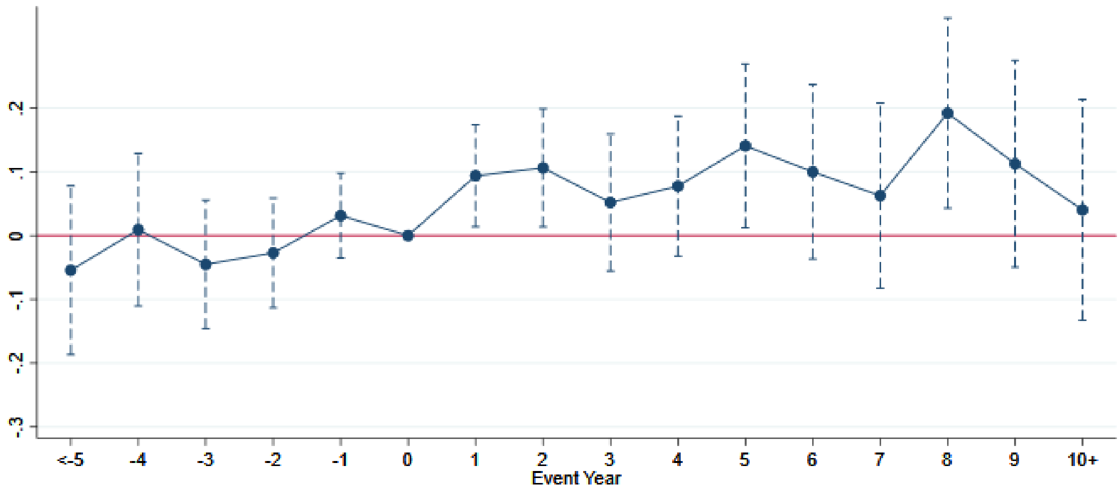


Table 1. Summary Statistics

This table presents summary statistics for variables used. Panel A presents summary statistics for the TRI plant-year panel, and Panel B presents the summary for the firm-year panel. Panel C reports statistics for buyers' and sellers' announcement cumulative returns.

Panel A: Plant-Level Sample

	N	Mean	Median	SD	P25	P75
Log(Release)	352,938	6.66	7.43	4.05	3.22	9.78
Release	352,938	58,528.59	1,687.19	215,344.54	24	17,705
Log(Release/Emp)	285,242	3.23	2.97	2.86	0.24	5.40
Release/Emp	285,242	1,158.93	18.42	5,190.52	0.28	220.51
IHS(Release)	352,938	7.24	8.12	4.24	3.87	10.47
IHS(Release/Emp)	285,242	3.67	3.61	3.12	0.27	6.09
Log(Sales) (NETS)	284,538	16.74	16.81	1.77	15.67	17.91
Sales (in $M, NETS)	284,538	73.92	20	174.94	6.40	59.99
Log(Emp) (NETS)	285,242	4.59	4.62	1.48	3.69	5.63
Emp (NETS)	285,242	258.02	100	449.79	39	277
# Source Reduction	352,938	9.30	1.00	21.21	0.00	8.00
% Recycling	352,938	31.18	0.00	43.34	0.00	90.11
% Recovery	352,938	5.35	0.00	18.17	0.00	0.00
% Treatment	352,938	21.42	0.00	36.38	0.00	30.78

Panel B: Firm-Level Sample

	N	Mean	Median	SD	P25	P75
Log(Release)	14,326	9.16	10.02	4.36	7.00	12.30
Release	14,326	625496.30	22,479	2,037,716	1,101	220,629.90
Log(Release/Emp)	13,466	3.63	3.54	2.68	1.26	5.64
Release/Emp	13,466	898.05	33.33	3,721.17	2.52	280.69
Log(Sales) (NETS)	14,326	4.72	4.90	2.24	3.45	6.22
Sales (in $M, NETS)	14,326	790.42	132.76	2,080.41	30.45	503.95
Log(Emp) (NETS)	14,326	6.06	6.37	2.35	5.02	7.63
Emp (NETS)	14,326	2,364.07	584	5,000.88	150	2,064
CSR Score (KLD)	38,203	0.32	0.00	2.31	-1.00	1.00
Environment Score (KLD)	38,203	0.15	0.00	0.83	0.00	0.00
Have ESG Event	180,203	0.07	0	0.26	0	0
Have Env. Event	180,203	0.04	0	0.19	0	0
Have Social, Governance Event	180,203	0.07	0	0.25	0	0
Enforcement Action	182,184	0.01	0	0.08	0	0
Log(Enforcement Cost)	14,013	0.94	0	3.23	0	0
IHS(Enforcement Cost)	14,013	0.99	0	3.41	0	0
Log(Contract Amount)	20,287	11.79	12.32	4.56	10.17	14.61
IHS(Contract Amount)	20,287	12.42	13.01	4.71	10.86	15.30
Log(Assets)	184,691	5.32	5.55	2.95	3.43	7.37
M/B	168,278	3.17	1.36	6.38	1.02	2.36
Leverage	180,965	0.39	0.34	0.34	0.04	0.64
Cash Holding	184,650	0.21	0.10	0.26	0.03	0.30
Tangibility	180,154	0.25	0.12	0.28	0.02	0.40
Market Share	184,416	0.01	0.00	0.02	0.00	0.00
Log(Sales)	164,571	4.91	5.06	2.87	3.22	6.90

Panel C: Announcement CARs

	N	Mean	Median	SD	P25	P75
Seller CAR, Market	290	2.91%	0.72%	12.80%	-1.19%	3.26%
Seller CAR, FF	287	2.85%	0.47%	12.76%	-1.41%	3.22%
Buyer CAR, Market	272	2.02%	1.08%	5.86%	-0.63%	3.92%
Buyer CAR, FF	270	1.69%	0.78%	5.65%	-0.82%	3.49%

Table 2. Buyer and Seller Characteristics
This table presents the univariate comparison of buyers and sellers' characteristics. *Private Firm* (*Unrated Firm*) is an indicator that the buyer or seller of a deal is a private company (not covered by KLD, Refinitive, or MSCI ratings). *Private Firm* and *Unrated Firm* are based on deal-level information. All other characteristics are tabulated for publicly traded buyers and sellers for the year before and in the year of the divestiture ($[t-1, t]$).

	Buyer		Seller		Difference
	Obs	Mean	Obs	Mean	(Buyer−Seller)
Private Firm	719	0.54	719	0.48	0.06**
Unrated Firm	719	0.66	719	0.62	0.05**
Log(Release)	347	11.08	372	11.71	-0.63**
Log(Release/Emp)	331	4.21	368	4.18	0.03
Log(Emp) (NETS)	347	7.03	372	7.87	-0.84***
Log(Sales) (NETS)	347	5.74	372	6.57	-0.84***
CSR Score (KLD)	275	0.17	338	0.13	0.04
Environment Score (KLD)	275	0.08	338	-0.12	0.20*
Size	499	7.99	523	8.60	-0.61***
M/B	493	1.62	515	1.52	0.09**
Leverage	499	0.42	522	0.45	-0.03**
Cash	499	0.09	523	0.09	0.00
Tangibility	499	0.30	521	0.30	0.00
Market Share	499	0.03	523	0.04	-0.01***
Log(Sales)	497	7.87	520	8.40	-0.54***

Table 3. Plant-Level Pollution and the Likelihood of Divestitures

In this table, we examine whether plants releasing more toxic chemicals are more likely to be divested by their parent firms. *Divested* equals 100 if a plant is divested in a given year, and zero otherwise. *Past Release (Quartile)* is the quartile partitions of the total toxic release generated by a plant, averaged over the past two years ($[t-1, t]$). *Release/Emp (Quartile)* stands for the quartile partition of the toxic emissions intensity by a plant (emission per employee), averaged over the past two years($[t-1, t]$). Both measures take the value of 1 to 4, with 4 being the highest pollution level. Data regarding the number of employees in a plant come from NETS. The sample is a plant-year panel, including all TRI plant observations up to the year it is sold. Standard errors are clustered at the plant level. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

Dep. Var.: *Divested*	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Past Release (Quartile)	0.058***	0.044***	0.046***	0.043***				
	(0.009)	(0.010)	(0.010)	(0.010)				
Past Release/Emp (Quartile)					0.040***	0.026**	0.029***	0.027**
					(0.010)	(0.011)	(0.011)	(0.011)
Year FE		Yes				Yes		
Industry FE		Yes				Yes		
Industry-Year FE			Yes	Yes			Yes	Yes
State-Year FE				Yes				Yes
Observations	301,172	301,166	301,044	301,032	242,258	242,254	242,125	242,102
R-squared	0.000	0.002	0.010	0.015	0.000	0.001	0.006	0.012

Table 4. Exposure to ESG Risks and the Decision to Sell Pollutive Plants

This table examines the response of firms to ESG risk exposure. Information on ESG risk events comes from RepRisk. *Have ESG Risk Event* is a dummy variable that equals one if a firm incurs an ESG risk event in the current or the past year. *Have Env. Risk Event* equals one if a firm incurs an environment-related risk event in the current or the past year. Similarly, *Have Social, Governance Event* indicates whether a firm incurs a social or environmental-related risk event in the current or the past year. In Panel A, we examine whether firms facing ESG risk events are more likely to sell pollutive plants. The dependent variable is *Sell (Pollutive)*, an indicator is a firm divests at least one TRI plant in a given year. This indicator is multiplied by 100, sot the coefficients represent the percentage likelihood of divestment. The sample used in this analysis is a parent firm-year panel, including all parents of TRI plants that have appeared at least once in the RepRisk database. In Panel B, we examine whether the same set of parent firms are more likely to divest other assets when facing ESG risk exposures. The dependent variable is *Sell (Non-Pollutive)*, an indicator for whether a firm divests other assets in a given year. This indicator is multiplied by 100. Standard errors are clustered at the parent firm level. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

Panel A. Pollutive Plants

Dep. Var.: *Sell (Pollutive)*	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Have RepRisk Event	0.669**	0.685**	0.729**						
	(0.310)	(0.312)	(0.321)						
Have Environment Event				1.012**	1.242***	1.300***	0.887**	1.198**	1.231**
				(0.397)	(0.462)	(0.487)	(0.419)	(0.488)	(0.515)
Have Social, Governance Event							0.245	0.090	0.142
							(0.321)	(0.313)	(0.329)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes			Yes			Yes		
Industry-Year FE		Yes	Yes		Yes	Yes		Yes	Yes
Firm Char			Yes			Yes			Yes
Observations	9,172	8,733	8,336	9,172	8,733	8,336	9,172	8,733	8,336
R^2	0.198	0.258	0.263	0.198	0.259	0.263	0.198	0.259	0.263

Panel B. Non-Pollutive Plants

Dep. Var.: *Sell (Non-Pollutive)*	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(8)
Have RepRisk Event	-1.361	-1.574	-2.117						
	(1.275)	(1.306)	(1.291)						
Have Environment Event				-1.574	-2.097	-2.339	-1.164	-1.502	-1.577
				(1.516)	(1.490)	(1.485)	(1.481)	(1.483)	(1.464)
Have Social, Governance Event							-0.817	-1.224	-1.570
							(1.207)	(1.306)	(1.284)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes			Yes			Yes		
Industry-Year FE		Yes	Yes		Yes	Yes		Yes	Yes
Firm Char			Yes			Yes			Yes
Observations	10,179	9,767	9,373	10,179	9,767	9,373	10,179	9,767	9,373
R^2	0.741	0.761	0.768	0.741	0.761	0.768	0.741	0.761	0.768

Table 5. Changes in Pollution Following Divestitures

This table presents regression estimates for the pollution level and abatement activities of divested plants around the divestiture. The sample includes all TRI plants. *Divested* is an indicator of whether a plant has been divested by its parent. *Post* is an indicator for years after the transaction. *Log(Release)* is the log value of the total toxic release. *Log(Release/Emp)* captures a plant's toxic emissions intensity, which is calculated as the ratio of total toxic release over the establishment's employment (based on information from NETS). *IHS(·)* represents the IHS transformation. Panel C examines various pollution abatement efforts, including the total number of source reduction practices (*# Source Reduction*), and the percentage of generated toxic chemicals reduced through recycling (*% Recycling*), energy recovery (*% Recovery*), and treatment (*% Treatment*). Standard errors are presented in parentheses and clustered by plant. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

Panel A. Total Toxic Release

Dep. Var.:	*Log(Release)*				*IHS(Release)*
	(1)	(2)	(3)	(4)	(5)
Divested × *Post*	0.115*	0.092	0.104	0.085	0.097
	(0.066)	(0.065)	(0.066)	(0.065)	(0.068)
Plant FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes				
Industry-Year FE		Yes		Yes	Yes
State-Year FE			Yes	Yes	Yes
R^2	0.858	0.860	0.859	0.860	0.859
Observations	316,722	316,571	316,716	316,565	316,565

Panel B. The Intensity of Toxic Release

Dep. Var.:	*Log(Release/Emp)*				*IHS(Release/Emp)*
	(1)	(2)	(3)	(4)	(5)
Divested × *Post*	0.137**	0.114*	0.129**	0.109*	0.119*
	(0.061)	(0.061)	(0.061)	(0.061)	(0.065)
Plant FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes				
Industry-Year FE		Yes		Yes	Yes
State-Year FE			Yes	Yes	Yes
R^2	0.854	0.856	0.855	0.856	0.856
Observations	255,389	255,228	255,368	255,204	255,204

Panel C. Pollution Abatement Activities

Dep. Var.:	*# Source Reduction*	*% Recycling*	*% Recovery*	*% Treatment*
	(1)	(2)	(3)	(4)
Divested × *Post*	0.165	0.305	-0.036	1.338
	(0.293)	(0.800)	(0.551)	(0.825)
Plant FE	Yes	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes	Yes
State-Year FE	Yes	Yes	Yes	Yes
R^2	0.955	0.839	0.706	0.817
Observations	316,565	316,565	316,565	316,565

Table 6. Buyers of Pollutive Plants: Ownership and ESG Ratings
In this table, we examine whether buyers of TRI plants are more likely to be private and non-ESG-rated, and whether this pattern is most salient for highly pollutive plants. In columns (1)-(2), we compare buyer and seller types across TRI divestiture deals. The sample is a deal-firm panel. The independent variables are *Private Firm*, an indicator of a private firm, and *Unrated Firm*, an indicator of a firm not covered by KLD, Refinitive, or MSCI. In columns (3)-(6), we regress plant-level past pollution (sorted into quartiles) on their buyer types. The sample is a deal-plant panel. The dependent variables are *Private Buyer*, an indicator of a buyer being a private company, and *Unrated Buyer*, an indicator of a buyer not covered by KLD, Refinitive, or MSCI. Robust standard errors are included. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

Dep. Var:	*Private Firm*	*Unrated Firm*	*Private Buyer*		*Unrated Buyer*	
	(1)	(2)	(3)	(4)	(5)	(6)
Past Release Measured By:			Quantity	Intensity	Quantity	Intensity
Buyer	0.062**	0.052**				
	(0.027)	(0.025)				
Past Release (Quartile)			0.010	0.049**	0.009	0.042**
			(0.017)	(0.017)	(0.017)	(0.018)
Industry FE	No	No	Yes	Yes	Yes	Yes
Year FE	No	No	Yes	Yes	Yes	Yes
Observations	1,419	1,419	855	708	855	708
R^2	0.003	0.002	0.105	0.121	0.113	0.134

Table 7. Changes in ESG Ratings Following Divestitures

This table presents ESG Rating changes post-divestitures for sellers. The sample includes all firms covered by the KLD database. Panel A reports results related to divestitures of TRI plants. *Seller (Pollutive)* is an indicator of whether a firm sells a plant in a divestiture transaction over our sample period. Panel B reports results related to divestitures of other, non-pollutive assets. *Seller (Non-Pollutive)* is an indicator of whether a firm sells a non-pollutive asset in a divestiture transaction over our sample period. In both panels, the dependent variable of the first three columns is *Overall CSR Score*, and the dependent variable of the last three columns is *Environmental Scores*. *Post* indicates years during or after the deals. Rating data come from the KLD database. *Firm Char* includes *Log(Assets)*, *M/B*, *Leverage*, *Cash*, and *Tangibility*. Standard errors are reported in parentheses and clustered by firm. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

Panel A. Pollutive Plants

Dep. Var.:	*Overall CSR Scores*			*Environment Scores*		
	(1)	(2)	(3)	(4)	(5)	(6)
Seller(Pollutive) × *Post*	0.701***	0.468**	0.483**	0.501***	0.249**	0.224**
	(0.226)	(0.220)	(0.223)	(0.111)	(0.108)	(0.109)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes			Yes		
Industry-Year FE		Yes	Yes		Yes	Yes
Firm Char			Yes			Yes
R^2	0.623	0.650	0.651	0.510	0.558	0.562
Observations	38,226	38,103	35,962	38,226	38,103	35,962

Panel B. Non-Pollutive Plants

Dep. Var.:	*Overall CSR Scores*			*Environment Scores*		
	(1)	(2)	(3)	(4)	(5)	(6)
Seller(Non-Pollutive) × *Post*	0.101*	0.032	0.043	0.038	-0.009	-0.019
	(0.060)	(0.061)	(0.064)	(0.027)	(0.028)	(0.030)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes			Yes		
Industry-Year FE		Yes	Yes		Yes	Yes
Firm Char			Yes			Yes
R^2	0.623	0.650	0.651	0.507	0.557	0.561
Observations	38,226	38,103	35,962	38,226	38,103	35,962

Table 8. Changes in Environmental Compliance Costs Following Divestitures

This table presents changes in enforcement costs for sellers around the divestiture. The sample includes all public firms. Panel A reports results related to divestitures of TRI plants. *Seller (Pollutive)* is an indicator for whether a firm sells a plant in a divestiture transaction over our sample period. *Post* indicates years during or after the deals. Panel B reports results related to divestitures of other, non-pollutive assets. *Seller (Non-Pollutive)* is an indicator for whether a firm sells a non-pollutive asset in a divestiture transaction over our sample period. In both panels, *Enforcement Action* is an indicator is a firm faces an EPA enforcement action in a given year. *Log(Enforcement Cost)* is the log dollar amount of cost incurred by the firm due to the enforcement, including fines and cleanup costs. *IHS(Enf. Cost)* is the IHS transformation of enforcement cost. *Firm Char* includes *Log(Assets)*, *M/B*, *Leverage*, *Cash*, and *Tangibility.* Standard errors are clustered at the firm level. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

Panel A. Pollutive Plants

Dep. Var.:	*Enforcement Action*			*Log(Enforcement Cost)*			*IHS(Enf. Cost)*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Seller (Pollutive) × *Post*	-0.070***	-0.061***	-0.063***	-0.882***	-0.791***	-0.690***	-0.732***
	(0.013)	(0.013)	(0.013)	(0.204)	(0.201)	(0.201)	(0.212)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes			Yes			
Industry-Year FE		Yes	Yes		Yes	Yes	Yes
Firm Char			Yes			Yes	Yes
Observations	180,676	165,329	142,238	13,813	13,442	12,775	12,775
R^2	0.328	0.338	0.346	0.283	0.325	0.330	0.331

Panel B. Non-Pollutive Plants

Dep. Var.:	*Enforcement Action*			*Log(Enforcement Cost)*			*IHS(Enf. Cost)*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Seller (NonPollutive) × *Post*	-0.003***	-0.003**	-0.003**	-0.165	-0.138	-0.123	-0.130
	(0.001)	(0.001)	(0.001)	(0.118)	(0.124)	(0.123)	(0.130)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes			Yes			
Industry-Year FE		Yes	Yes		Yes	Yes	Yes
Firm Char			Yes			Yes	Yes
Observations	180,676	165,325	142,227	13,976	13,610	12,916	12,916
R^2	0.328	0.339	0.346	0.285	0.327	0.331	0.331

Table 9. Changes in the Allocation of Government Contracts Following Divestitures
This table presents changes in the likelihood of a firm obtaining government contracts around divestitures. The sample includes all public firms. In Panel A, we examine the effect of divesting pollutive plants. *Seller (Pollutive)* is an indicator of whether a firm sells a plant in a divestiture transaction over our sample period. *Post* indicates years during or after the deals. The sample is a firm-year panel, including all firms owning a pollutive plant. In Panel B, we examine the effect of divesting non-pollutive assets. *Seller (Non-Pollutive)* is an indicator of whether a firm sells a non-pollutive asset in a divestiture transaction over our sample period. *Log(Contract Amt)* is the log dollar amount of government contracts. *IHS(Contract Amt)* is the IHS transformation of the contract dollar amount. *Firm Char* includes *Log(Assets)*, *M/B*, *Leverage*, *Cash*, and *Tangibility*. Standard errors are clustered at the firm level. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

Panel A. Pollutive Plants

Dep. Var.:	*Log(Contract Amt)*			*IHS(Contract Amt)*
	(1)	(2)	(3)	(4)
Seller (Pollutive) × *Post*	0.221	0.772*	0.772*	0.805*
	(0.390)	(0.421)	(0.421)	(0.431)
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes			
Industry-Year FE		Yes	Yes	Yes
Firm Char			Yes	Yes
Observations	19,589	18,359	18,359	18,359
R^2	0.571	0.616	0.616	0.607

Panel B. Non-Pollutive Plants

Dep. Var.:	*Log(Contract Amt)*			*IHS(Contract Amt)*
	(1)	(2)	(3)	(4)
Seller (NonPollutive) × Post	-0.086	-0.203	-0.203	-0.207
	(0.148)	(0.160)	(0.160)	(0.166)
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes			
Industry-Year FE		Yes	Yes	Yes
Firm Char			Yes	Yes
Observations	19,550	18,342	18,342	18,342
R^2	0.571	0.616	0.616	0.606

Table 10. Pollution Levels at the Remaining Plants Following Divestitures
This table presents regression estimates for the pollution level of remaining (non-divested) plants. *Peer Divestiture* is an indicator for whether a plant's parent is a seller in a divestiture deal over our sample period. *Post* indicates years during and after the divestiture deal. *Log(Release)* is the log value of total toxic release of a plant. *Log(Release/Emp)* captures a plant's toxic emissions intensity, which is calculated as the ratio of total toxic release over the establishment's employment (based on information from NETS). *IHS* represents the IHS transformation of pollution levels. Standard errors are presented in parentheses and clustered by plant. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

Panel A. Total Toxic Release

Dep. Var.:	*Log(Release)*				*IHS(Release)*
	(1)	(2)	(3)	(4)	(5)
Peer Divestiture × *Post*	-0.065	-0.051	-0.072	-0.052	-0.046
	(0.048)	(0.048)	(0.048)	(0.048)	(0.050)
Plant FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes				
Industry-Year FE		Yes		Yes	Yes
State-Year FE			Yes	Yes	Yes
R^2	0.858	0.859	0.858	0.859	0.858
Observations	305,207	305,072	305,201	305,066	305,066

Panel B. Intensity of Toxic Release

Dep. Var.:	*Log(Release/Emp)*				*IHS(Release/Emp)*
	(1)	(2)	(3)	(4)	(5)
Peer Divestiture × *Post*	0.047	0.045	0.041	0.044	0.040
	(0.038)	(0.038)	(0.038)	(0.038)	(0.041)
Plant FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes				
Industry-Year FE		Yes		Yes	Yes
State-Year FE			Yes	Yes	Yes
R^2	0.854	0.855	0.854	0.855	0.856
Observations	246,017	245,866	245,996	245,842	245,842

Table 11. Business Ties between Buyers and Sellers of Pollutive Assets
This table reports results regarding whether the buyer and seller of a divestiture share operational relations, such as supply-chain or joint-venture partners. In Column (1), we examine whether firms that shared operational relationships with the seller in the past are more likely to become buy the divested plants from the seller. *Operationally Related* is an indicator for whether a firm is a supply-chain or joint venture partner with the seller in the past. *Buyer of Divested Plants* is an indicator for whether a firm purchases a divested plant from the seller. In Column (2), we examine whether firms are more likely to develop new supply-chain or joint venture relations after the divestiture. For each divestiture deal, we match the buyer with five randomly chosen acquirers in the SDC universe in the same industry. Each matched acquirer is considered a potential buyer. The analysis utilizes a matched-pair sample, wherein each observation is a seller-potential buyer pair. As such, each deal has six observations (a matched group), consisting of the actual buyer-seller pair and five potential buyer-seller pairs. Regressions include matched group fixed effects. Standard errors are double clustered by matched group and deal year. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

Dep. Var.:	(1) *Buyer of Divested Plants*	(2) *Develop New Relationship*
Operationally Related	0.456***	
	(0.062)	
Buyer of Divested Plants		0.071***
		(0.013)
Matched Group FE	Yes	Yes
Observations	2,880	2,880
R^2	0.020	0.233

Table 12. Equity Returns to Deal Announcement

This table examines sellers' cumulative abnormal returns (CARs) around a three-day window of the divestiture announcement date in relation to the pollution level of plants being sold. Abnormal returns are computed in two ways. First, we subtract market returns from firms' equity returns and define the difference as abnormal returns ("Market" benchmark). Second, we take the residual from regressing total returns on the Fama-French 3-factor model ("FF" benchmark). We examine the relation between announcement CARs and past releases of sold plants in a deal. Past releases of a deal is measured as both the total quantity of toxic releases generated by all plants sold in the deal (*Quantity*), or the ratio of total release over total employment of the sold plants (*Intensity*). Similar to Table 3, we assign quartile values of these pollution metrics, ranging from 1 (least pollutive) to 4 (most pollutive). The unit of observation is a divestiture deal that includes a publicly traded seller. All regressions include industry fixed effects and year fixed effects. Standard errors are double clustered by year and industry. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

Dep. Var.: Seller $CAR[-1,+1]$	(1)	(2)	(3)	(4)
Benchmark	Market	Market	FF	FF
Past Release Measured By:	Quantity	Intensity	Quantity	Intensity
Past Release (Quartile)	0.011**	0.012**	0.012**	0.013**
	(0.004)	(0.005)	(0.004)	(0.006)
Seller Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	279	248	276	244
R^2	0.308	0.412	0.309	0.433

Table 13. The Performance of Buyers Following Divestitures

This table presents operating performance changes post-divestitures for buyers. The sample is a firm-year panel, including all public firms in Compustat Universe, excluding firms in the financial industries. *Buyer* is a dummy variable that equals one if a firm purchases a plant via a divestiture transaction over our sample period, and zero otherwise. *Post* is an indicator for years during and after the transaction. Standard errors are clustered at the firm level. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

Dep. Var.:	*Market Share*		*Log(Sales)*	
	(1)	(2)	(3)	(4)
Buyer × *Post*	0.003**	0.003***	0.061	0.096**
	(0.001)	(0.001)	(0.046)	(0.048)
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes		Yes	
Industry-Year FE		Yes		Yes
R^2	0.923	0.931	0.929	0.931
Observations	182,833	182,680	162,889	162,764

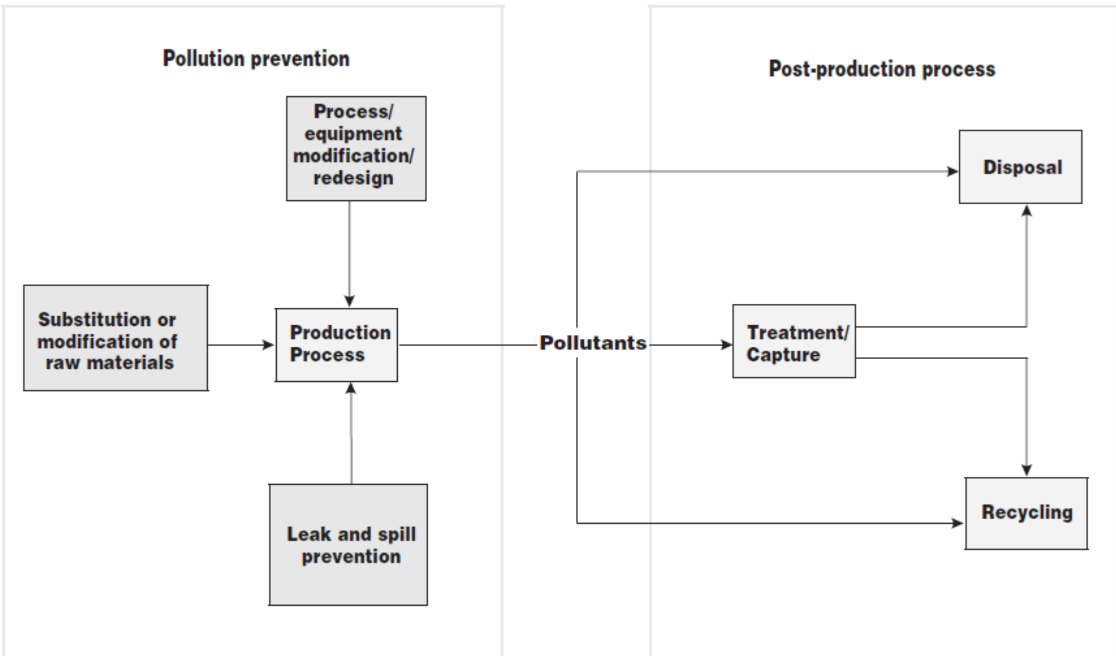
Appendix A Pollution Abatement Activities

The figure below provides an overview of plants' pollution abatement activities under two major categories: *pollution prevention* (also referred to as *source reduction*) and *post-production processes.*

Each year, facilities must report their newly implemented source reduction activities by selecting 47 codes that fall under eight broad categories (ranked according to reported frequency): (1) Good Operating Practices; (2) Process Modifications; (3) Spill and Leak Prevention; (4) Raw Material Modifications; (5) Inventory Control; (6) Surface Preparation and Finishing; (7) Cleaning and Degreasing; (8) Product Modifications.

Post-production waste management includes the following: (1) Recycling, which involves a series of activities through which discarded materials are collected, sorted, processed, and converted into raw materials and used in the production of new products; (2) Energy recovery (Capture), which is process of generating energy from the combustion of wastes, including at waste-to-energy combustion facilities and landfill-gas-to-energy facilities; (3) Treatment, which involves the use of various processes, such as incineration or oxidation, to alter the properties or composition of hazardous materials.

Figure A.1. Pollution Abatement Activities



Appendix B Detecting Ownership Changes of TRI Plants

We track the changes in ownership of TRI plants as follows.

First, we flag incidences where a plant experiences a change of parent names and label the parent name before the change as the seller and the name after the change as the buyer. Parent name changes are either directly reported by the TRI, or could be detected by changes in a plant's CUSIP number.

Next, we match the buyer and seller names to those of divestiture deals from the SDC database. The matching is performed both at the subsidiary firm level as well as the ultimate parent level. In this process, we account for the scenario that TRI data may capture inaccurately the timing of ownership changes, and require the SDC deal year to fall within a $[-3, 3]$ year window around the year of the parent name change in TRI. We use SDC's deal effective date as the official date for the ownership change.

We further consider the possibility that the TRI data may not update parent information correctly in all cases. To address this concern, for each plant in TRI, we track whether it has gone through a divestiture by matching its name or its parent's name to the target name in SDC. We also require the TRI plant to fit the target's geographical location and industry classification in SDC. For example, Westmoreland Coal acquired the Roanoke Valley Energy Facility from its joint venture partner, LG&E Energy Corp in 2006. While we do not see a change of parent name for the Roanoke valley Energy Facility in TRI, we still classify it as a divested plant.

Finally, we remove plants that have been sold multiple times during the sample period. We do so because the difference-in-differences tests struggle with the classification of repeat divestiture targets as treatment vs. control plants. Our final sample contains 719 deals.

Appendix C   Variable Definition

Plant-Level Variable

- *Log(Release)*: The natural log of one plus total toxic release amount
- *Release*: The amount of total toxic releases
- *Log(Release/Emp)*: The natural log of one plus total toxic release amount divided by the number of employees
- *Release/Emp*: The amount of total toxic releases divided by the number of employees
- *IHS(Release)*: The IHS transformation of total toxic release amount
- *IHS(Release/Emp)*: The IHS transformation of total toxic release amount divided by the number of employees
- *Log(Sales)* (NETS): The natural log of one plus sales dollar amount based on NETS
- *Sales* (in $M, NETS): The total sales dollar amount based on NETS
- *Log(Emp)* (NETS): The natural log of one plus the number of employees based on NETS
- *Emp* (NETS): The number of employees based on NETS
- *# Source Reduction*: The total number of source reduction activities
- *% Recycling*: The percentage of total produced toxic chemicals reduced through recycling
- *% Recovery*: The percentage of total produced toxic chemicals reduced through energy recovery
- *% Treatment*: The percentage of total produced toxic chemicals reduced through treatment

Panel B: Firm-Level Variable

- *D(Public firms)*: An indicator of a firm being publicly traded
- *D(KLD rating)*: An indicator of a firm having KLD rating
- *Log(Release)*: The natural log of one plus total toxic release amount
- *Release*: The total amount of toxic releases
- *Log(Release/Emp)*: The natural log of one plus total toxic release amount divided by the number of employees
- *Release/Emp*: The total amount of toxic releases divided by the number of employees
- *Log(Sales)* (NETS): The natural log of one plus sales dollar amount based on NETS
- *Sales* (in $M, NETS): The total sales dollar amount based on NETS
- *Log(Emp)* (NETS): The natural log of one plus the number of employees based on NETS
- *Emp* (NETS): The number of employees based on NETS
- *CSR Score* (KLD): The aggregate net strength and concern counts across six dimensions in KLD
- *Environment Score* (KLD): The net strength and concern counts for the environmental dimension in KLD
- *Log(Assets)*: The natural log of one plus total assets
- *M/B* : $(at - ceq + csho * prcc_f)/at$
- *Leverage*: $(dlc + dltt)/(dlc + dltt + ceq)$
- *Cash Holding*: $Cash/at$
- *Tangibility*: $PPENT/at$
- *Market Share*: The percentage of sales (Compustat) within all public firms in the same NAICS3-year
- *Log(Sales)*: The natural log of one plus sales (Compustat)
- *Have ESG Event*: An indicator of a firm having an ESG risk event based on RepRisk
- *Have Env. Event*: An indicator of a firm having an environmental risk event based on RepRisk
- *Enforcement Action*: An indicator of a firm experiencing a regulatory enforcement event

- *Log(Enforcement Cost)*: The natural log of one plus the total regulatory enforcement costs
- *IHS(Enforcement Cost)*: The IHS transformation of the total regulatory enforcement costs
- *Enforcement Cost* (in $M): The total dollar amount of regulatory enforcement costs
- *Log(Contract Amount)*: The natural log of one plus the total dollar amount of government contract
- *IHS(Contract Amount)*: The IHS transformation of the total dollar amount of government contract
- *Contract Amount* (in $M): The total dollar amount of government contract
- *Operationally Related*: An indicator of a firm being a supply-chain or join venture partner with the seller in the past
- *Develop New Relationship*: An indicator of a firm developing new supply-chain or join venture relation with the seller

Appendix D Industry Composition

Table D.1. Industry Composition
This table reports the three-digit NAICS3 code for our sample divested plants.

NAICS3	Industry	Observations
325	Chemical Manufacturing	258
332	Fabricated Metal Product Manufacturing	117
311	Food Manufacturing	89
336	Transportation Equipment Manufacturing	73
424	Merchant Wholesalers, Nondurable Goods	72
331	Primary Metal Manufacturing	66
334	Computer and Electronic Product Manufacturing	63
326	Plastics and Rubber Products Manufacturing	53
333	Machinery Manufacturing	47
322	Paper Manufacturing	45
321	Wood Product Manufacturing	39
324	Petroleum and Coal Products Manufacturing	31
335	Electrical Equipment, Appliance, and Component Manufacturing	30
221	Utilities	25
327	Nonmetallic Mineral Product Manufacturing	21
562	Waste Management and Remediation Services	12
339	Miscellaneous Manufacturing	12
312	Beverage and Tobacco Product Manufacturing	10
112	Animal Production and Aquaculture	9
323	Printing and Related Support Activities	7
212	Mining (except Oil and Gas)	7
316	Leather and Allied Product Manufacturing	5
337	Furniture and Related Product Manufacturing	4
313	Textile Mills	3
493	Warehousing and Storage	3
811	Repair and Maintenance	1
314	Textile Product Mills	1
315	Apparel Manufacturing	1
517	Telecommunications	1

Appendix E Alternative ESG Rating Measures

Our analysis on ESG ratings relies primarily on the KLD database, because this database provides ratings on firm business conducts in earlier years of our sample. Figure E.1 presents the number of unique firms covered by KLD, Refinitive, and MSCI ESG ratings during 1990-2020. KLD provides the most comprehensive coverage in the early sample period.

In Table E.1, we augment KLD rating data with the Refinitive and MSCI ratings. Specifically, we first standardize ratings within each dataset-year, and then fill in firm-years missing KLD ratings with Refinitive and MSCI ratings when available. If both Refinitive and MSCI ratings are available, we prioritize Refinitive ratings due to a higher correlation with KLD: in the overlapping sample across three datasets, the correlation of the Overall CSR (Environmental) scores is 0.50 (0.45) between the standardized Refinitive and KLD ratings, and 0.40(0.26) between the standardized MSCI and KLD ratings. Our results remain robust to the augmented ESG rating measures.

Figure E.1. KLD, Refinitive, and MSCI Coverage
This figure reports the number of U.S. non-financial firms included in the KLD, Refinitive, and MSCI ESG ratings between 1990-2020.

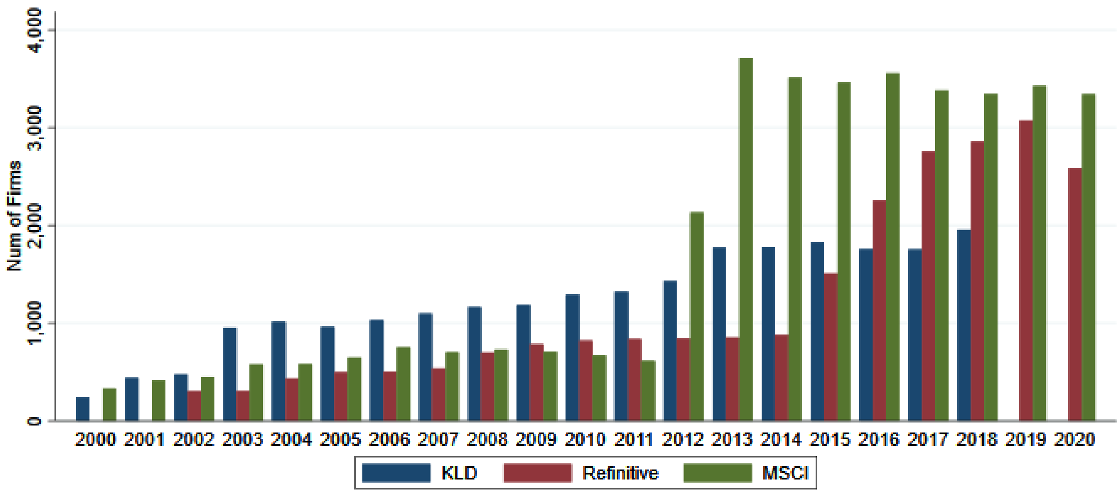


Table E.1. Robustness: Alternative ESG Ratings

This table presents ESG Rating changes post-divestitures for sellers, where we use Refinitive and MSCI data to augment KLD ratings. All rating observations are first standardized with each dataset-year, and then observations with missing KLD ratings are filled in with ratings from Refinitive and MSCI if available. Panel A reports results related to divestitures of TRI plants. *Seller (Pollutive)* is an indicator of whether a firm sells a plant in a divestiture transaction over our sample period. Panel B reports results related to divestitures of other, non-pollutive assets. *Seller (Non-Pollutive)* is an indicator of whether a firm sells a non-pollutive asset in a divestiture transaction over our sample period. In both panels, the dependent variable of the first three columns is *Overall CSR Score*, and the dependent variable of the last three columns is *Environmental Scores. Post* indicates years during or after the deals. *Firm Char* includes *Log(Assets)*, *M/B*, *Leverage*, *Cash*, and *Tangibility.* Standard errors are reported in parentheses and clustered by firm. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

Panel A. Pollutive Plants

Dep. Var.:	*Overall CSR Scores*			*Environment Scores*		
	(1)	(2)	(3)	(4)	(5)	(6)
Seller(Pollutive) × *Post*	0.309***	0.218**	0.228**	0.644***	0.392***	0.369***
	(0.097)	(0.094)	(0.095)	(0.145)	(0.137)	(0.138)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes			Yes		
Industry-Year FE		Yes	Yes		Yes	Yes
Firm Char			Yes			Yes
R^2	0.518	0.545	0.547	0.410	0.456	0.459
Observations	53,250	53,111	49,880	53,242	53,103	49,871

Panel B. Non-Pollutive Plants

Dep. Var.:	*Overall CSR Scores*			*Environment Scores*		
	(1)	(2)	(3)	(4)	(5)	(6)
Seller(Non-Pollutive) × *Post*	0.067**	0.003	0.003	0.049	-0.041	-0.043
	(0.026)	(0.026)	(0.027)	(0.031)	(0.032)	(0.034)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes			Yes		
Industry-Year FE		Yes	Yes		Yes	Yes
Firm Char			Yes			Yes
R^2	0.519	0.546	0.549	0.408	0.456	0.459
Observations	52,783	52,644	49,449	52,777	52,638	49,443