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Creditor Control of Environmental Activity: The Role of Liquidation Value

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Abstract

I study the impact of creditor control on pollution activity, focusing on the role of liquidation value. My setting exploits a law change that protects property purchasers from environmental cleanup liabilities. Using a triple-difference design and financial covenant violations to proxy for creditor control, I find that firms that violate a financial covenant increase ground pollution by 13-26 percent when purchasing liability is reduced. Evidence suggests this increase stems from the adoption of less effective abatement technology rather than increased production. These findings suggest reducing pollution's effect on asset value disincentivizes creditors to monitor their borrower's environmental behavior. Overall, my results indicate that the market for corporate assets has important implications on how creditors affect corporate environmental practices.

JEL Classification: G21, G34, M14, Q50

Keywords: control rights, the market for corporate assets, covenant violations, corporate governance, social responsibility, environmental economics.

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1 Introduction

Creditors face increasing pressure to exit polluting industries. A recent article in Forbes says that "banks are in part responsible for the plastic pollution crisis because they are lending vast sums of capital without any effort to address the plastic pollution crisis."[1] As a result, many creditors have committed to stop financing polluting firms. For example, JP Morgan states the bank plans to "phase out remaining credit exposure to coal mining companies."[2] Reducing polluting firms' access to debt financing can positively affect the environment because it increases polluting firms' cost of capital, inducing them to adopt "cleaner" business models. However, limiting debt financing could also negatively affect the environment if governance by creditors (creditor's voice) is effective in disciplining corporate environmental behavior. Specifically, reducing bank debt can make firms financially constrained, resulting in diminished investment in pollution abatement stemming from risk-shifting or agency motives (Xu and Kim (2020); Akey and Appel (2021); Cohn and Deryugina (2018)). In this case, governance by creditors is critical to limiting these actions because creditors bear much of the costs of such activities.

In this paper, I examine whether lenders' concerns over pollution damaging collateral value create incentives for lenders to discipline polluting activity. Using plausibly exogenous variation in pollution's impact on asset value, I document that firms with heightened creditor control rights (1) increase ground pollution, and (2) invest in less effective pollution abatement when pollution's effect on asset value is reduced. My findings indicate that the risk of pollution adversely impacting asset value (liquidation value risk) allows lenders to internalize pollution externalities.

So far, there is limited research on how creditors influence corporate environmental behavior. Existing research has focused on whether exposing lenders to environmental liability incentivizes them to monitor corporate environmental behavior. For example, Bellon (2021) shows that reducing secured lenders' exposure to cleanup liability leads to worse environ-

1. https://www.forbes.com/sites/mikescott/2021/01/08/banks-called-out-for-their-role-in-financing-plastic-pollution/?sh=57a07bc51d35

2. https://www.jpmorganchase.com/content/dam/jpmc/jpmorgan-chase-and-co/documents/environmental-and-social-policy-framework.pdf

mental behavior by their borrowers. Ohlrogge (2020) finds that making bankrupt firms more liable for environmental cleanups reduces pollution.[3] Choy et al. (2021) show that exposing corporations to heightened environmental enforcement risk incentivizes creditors to monitor their borrowers leading to better environmental practices. Compared to this work, I document that liquidation value risk creates incentives for creditors to monitor environmental behavior. The unique aspect of the liquidation value risk channel is that it is not necessarily a product of enforcement risk. Instead, it creates monitoring incentives for lenders because debt is senior in a corporation's capital structure, and therefore lenders' payoff depends heavily on the liquidation value of firm assets.

In the U.S., pollution can significantly impair asset value because property purchasers can be held liable for cleaning up contamination caused by previous owners. Uncertainty about the cleanup costs can further impair the selling price of industrial plants since buyers have to pay investigation costs (e.g., hiring environmental engineers to produce environmental reports) to determine the cleanup costs. When the uncertainty about cleanup costs is severe enough, adverse selection can cause the market for polluted assets to break down completely (Akerlof (1978)). Indeed, the EPA estimates 450,000 sites are currently abandoned because of concerns over the presence of hazardous pollutants.

Reduction in asset value stemming from contamination or uncertainty about contamination is particularly costly for lenders. First, when the borrower defaults, an important way that lenders recover their claims is by liquidating borrowers' assets. Second, regardless of whether the borrower has defaulted, impairing firms' liquidation value is costly for lenders because it reduces lenders' bargaining power during debt renegotiations (e.g., Aghion and Bolton (1992); Shleifer and Vishny (1992); Hart and Moore (1994); Hart and Moore (1998);Bolton and Scharfstein (1996); Benmelech and Bergman (2008)). Therefore, I hypothesize heightened creditor control rights leads to larger reductions in pollution when pollution's negative impact on asset value is more significant.

To test this prediction, I exploit a novel natural experiment that protects purchasers of contaminated sites from cleanup liabilities. My empirical setting uses the passage of the Brown-

3. Ohlrogge (2020) argues that the change in pollution is due to pressure from creditors because creditors become owners of the corporation after bankruptcy.

fields Revitalization Act of 2002 (Brownfields Act), which introduced the Bona fide prospective purchaser (BFPP) defense.[4] The BFPP defense protects property purchasers from cleanup liabilities under the Comprehensive Environmental Response, Compensation, and Liability Act (CERLCA) but not under the Resource Conservation and Recovery Act (RCRA).[5] Compared to RCRA, CERCLA enforces cleanups of contamination caused by a more extensive set of hazardous pollutants. Thus, the BFPP defense reduces cleanup liability, especially for purchasers acquiring a plant with contamination caused by pollutants *not* covered by RCRA.

Using this feature, I employ a triple-difference research design by comparing ground pollution before versus after BFPP, pollution more and less protected by BFPP, and across high and low creditor control firms. Intuitively, my empirical strategy uses BFPP to shift pollution's impact on asset value and examine how high and low creditor control firms respond to the shock. If concerns over liquidation value incentivize creditors to limit pollution activity, reducing pollution's negative impact on asset value should cause firms with high creditor control rights to increase pollution. The identifying assumption is that BFPP protected pollution would have evolved similarly across firms with high and low creditor control rights in the absence of BFPP. Thus, an alternative explanation must relate to creditor control, to BFPP protected pollution only, and to the periods after the Brownfields Act only.

To implement this research design, I need to identify RCRA covered pollution activity. Identifying RCRA covered pollutants is not straightforward because it depends on whether a chemical exhibits particular characteristics (e.g., corrosive) and the facilities' production process. I construct two measures that capture a polluting activity exposure to RCRA enforcement, one at the industry level and the other at the chemical level. The industry-level measure classifies pollution by industries that experience RCRA enforcement below the sample average as BFPP protected ("treated"). The chemical-level measure considers pollution that uses chemicals not explicitly listed as RCRA pollutants as BFPP protected pollution activity.

I also need an appropriate measure of creditor control. I use financial covenant violations

4. The exemption applies only when the potential purchaser purchased the property after January 11, 2002, does not impede the performance of a response action, and meets the threshold criteria and ongoing obligations in the statute. I discuss this in greater detail in section 2.2

5. The Revitalization handbook states that "Unlike CERCLA, RCRA does not contain a bona fide prospective purchaser or similar landowner liability provision." (https://www.epa.gov/sites/default/files/2020-06/documents/revitalization-handbook-final-2020.pdf)

to capture heightened creditor control. Financial covenant violations are state-contingent control rights that allocate control rights to lenders when the borrowers' financial performance deteriorates below pre-specified thresholds. Lenders often use increased bargaining from a financial covenant violation to influence firm policy (e.g., Nini, Smith, and Sufi (2012)). Economic theory suggests that control rights are allocated to lenders precisely because the borrower would take different actions (Aghion and Bolton (1992); Dewatripont and Tirole (1994)). Therefore, financial covenant violations provide a valuable setting to study how creditors shape corporate policy.

Finally, I need appropriate measures of pollution activity. To this end, I use micro-data from the EPA's Toxic Release Inventory (TRI) to measure pollution activity at the plant-chemical level. Since both CERCLA and RCRA focus on the cleanup of land pollution, my main outcome variable is the pounds of toxic ground pollution. I find that, after the introduction of BFPP, firms that violate a financial covenant, henceforth violating firms, increased BFPP protected ground pollution by 13-26 percent relative to firms that did not violate a financial covenant, hereafter non-violating firms. The increase stems from both the intensive and extensive margins of ground pollution and is economically meaningful. Specifically, the effect is about 1 to 1.5 times greater than reducing secure lenders' environmental liability (Bellon (2021)) and 1.5 to 3 times larger than imposing stronger parent liability protection (Akey and Appel (2021)).[6]

I use water and air pollution as the outcome variable to perform placebo tests. I find covenant violation did not have a differential effect on BFPP protected water and air emissions post BFPP. This result provides confidence that the change in ground pollution is unlikely driven by an alternative shock that caused heightened creditor control to increase total pollution.

Next, I examine channels that potentially explain the increase in ground pollution. First, the rise in pollution could stem from increased economic activity. This could happen if lenders' reduction in monitoring effort gives borrowers more flexibility to ramp up production, result-

6. Bellon (2021) shows that reducing lenders' environmental liability leads to a 14 percent increase in pollution. Akey and Appel 2021 find that stronger parent liability leads to a 5-9 percent increase in toxic release by subsidiaries.

ing in more toxic emissions. Using a plant-chemical level measure of production, I find no evidence that the change in ground pollution stems from increased production. The estimated effect of BFPP on how a covenant violation affects BFPP protected production is economically small and statistically indistinguishable from zero.

Second, I consider whether the increase in ground pollution is driven by changes in the quantity or the quality of abatement technology implemented. Using the EPA's Pollution Prevention (P2) database, I measure abatement activity at the plant-chemical level. Since reported abatement initiatives in the P2 database do not specify whether an abatement limits air, ground, or water pollution, I classify an abatement initiative as ground abatement if the plant has reported positive ground pollution for a chemical. The idea is that if a plant has ever emitted a chemical into the ground, an abatement reported for this chemical is more likely to be used to limit ground releases.[7] I find that violating firms do not change their propensity to invest in BFPP protected ground abatement after the introduction of the BFPP defense. This finding is more consistent with the idea that the increase in ground pollution is driven by the adoption of less effective abatement technologies.

I implement several cross-sectional tests to bolster the interpretation that the increase in pollution is driven by a reduction in creditors' monitoring efforts. Specifically, I show that the effect is larger when the lender has higher bargaining power, proxied using financial leverage and measures of financial constraint (Hoberg and Maksimovic 2015). Consistent with the prediction that reducing pollution's damage on asset value disincentives lenders to limit risk-shifting actions by their borrowers, I find that the effect is larger for firms closer to default (i.e., lower Z-score).[8]

This paper contributes to several strands of literature. First, this paper deepens our understanding of how governance mechanisms influence corporate environmental policy. Existing studies have focused mainly on shareholders' role in influencing corporate environmental policy.[9] The exceptions are Bellon (2021), Ohlrogge (2020) and Choy et al. (2021). Bellon 2021

7. Under this classification, approximately a third of abatement efforts are classified as ground abatement. This seems more reasonable than using all reported abatement efforts as only 16 percent of plant-chemical-year observations have positive ground pollution.

8. Prior research shows that firms closer to default have an incentive to increase pollution due to risk-shifting motives (Akey and Appel (2021)).

9. E.g., Chu and Zhao (2019); Shive and Forster (2020); Naaraayanan, Sachdeva, and Sharma (2020); Bellon

and Ohlrogge (2020) show that exposing lenders to environmental liability affects borrowers' environmental behavior. Choy et al. (2021) find that environmental enforcement reinforces private environmental monitoring by lenders, which influences environmental policy. My paper differs by showing that the incentive to protect asset value provides important economic incentives for creditors to discipline debtors' environmental activity. Another unique aspect of my setting is I use financial covenant violation to proxy for creditor control, enabling me to trace changes in environmental policy to creditor control more directly. My findings also indicate that creditors use state-contingent control to discipline borrowers' environmental behavior.

My paper also adds to the literature that studies how the market for corporate assets affects firm outcomes. Prior research documents that asset redeployability has implications on debt maturity (Benmelech (2009)), cost of capital (Benmelech and Bergman (2009)), capital investment (Kim and Kung (2017)), leverage (Campello and Giambona (2013)), trading activity (Gavazza (2011)), selling price (Gavazza (2011)), and debt recovery rate (Acharya, Bharath, and Srinivasan (2007)). My paper extends prior research by showing that the market for corporate assets affects how the financial market, particularly creditors, shapes corporate environmental policy.

Finally, my findings have important policy implications. While the passage of the Brownfields Act is intended to reduce the number of abandoned sites, the effectiveness of the policy can be limited because protecting purchasers from environmental liability disincentivizes creditors to monitor ex-ante, potentially leading to more contaminated sites. Therefore, policymakers must carefully consider the cost and benefits of increasing the saleability of contaminated property.

(2020); Akey and Appel (2019); Brandon et al. (2021)

2 Background and hypothesis development

2.1 Environmental enforcement in the United States

In the U.S., environmental cleanups are enforced under two federal environmental statutes. The first statute, the Resource Conservation and Recovery Act (RCRA), which Congress enacted in 1976, authorizes the EPA to regulate the production and disposal of hazardous waste, solid waste, and underground storage tanks (from "Cradle to the Grave"). RCRA also gives the EPA the authority to initiate "corrective actions" (i.e., cleanups) of toxic sites. Enforcement provisions under RCRA are broad and powerful. For instance, any time the EPA determines that hazardous waste pollution may have created an imminent endangerment to public health or the environment, the EPA can bring suit to require "any person" to take necessary actions to protect public health and the environment.[10] Where "any person" includes any past or present generator, past or present transporter, or past or present owner or operator of a treatment, storage, or disposal facility. According to Ohlrogge (2020), the cost of being targeted by corrective actions can be expensive. $50 to $100 million is often the lower bound for cleaning up contaminated sites.

The second statute, the Comprehensive Environmental Response Compensation and Liability Act of 1980 (CERCLA, also known as Superfund), authorizes the EPA to cleanup hazardous waste sites. Congress intended CERCLA to fill gaps left by RCRA, particularly the cleanups of inactive, abandoned, or uncontrolled sites. The liability imposed under CERCLA is broad and on a wide range of parties ("Potentially Responsible Parties" (PRPs)), including present owners, owners at the time of disposal, and those involved in transporting hazardous waste. CERCLA liability imposed on PRPs is strict, joint, several, and retroactive. Strict liability means that a PRP cannot say that it was not negligent or operating according to industry standards. Joint and several means that the EPA may pursue a single party for the total cleanup cost even if the party contributed a fraction of the contamination. Retroactive implies that parties may be held liable for acts that happened before the enactment of CERCLA.

10. 42 U.S.C.A. §6973

The average cleanup costs at Superfund sites in 1995 amounted to approximately $25 to $30 million (Porter (1995)).

While both RCRA and CERCLA regulate the emissions of hazardous chemicals to the environment, they differ along several dimensions. Importantly, from a hazardous waste perspective, CERCLA is a more comprehensive statute because it covers a larger set of pollutants (Clay (1990)). CERCLA hazardous substances encompass RCRA hazardous waste and other toxic pollutants covered by the Clean Air Act, the Clean Water Act, and the Toxic Substance Control Act. Thus, all toxic chemicals covered under RCRA are regulated by CERCLA, and releases of RCRA pollutants may trigger CERCLA response actions. This feature is important for constructing a treatment and control group because the BFPP defense only protects purchasers from CERCLA liability.[11]

Identifying whether RCRA covers a pollutant is not straightforward because RCRA regulations do not always explicitly list all pollutants covered. Instead, it covers any chemicals that exhibit the characteristics of corrosivity, reactivity, ignitability, and toxicity. Whether a pollutant exhibits these characteristics depends on its concentration and form. For example, under RCRA, a pollutant exhibits ignitability if (1) it is a liquid containing less than 24 percent alcohol by volume and at least 50 percent water by weight, (2) it is not a liquid and is capable of causing fire under standard temperature and pressure, (3) it is a compressed gas that either is a mixture of 13 percent or less with air forms a flammable mixture or the flammable range with air is wider than 12 percent regardless of the lower limits, (4) it is an oxidizer.

Furthermore, some chemicals are designated as RCRA hazardous waste if they are emitted from a particular production process ("specific sources"). For example, waste-water treatment sludge from the production of chrome yellow and orange pigments is covered by RCRA regulations. Since different industries use different production processes and chemicals, a plant's industry is a good proxy for RCRA exposure. Therefore, I measure a polluting activity's exposure to RCRA at the industry level. I also use chemicals explicitly listed by RCRA regulations to measure the exposure to RCRA enforcement. I discuss how I construct these measures in section 3.1.1.

11. Note that RCRA regulates **non**-hazardous solid waste that is not regulated under CERCLA. This difference is not relevant for the TRI data used in this paper, as the TRI data only measures releases of hazardous chemicals.

2.2 Brownfields Revitalization Act and Bona Fide Prospective Purchaser

As discussed above, under CERCLA, "the current owner" of a property can be held liable for cleanup costs. The current owner liability caused reluctance to buy potentially contaminated sites, resulting in many abandoned and under-utilized sites known as brownfields. In 2002, Congress, realizing CERCLA's negative impact on brownfield redevelopment, enacted the Small Business Liability Relief and Brownfields Revitalization Act (Brownfields Act) to encourage the redevelopment of brownfields.[12] Specifically, the Brownfields Act amended CERCLA to provide liability protection for a "bona fide prospective purchaser."[13] The bona fide prospective purchaser (BFPP) defense shields the purchaser from CERLCA liability as long as the purchaser satisfies the criteria outlined in the statute. Below I discuss the most important and relevant requirements for implementing my empirical design.[14]

An important requirement for establishing the BFPP defense is that before the purchaser buys the property, the purchaser must conduct "all appropriate inquires" (AAI) into the previous ownership and use the property consistent with good commercial or customary practices. The AAI requirement existed before the Brownfields Act. Specifically, AAI was a requirement established for the "innocent landowner defense" in 1986, allowing property owners to escape cleanup liability. The rationale of AAI was for an innocent landowner to show that he had no knowledge or reason to know of the disposal before purchasing the property. The significance of BFPP compared to the innocent landowner defense is that the BFPP defense still applies if the purchaser knew or should have known of a release or threatened release of a hazardous substance on the property (Weissman and Sowinski Jr (2015)).

12. The act also provides liability relief to certain small generators. In particular, the Brownfields Act set forth circumstances under which parties that sent small amounts of solid or liquid waste and small businesses that sent only municipal waste to Superfund sites will be exempted from CERCLA liability. This change is less relevant for this paper as I focus on plants owned by large public companies.

13. It is worth noting that the Brownfields Act also introduced the "contiguous property holder" defense protecting a landowner from liability where the contamination on land originated by an adjacent property. It is unlikely this affects my analysis because it is unclear how "contiguous property holder" affects high and low creditor control firms differently.

14. Examples of other requirements include: the purchase happened after January 11th, 2002, the purchaser must provide evidence that all disposal of hazardous substance occurred before the purchase and the purchaser must not impede the performance of a response action or natural resource restoration (Scott (2009)).

Before the Brownfields Act, to comply with "good commercial or customary practices," the industry had adopted standards set by a private entity: ASTM (American Society of Testing Materials). The Brownfields Act directed the EPA to define AAI by regulation within two years. Meanwhile, allowing AAI to follow ASTM standards. In August 2004, the EPA published its proposed rule, setting standards for AAI in the Federal Register.[15] The proposed AAI Rule resembles the ASTM standard but requires a broader scope of inquiring and stricter standards for professionals conducting AAI. The more stringent requirements raised some concerns. For instance, "the EPA received a significant number of comments regarding the statutory requirements for qualifying for the CERCLA liability protections".[16] Ultimately, in November 2005, the EPA published its final AAI rule relaxing some of the requirements in the proposed rule.

Another important requirement is that the purchaser must meet "continuing obligations" including (1) exercise "appropriate care" concerning hazardous substances, (2) take reasonable steps to stop continuous release, (3) prevent any future or threatened releases, and (4) limit human and environmental exposure to previously released pollutants.

In sum, to assert the BFPP defense, a purchaser must conduct environmental due diligence and adopt good environmental practices. To the extent that better environmental practices affect the polluting activity of multiple plants' owned by the same firm (e.g., better operating procedures), the requirements to satisfy the BFPP defense can reduce pollution for the newly acquired plants and other plants owned by the purchaser. Therefore, while BFPP shields property sellers from environmental cleanup liabilities, it also encourages purchasers to conduct environmental due diligence and adopt better environmental practices.

2.3 Hypothesis development

Lenders consider the costs and benefits of disciplining borrowers' pollution activity. On the one hand, lenders incur monitoring costs such as site visits and investigation costs to gather information used in determining how to shape environmental behavior.

15. See 69 FR 52542
16. See 70 FR 66069

On the other hand, lenders benefit from reducing pollution. A significant risk for lenders is that pollution can adversely affect collateral value. If the borrower defaults, one important way in which lenders recover their investments is by liquidating firm assets. Furthermore, economic theory suggests that even if the borrower does not default, adverse effect on the liquidation value is costly for lenders because it renders lenders' threat of liquidating the firm non-credible, diminishing their bargaining power during debt re-negotiations (Aghion and Bolton (1992); Shleifer and Vishny (1992); Hart and Moore (1994); Hart and Moore (1998);Bolton and Scharfstein (1996); Benmelech and Bergman (2008)). Therefore, liquidation risk provides lenders with strong incentives to limit pollution. By increasing the saleability of contaminated property, BFPP reduces the benefits of reducing pollution, which reduces creditors' incentives to monitor and limit their borrowers' polluting activity.

As discussed above, requirements for exerting the BFPP defense create incentives to reduce pollution. However, my empirical setting isolates the effect stemming from liquidation risk by comparing firms with high and low creditor control before and after BFPP. Specifically, the incentive of reducing pollution to satisfy the requirements of the BFPP defense is likely similar across firms with high and low creditor control rights. In that case, this effect is "removed" by comparing pollution by firms with high and low creditor control rights.

3 Data and research design

3.1 Data

3.1.1 TRI data

I use data from the EPA's Toxic Release Inventory Program (TRI) to measure environmental activities. The data is used in other papers in the finance literature to study environmental activity (e.g., Akey and Appel (2021); Xu and Kim (2020)). The TRI program was established under the Emergency Planning and Community Right-to-Know Act (EPCRA). Under the TRI program, facilities located in the United States that meet reporting standards set by the TRI program must report their waste management practices for covered chemicals annually.[17] While the TRI data is self-reported, the EPA conducts audits to investigate misreporting.

To ensure that I am handling the data correctly, I contacted the TRI program manager and followed their suggestions regarding the treatment of the data.[18] Plants report their environmental activity in two forms, form A and form R. I use form R for my analysis because plants that file form A do not report the quantities of pollution. The same plant may file multiple forms for each chemical. The majority of duplicate filings is because the reporting plant consists of multiple economic units ("multi-establishments") and is sometimes due to chemical composition unknown to the reporting plant ("mixtures"). I aggregate duplicate filings by summing the pollution quantities reported across multiple R forms.

Plants subject to TRI report the pounds of ground, water, and air pollution for each covered chemical. Ground pollution includes toxic chemicals released into underground injection wells, landfills, and surface impoundments. Air pollution comprises stack (e.g., confined vents, pipes, and ducts) and fugitive (e.g., evaporation) air releases. Water emissions include discharges to streams, rivers, lakes, oceans, and other bodies of water. Since CERCLA and RCRA cleanups target ground and groundwater contamination, my main outcome variable is pounds of ground pollution. I use air and surface water pollution to perform placebo tests.

As discussed in section 2.2., I construct two measures of BFPP protection. The goal is to identify pollution activities that are more (non-BFPP protected) and less (BFPP-protected) subject to RCRA enforcement. My first proxy for BFPP protection is at the industry level. Specifically, I calculate the number of enforcements with RCRA as the primary law on facilities operating in a particular industry (4-digit NAICS). Enforcement data comes from EPA's Enforcement and Compliance History Online (ECHO) database. I include both formal and informal enforcement. Since enforcements at each industry are infrequent, I use all RCRA enforcements in the ECHO database spaning between 1979 and 2020. I define a plant as BFPP protected if its industry has the above sample median of RCRA enforcement and non-BFPP

17. Currently, the requirements are that the facility is in one of 409 covered NAICS industries; has 10 or more full-time employees; and uses one of 770 chemicals in the specified amounts. The list of chemicals is often updated. The list of industries is updated less frequently

18. I would like to thank Sarah Swenson, Tim Antisdel, and Steve Witkin for answering questions regarding the TRI database.

otherwise. The outcome is an indicator variable $BFPP_j$ that indicates whether an industry is BFPP protected

The second measure is at the chemical level. To identify RCRA covered chemicals, I begin by identifying chemicals explicitly listed as RCRA hazardous waste using information from the substance registry services. Depending on their characteristics, some pollutants are not explicitly listed but are still covered by RCRA. To determine covered chemicals not explicitly listed, I first use enforcement data from ECHO to identify pollutants that were enforced by cases where RCRA is the statute. I perform Google searches to determine if the chemical likely exhibits characteristics covered by RCRA. For example, hydrochloric acid is deemed corrosive.[19] I do not include chemicals that may be characterized as a RCRA chemicals depending on testing for certain characteristics.[20] Next, I drop chemicals not covered under CERCLA and mixtures to avoid false classifications.[21] Finally, I create an indicator variable $BFPP_c$ that equals one if the chemical is only covered under CERCLA and zero otherwise. Approximately 44 percent of the chemical-year observations are only covered by CERCLA (i.e., BFPP protected). The disadvantage of this classification is that whether a particular chemical is subject to RCRA enforcement depends on the production process and characteristics of the chemical. Thus, the two measures of BFPP protection complement each other. The correlation coefficient of the two classifications is 0.1231 and is statistically significant at the 1 percent level.

I use the EPA's Pollution Prevention (P2) database to measure production and investment abatement. TRI facilities are required to report the production ratio for each chemical, defined as the output (outcome) in the current year, divided by output (outcome) in the previous year. Specifically, if a chemical is used in the production of refrigerators, the production ratio is equal to $\frac{\#\, of\ refrigerators\ produced_t}{\#\, of\ refrigerators\ produced_{t-1}}$. If a chemical is used for cleaning molds, the productivity ratio is equal to $\frac{\#\, of\ molds\ cleaned_t}{\#\, of\ modls\ cleaned_{t-1}}$. Following Akey and Appel (2021), I exclude production ratios greater than five and less than zero to ensure that reporting errors do not influence my

19. See https://archive.epa.gov/epawaste/hazard/web/pdf/hwid-char.pdf

20. For example, Phosphorus may be characteristized as a RCRA hazardous waste if following testing it exhibits reactivity characteristics (https://webwiser.nlm.nih.gov/substance?substanceId=323&identifier=Phosphorus,%20Elemental&identifierType=name&menuItemId=21&catId=16)

21. The list of CERCLA chemicals comes from Consolidated list of Lists under EPCRA/CERCLA/CAA section 112r (https://www.epa.gov/epcra/consolidated-list-lists-under-epcracerclacaa-ss112r-september-2021-version).

analysis.[22]

Facilities also report their abatement efforts along with their annual TRI report. These abatement activities are reported at the chemical level and are classified into eight broad categories. The list of categories is provided in Table A2. I create an indicator variable that equals one if the plant implements any abatement efforts regardless of the type and zero otherwise. The reported abatement efforts do not indicate whether an abatement effort reduces air, water, or ground pollution. Since I am mainly interested in abatement efforts intended to limit ground pollution, I classify abatement initiatives reported by a plant that has ever reported positive amounts of ground pollution for a chemical during my sample period (between 1998 and 2007). The idea is that an abatement initiative implemented by a plant that has emitted ground pollution for a chemical is more likely targeted at limiting ground pollution. Also, I do not count abatement initiatives related to related to installing vapor recovery system as ground abatement.

I match the TRI database to Compustat/CRSP to identify facilities owned by public companies. I first match the historical parent names reported in TRI with historical names from CRSP and 10-X headers from EDGAR. I clean historical names by dropping suffixes such as "Corp.", "Incorp", etc. I then perform fuzzy matching, followed by a manual inspection to identify correct matches. For facility-years where the facility does not report a parent company, I use the National Establishment Time-Series (NETS) database to identify the Compustat parent for these facilities. In some cases, the EPA parent name is missing in one or two years, while before and after missing years have the same parent name. In this case, I use parent names from non-missing years to fill in the missing years.

I drop observations with zero emissions (ground + air + water) because some facilities choose to report zero emissions, and some facilities do not report. Therefore, dropping observations with zero emissions provides consistency when performing analysis. I obtain firm-level accounting data from Compustat and restrict my sample to non-financial firms.

Figure 1 displays the fraction of plant industries (defined using the 3-digit NAICS code) that are in my sample. The most common industries in my sample are chemical manufac-

22. In unreported results I find the results do not change if I truncate by 0 and 3.

turing (15.8 percent), fabricated metal product manufacturing (10.1 percent), transportation equipment manufacturing (7.9 percent), and computer manufacturing (7.4 percent).

3.1.2 Covenant violation data

To identify violating firms, I obtain covenant violation data from Griffin, Nini, and Smith (2019).[23] The data is constructed using an automated search algorithm and manual inspection. Specifically, the authors search the universe of 10-K/10-Q filings by registered firms on EGDAR to identify potential violations. They then conduct a manual inspection of each potential violation to remove false positives. The final dataset is a firm-quarter panel that indicates whether a firm violated a financial covenant.[24] I augment their data by collecting data with missing firm-quarter observations for TRI firms. I aggregate covenant violation to the year calendar level by creating an indicator variable that equals one if a firm violated a financial covenant in any quarter. For firm-years where the firm reported no violation, I require the firm to have at least three-quarters of non-missing data to minimize false negatives.

To measure creditor control, I construct variable $Viol_{i,t}$ that equals one if a company reports a new financial covenant violation in the current or previous year and is equal to zero otherwise. A new financial covenant violation is a financial covenant violation by a parent firm that has not violated a covenant in the previous calendar year. I focus on changes in environmental activities following a new covenant violation as it is the first opportunity for creditors to influence firm policy (Nini, Smith, and Sufi (2012)). Figure 2 reports the fraction of TRI reporting firms that violated a covenant in any given year from 1998 to 2007. The figure shows that the fraction of violations reported by TRI firms is similar to those reported by a broader sample of public companies in Griffin, Nini, and Smith (2019).

3.1.3 Loan agreement data

Loan agreements include clauses that allow the lender to obtain environmental information, such as environmental reports or audits (environmental information covenants). An example

23. I thank Greg Nini for sharing this data.
24. Please refer to the appendix of Nini, Smith, and Sufi (2012) for details.

where lenders can acquire environmental information upon request is Steel Dynamics's loan agreement on June 2007:

"At the request of the Joint Lead Arrangers or the Collateral Agent from time to time, provide to the Lender Parties within 60 days after such request, at the expense of the borrower, an environmental site assessment report for any of its or its Subsidiaries' properties described in such request."

I use the inclusion of environmental information covenants in the loan agreement to proxy for creditors' monitoring intensity on environmental matters. To identify whether a loan agreement includes environmental information covenants, I begin with a sample of 8,819 from loan agreements between 1997 and 2014 collected from EDGAR.[25] I restrict the sample to agreements for firms that reported data to the TRI program at least once between 1998 and 2016. I then match the contracts to DealScan to obtain loan characteristics and then to COMPUSTAT to obtain quarterly firm-level accounting data. The final sample consists of 2,385 loan agreements from 802 unique firms. I employ an automated search algorithm using Python to identify whether a loan agreement contains environmental information covenants. In particular, I search for the number of times terms appear that capture whether a loan agreement includes environmental information covenants.[26] When these terms appear in the clauses that discuss the indemnification of expenses, they are not about providing lenders with environmental information. Instead, for the majority of cases, they state that the borrower is responsible for paying for the costs of providing environmental reports. Thus, I exclude counts where these terms appear within 400 words after an indemnification phrase to minimize false positives.[27] I classify a loan agreement as having an environmental information covenant if

25. I thank Greg Nini for sharing the loan agreements.

26. The terms I search for are as follows: "environmental report", "environmental audit", " environmental studies", "environmental due diligence", "environmental review", "environmental site assessment", "environmental site report", "environmental site review", "environmental site audit", "environmental site studies", "environmental consultant", "environmental assessment", "environmental files", "environmental engineer", "environmental health and safety report", " environmental health and safety audit", "environmental health and safety studies", "environmental record", "written information to and from the United States Environmental Protection Agency", "environmental investigations", "report providing an update of the status of any environmental", "environmental, health or safety audit", "environmental survey", "environmental consulting", " environmental and hazardous substance assessments", and "environmental analyses".

27. Indemnification terms include: "indemnity", "Indemnities", "cost, expenses, fee", "extraordinary expenses", "payment of expenses","”lender group expense" means", "summary of proceedings to date", "indemnified", "indemnification", "all costs and expenses", "all costs, expenses", "fees and expenses", "agent professionals", "expenses"", "costs"", "fees"", "out-of-pocket expenses", and "environmental complaint". The extra quotes are inten-

environmental terms appear at least once. I read a random sample of 165 with zero counts and 157 with at least one count to validate this classification. Table A3 reports the summary statistics. Only 8 percent of loan agreements with zero hits contain environmental information covenants. Only 4 percent of loan agreements with positive hits do not have an environmental information covenant. Thus, the procedure generates very few false positives and negatives. I also corrected the false positives and negatives using the 322 manually inspected loan agreements when performing the analysis.

3.2 Summary statistics

Panel A of Table 1 reports summary statistics at the chemical-plant level. The sample consists of 224,794 plant-chemical observations, with 10,054 unique plants and 1,306 unique firms. Plants, on average, emit 32 thousand pounds into the ground for each chemical. The average amount of air and water pollution reported for each chemical is 34 thousand and 5 thousand, respectively. Note that all types of pollution are highly skewed. Air emissions are the most common. 89 percent of plant-chemical observations have positive amounts of air emissions. Ground pollution is relatively less common. Only 16 percent of plant-chemical observations have positive ground pollution. Abatement efforts are implemented for 12 percent of plant-chemical-year observations. Ground abatement initiatives are reported for approximately 3 percent of plant-chemical-year observations. The mean for production ratio is 0.96.

Panel B and C in Table 1 report firm and deal characteristics, respectively. On average, 13 percent of firms reported a new violation in the current or previous year. The average deal is about 643 million, with a maturity of 46 months, and has ten lenders.

3.3 Environmental information covenants

One important question is whether creditors use covenant violations as an opportunity to influence their borrowers' environmental activity. To shed light on this question, I explore whether loan agreements are more likely to include environmental information covenants when the borrower is in a covenant violation prior to loan origination. If lenders use covenant

tionally are included because it captures when loan agreements are defining a term.

violation to influence borrowers' environmental behavior, I expect to observe environmental information covenants to be more prevalent among borrowers in violation. To test this idea, I perform univariate analysis in Table 2. The analysis shows that nearly half (52 percent) of loan agreements with violating firms include environmental information covenants. In contrast, only 25 percent of loan agreements with non-violating borrowers allow lenders to acquire environmental information.

The inclusion of environmental information covenants also varies with borrower and deal characteristics. Smaller and riskier borrowers are more likely to include clauses that allow lenders to acquire environmental information. This is consistent with including stringent covenants when the net benefits of acquiring environmental information are higher (Smith and Warner (1979)). In addition, secured deals are much more likely to include environmental information covenants. This finding is consistent with theoretical work by Rajan and Winton (1995) that suggests a bank's ability to collateralize loans selectively makes the loan's priority contingent on monitoring, thereby creating monitor incentives for lenders. It also supports the idea that making bank debt more senior mitigates the free-rider problem and generates incentive monitoring (Park (2000)). Borrowers with more TRI plants relative to firm size (total assets), are more likely to include environmental information covenants in their loan agreement. This finding is consistent with the notion that the benefit of monitoring the borrowers' environmental behavior is larger when a significant fraction of firm assets are exposed to pollution.

In Table 3, I display a series of OLS regressions to examine whether the likelihood of including environmental information covenants varies with creditor control rights (financial covenant violations) before loan origination, holding observable firm and deal characteristics fixed. All continuous variables are standardized to facilitate the interpretation of economic magnitude. In column (1), I include year, industry, rating, and deal purpose fixed effects. Between columns (2)-(4), I gradually add controls. In column (2), I add firm characteristics. In column (3), I add deal characteristics. In column (4), I add an indicator of whether the number of TRI plants to assets ratio is above the sample median. Across all specifications, the coefficient on $In\ Violation$ is positive and statistically significant, suggesting that loans originated when the borrower is in a financial covenant violation are more likely to include an environmental information covenant. The magnitude is economically meaningful. The point estimates suggest violating firms are 8.7-16.3 percent more likely to include environmental information covenants, a 31-58 percent increase over the sample mean.

I also find that environmental information covenants are most common among smaller and risky borrowers, proxied using (log of) total assets and Z-score, respectively. I observe a negative but insignificant coefficient on the number of lenders. The point estimate on deal size indicates that larger deals are more likely to include environmental information covenants, consistent with lenders' marginal benefit of monitoring increases with exposure. Importantly, I find that the inclusion of environmental information covenants is strongly associated with the presence of collateral. The point estimate on $secured$ indicates that the likelihood of including environmental information covenants increases by about 24 percent for secured deals, an 85.7 percent increase relative to the unconditional mean. Finally, firms with TRI plants above the sample median are more likely to include environmental information covenants.

3.4 Research design

I use the introduction of BFPP and covenant violations to implement a triple-difference framework. Specifically, I estimate the following regression model:

$$\begin{aligned} y_{c,p,i,j,t} = \beta_1 Viol_{i,t} \times BFPP_{j(c)} \times Post_t + \beta_2 Viol_{i,t} \times BFPP_{j(c)} + \beta_3 Viol_{i,t} \times Post_t \\ + \beta_4 Viol_{i,t} + \alpha_{p,c} + \alpha_{i,c} + \alpha_{c,t} + \alpha_{j,i} + \epsilon_{c,p,i,j,t} \end{aligned} \tag{1}$$

Where c indexes a chemical emitted by a plant p with primary industry j owned by parent firm i at time t. $y_{c,p,i,j,t}$ represents the log of one plus pounds of on-site ground pollution. $BFPP_{j(c)}$ is an indicator that equals to one if plant p's industry (chemical c) is protected by BFPP and is zero otherwise. $Post_t$ is an indicator variable that equals one if the year is greater or equal to 2002 and is zero otherwise. I include plant-chemical ($\alpha_{p,c}$) and parent-chemical fixed effects ($\alpha_{i,c}$) to control for time-invariant factors at the facility-chemical and parent-chemical levels, respectively. Since there is no clear way to aggregate chemicals and because reporting requirements frequently change for different chemicals, I include chemical-year fixed effects ($\alpha_{c,t}$) to control for time-varying heterogeneity at the chemical-year level. I include industry-year ($\alpha_{j,t}$) fixed to control for time-varying industry characteristics.[28] In the most stringent specification, I add state-year fixed effects and parent-year fixed effects controlling for time-varying state and parent heterogeneity, respectively. The coefficient (β_1) of the explanatory variable of interest $Viol_(i,t) \times BFPP_{j(c)} \times Post_t$ estimates the impact of covenant violation on BFPP protected pollution relative to non-protected pollution after the introduction of BFPP defense. The identifying assumption is that the effect of covenant violation on protected pollution relative to non-protected pollution evolves similarly without introducing the BFPP defense

To examine whether the identifying assumption holds, I estimate the following event-study style regression model:

$$y_{c,p,i,j,t} = \sum_{k=1998}^{2007} \gamma_k [Viol_{i,t} \times BFPP_{j(c)} \times \mathbb{1}(Year_t = k)] + \sum_{k=1998}^{2007} \theta_k [Viol_{i,t} \times \mathbb{1}(Year_t = k)]$$
$$+\beta_1 Viol_{i,t} \times BFPP_{j(c)} + \alpha_{p,c} + \alpha_{i,c} + \alpha_{c,t} + \alpha_{j,i} + \epsilon_{c,p,i,j,t} \quad (2)$$

$\mathbb{1}(Year_t = k)]$ is an indicator variable that equals one when k equals $Year_t$. The coefficients of interest γ_k deliver event-study style regression estimates corresponding to the effect of covenant violation on BFPP protected and non-protected pollution in the years before and after the introduction of BFPP. The inclusion of $Viol_(i,t) \times \mathbb{1}(Year_t = k)]$ controls for the time-varying effect of covenant violation.

In addition, I also estimate two dynamic difference-in-difference regressions for violating and non-violating firms separately:

$$y_{c,p,i,j,t} = \sum_{k=1998}^{2007} \gamma_k [BFPP_{j(c)} \times \mathbb{1}(Year_t = k)] + \alpha_{p,c} + \alpha_{i,c} + \alpha_{c,t} + \alpha_j + \epsilon_{c,p,i,j,t} \quad (3)$$

In this specification, I do not use chemical level protection ($BFPP_c$) because it precludes me from including chemical-year fixed effect, making results difficult to interpret.

28. The inclusion of industry-year fixed effect is important because reporting requirements vary at the industry level over time.

4 Results

4.1 The effect of BFPP on pollution

4.1.1 Ground pollution

I begin by studying the effect of BFPP on how creditor control influences ground pollution. Specifically, I estimate Equation 1 and report the results in Table 4. In columns (1)-(4), BFPP protection is measured at the industry level. In columns (5)-(8), BFPP protection is proxied at the chemical level. In the tightest specification (columns (4) and (8)), I include firm-year fixed effects studying how violating firms change their allocation of pollution across different plants (chemicals) after BFPP. Across all specifications, the coefficient of $Viol \times BFPP \times Post$ is positive and statistically significant, indicating that violating firms increase BFPP protected ground pollution relative to non-violating firms after BFPP. The increase in ground pollution is economically meaningful. The point estimates range from 0.164 to 0.313, an increase of 13-26 percent compared to the sample mean. The results from Table 4 are consistent with the theory that reducing pollution's negative impact on asset value leads lenders to reduce their monitoring of pollution activity.

Next, I examine the parallel trends assumption. Figure 3 plots coefficients estimated from the two difference-in-difference regressions (Equation 3) for violators and non-violators. For both violators and non-violators, we observe that the coefficients trend is relatively flat before BFPP. However, after BFPP, violators begins to increase BFPP protected ground pollution, but non-violators do not. Figure 4 plots coefficients estimated from a dynamic triple-difference (equation Equation 2). Panel A and Panel B present results for industry and chemical level BFPP measures, respectively. The results confirm results in Figure 3. Interestingly, in all figures, there is a drop in covenant violations impact on BFPP protected ground pollution in 2005 and a rebound after. The drop and rebound are likely driven by uncertainty surrounding stricter AAI standards.

4.1.2 Intensive and extensive margins

Table 5 examines whether the increase in ground pollution is driven by the intensive or extensive margins of pollution. Columns (1)-(4) of Table 5 examines the intensive margin by restricting the sample to observations with positive ground emissions. The dependent variable is the log of pounds of ground pollution. I find that violating firms increase ground pollution relative to non-violating firms along the intensive margin. The point estimates suggest the increase in ground pollution is between 40-54 percent.

Columns (5)-(8) of Table 5 examines the extensive margin of ground pollution. The outcome variable is an indicator of whether a plant reports positive ground pollution for a particular chemical. I find that the likelihood of reporting positive BFPP protected ground pollution increased by 2.5 to 3.9 percentage points for violating firms compared to non-violating firms after the introduction of BFPP. The increase is sizable: 16-25 percent compared to the unconditional probability of emitting ground pollution. In sum, the results in Table 5 suggest that the increase in ground pollution after the introduction of BFPP is driven by both changes along the intensive and extensive margins.

4.1.3 Air and water pollution

Suppose there is an alternative contemporaneous shock that affects how creditors influence their borrowers *all* pollution activity (e.g., improved productivity), then we should observe water and air emissions increase. To test this possibility, I estimate Equation 1, but with log of one plus air and water pollution as the dependent variable. Columns (1)-(4) ((5)-(8)) of Table 6 report the results using air (water) pollution as the dependent variable. Since RCRA and CERCLA focus on ground and groundwater contamination cleanups, I expect air and water emissions do not change.

I find no evidence that BFPP resulted in an increase in air or water emissions protected by BFPP for violators relative to non-violators. The estimated coefficient in columns (1)-(4) is negative and not statistically significant at conventional levels, indicating if anything violating firms decreased BFPP protected air emissions. The point estimates in columns (5)-(8) are statistically indistinguishable from zero, suggesting violating firms did not change water pollution following the enactment of the Brownfields Act. The economic magnitudes are small. The point estimates in Table 6 are -1.57-5.8 percent compared to the sample mean. Taken together, the results in Table 6 cast doubt on the changes in ground emissions is driven by an alternative shock that increased total pollution.

5 What drives the increase in ground pollution?

The results so far indicate that the introduction of BFPP increases BFPP protected ground pollution by violating firms. In this section, I shed light on the channel that drives this change. Specifically, I examine whether changes in production or abatement investments are driving the results.

5.1 Production

I begin by examining whether the increase in ground pollution stems from changes in economic activity. Reducing pollution's impact on asset value could disincentivize lenders to limit borrowers' spending, allowing borrowers to increase economic activity (e.g., increase capital expenditure and hire more employees). If this is the case, we should expect production to increase.

To this end, I estimate Equation 1 using the production ratio as the dependent variable. Table 7 reports the results of this analysis. Columns (1)-(3) report results using the plant's industry to capture BFPP protection. The point estimates are positive but are statistically indistinguishable from zero. The economic magnitude is small compared to the effects on ground pollution. In particular, the estimated coefficients in column (3) suggest a 3.8 percent increase in production compared to the mean, much smaller than a 13-26 percent increase in ground pollution. In columns (4)-(6), I measure BFPP protection at the chemical level. The point estimates are negative and statistically insignificant at conventional levels. Overall, the results in Table 7 suggest that the increase in ground pollution is unlikely driven by changes in production.

5.2 Abatement

Next, I examine whether changes in abatement investment drive the increase in ground pollution. There are two ways in which changes in abatement can lead to more ground pollution. First, violating firms might reduce investment in ground abatement. Second, reduced environmental monitoring intensity by lenders can cause violating firms to implement less effective abatement technology. Put differently, BFPP protection may cause violating firms to engage in more "green-washing" activities. In this case, we should observe no changes or an increase in abatement investment.

I test these predictions by estimating Equation 1 using an indicator of whether a plant implemented a ground abatement as the outcome variable. Table 8 reports the results. The coefficients of $Viol \times BFPP \times Post$ are economically small (ranging from -0.015 to 0.009) and statistically insignificant, suggesting that violating firms do not cut investment in ground abatement for BFPP protected polluting activity. This finding is more consistent with violating firms adopting less effective abatement technology.

6 Cross-sectional tests

In this section, I investigate whether the effect of BFPP on how creditors influence pollution varies with creditors' bargaining power. If creditors drive the increase in ground pollution, the effect should be stronger when creditors have greater bargaining power. Because firms with more financing frictions have fewer alternative financing options, creditors should have a larger bargaining power. Furthermore, to the extent that financing frictions exacerbate risk-shifting, creditors should have increased incentives to influence firm policy when firms have high financing frictions. I use three proxies for financing frictions, book leverage, Z-score, and financial constraint score developed by Hoberg and Maksimovic (2015). I then estimate Equation 1 on subsamples with high and low financing friction.

Columns (1) and (2) of Table 9 split the sample based on high and low book leverage. High (low) leverage firms have leverage in the top (bottom) quartile. The results indicate that the estimated coefficient of $Viol \times BFPP \times Post$ using the high leverage subsample is positive and statistically significant. On the other hand, the coefficient estimated using the low leverage subsample is indistinguishable from zero. The difference is statistically significant at the 5 percent level. In columns (3) and (4), I split the sample based on Z-score. Columns (5) and (6) divide the sample based on financial constraint score. Consistent with findings in columns (1) and (2), the estimated coefficient is larger for firms with low Z-score and for firms that are financially constrained.

7 Conclusion

There is increasing interest in how the financial markets affect corporate environmental behavior with much focus on shareholders. In this paper, I investigate how creditors influence industrial pollution. In particular, I focus on how pollution's impact on asset value affects creditors' incentives to discipline polluting activity. My empirical setting exploits the introduction of a law that protects property purchasers from cleanup liability. I find that improving the saleability of contaminated property leads to a 13-26 percent increase in pollution by violating firms. Both the intensive and extensive margins drive the increase. Since cleanup liability only pertains to ground contamination, I use air and water emissions as placebo tests and find no changes in air and water emissions. Further analyses indicate that the increase in ground pollution is driven by deterioration in the quality of abatement technology adopted and not by increased economic activity. Cross-sectional tests suggest that the effect of improving the saleability of contaminated property is amplified when creditors' bargaining power is stronger.

Overall, my findings suggest that liquidation risk causes lenders to internalize the externality of pollution, thereby incentivizing them to discipline their borrowers' environmental activity. In addition, my results also document a previously unknown environmental implication for the market of corporate assets.

References

Acharya, Viral V, Sreedhar T Bharath, and Anand Srinivasan. 2007. "Does industry-wide distress affect defaulted firms? Evidence from creditor recoveries." *Journal of Financial Economics* 85 (3): 787–821.

Aghion, Philippe, and Patrick Bolton. 1992. "An incomplete contracts approach to financial contracting." *The Review of Economic Studies* 59 (3): 473–494.

Akerlof, George A. 1978. "The market for "lemons": Quality uncertainty and the market mechanism." In *Uncertainty in Economics,* 235–251. Elsevier.

Akey, Pat, and Ian Appel. 2019. "Environmental externalities of activism." *Available at SSRN 3508808.*

———. 2021. "The limits of limited liability: Evidence from industrial pollution." *The Journal of Finance* 76 (1): 5–55.

Bellon, Aymeric. 2020. "Does Private Equity Ownership Make Firms Cleaner? The Role Of Environmental Liability Risks." *Available at SSRN: https://ssrn.com/abstract=3604360.*

———. 2021. "Fresh Start or Fresh Water: Collateral, Lender Environmental Liability and The Pollution-Employment Tradeoff." *Available at SSRN: https://ssrn.com/abstract=3877378.*

Benmelech, Efraim. 2009. "Asset salability and debt maturity: Evidence from nineteenth-century American railroads." *The Review of Financial Studies* 22 (4): 1545–1584.

Benmelech, Efraim, and Nittai K Bergman. 2008. "Liquidation values and the credibility of financial contract renegotiation: Evidence from US airlines." *The Quarterly Journal of Economics* 123 (4): 1635–1677.

———. 2009. "Collateral pricing." *Journal of Financial Economics* 91 (3): 339–360.

Bolton, Patrick, and David S Scharfstein. 1996. "Optimal debt structure and the number of creditors." *Journal of Political Economy* 104 (1): 1–25.

Brandon, Rajna Gibson, Simon Glossner, Philipp Krueger, Pedro Matos, and Tom Steffen. 2021. *Do Responsible Investors Invest Responsibly?* Technical report. ECGI Working Paper Series in Finance.

Campello, Murillo, and Erasmo Giambona. 2013. "Real assets and capital structure." *Journal of Financial and Quantitative Analysis* 48 (5): 1333–1370.

Choy, Stacey, Shushu Jiang, Scott Liao, and Emma Wang. 2021. "Public Environmental Enforcement and Private Lender Monitoring: Evidence from Environmental Covenants." *Rotman School of Management Working Paper No. 3860178.*

Chu, Yongqiang, and Daxuan Zhao. 2019. "Green Hedge Fund Activists." *Available at SSRN 3499373.*

Clay, DR. 1990. *RCRA orientation manual.* Technical report. Environmental Protection Agency, Washington, DC (USA). Office of Solid Waste.

Cohn, Jonathan, and Tatyana Deryugina. 2018. *Firm-level financial resources and environmental spills.* Technical report. National Bureau of Economic Research.

Dewatripont, Mathias, and Jean Tirole. 1994. "A theory of debt and equity: Diversity of securities and manager-shareholder congruence." *The Quarterly Journal of Economics* 109 (4): 1027–1054.

Gavazza, Alessandro. 2011. "The role of trading frictions in real asset markets." *American Economic Review* 101 (4): 1106–43.

Griffin, Thomas P, Greg Nini, and David C Smith. 2019. "Losing control? the 20-year decline in loan covenant restrictions." *Available at SSRN: https://ssrn.com/abstract=3277570e.*

Hart, Oliver, and John Moore. 1994. "A theory of debt based on the inalienability of human capital." *The Quarterly Journal of Economics* 109 (4): 841–879.

———. 1998. "Default and renegotiation: A dynamic model of debt." *The Quarterly Journal of Economics* 113 (1): 1–41.

Hoberg, Gerard, and Vojislav Maksimovic. 2015. "Redefining financial constraints: A text-based analysis." *The Review of Financial Studies* 28 (5): 1312–1352.

Kim, Hyunseob, and Howard Kung. 2017. "The asset redeployability channel: How uncertainty affects corporate investment." *The Review of Financial Studies* 30 (1): 245–280.

Naaraayanan, S Lakshmi, Kunal Sachdeva, and Varun Sharma. 2020. "The real effects of environmental activist investing." *Available at SSRN 3483692.*

Nini, Greg, David C Smith, and Amir Sufi. 2012. "Creditor control rights, corporate governance, and firm value." *The Review of Financial Studies* 25 (6): 1713–1761.

Ohlrogge, Michael. 2020. "Bankruptcy claim dischargeability and public externalities: Evidence from a natural experiment." *Available at SSRN 3273486.*

Park, Cheol. 2000. "Monitoring and structure of debt contracts." *The Journal of Finance* 55 (5): 2157–2195.

Porter, James Winston. 1995. *Cleaning Up Superfund: The Case for State Environmental Leadership.* Reason Foundation.

Rajan, Raghuram, and Andrew Winton. 1995. "Covenants and collateral as incentives to monitor." *The Journal of Finance* 50 (4): 1113–1146.

Scott, Emilee Mooney. 2009. "Bona Fide Protection: Fulfilling CERCLA's Legislative Purpose by Applying Differing Definitions of Disposal." *Connecticut Law Review* 42:957.

Shive, Sophie A, and Margaret M Forster. 2020. "Corporate governance and pollution externalities of public and private firms." *The Review of Financial Studies* 33 (3): 1296–1330.

Shleifer, Andrei, and Robert W Vishny. 1992. "Liquidation values and debt capacity: A market equilibrium approach." *The Journal of Finance* 47 (4): 1343–1366.

Smith, Clifford W, and Jerold B Warner. 1979. "On financial contracting: An analysis of bond covenants." *Journal of Financial Economics* 7 (2): 117–161.

Weissman, William R, and J Michael Sowinski Jr. 2015. "Revitalizing the brownfields revitalization and environmental restoration act: Harmonizing the liability defense language to achieve brownfield restoration." *Virginia Environmental Law Journal* 33:257.

Xu, Qiping, and Taehyun Kim. 2020. "Financial Constraints and Corporate Environmental Policies." *Available at SSRN 3028768.*

Figure 1: **Distribution of Plant Industries**

The figure shows the distribution of subsectors (three-digit NAICS) for plants owned by TRI reporting firms in EDGAR and Compustat.

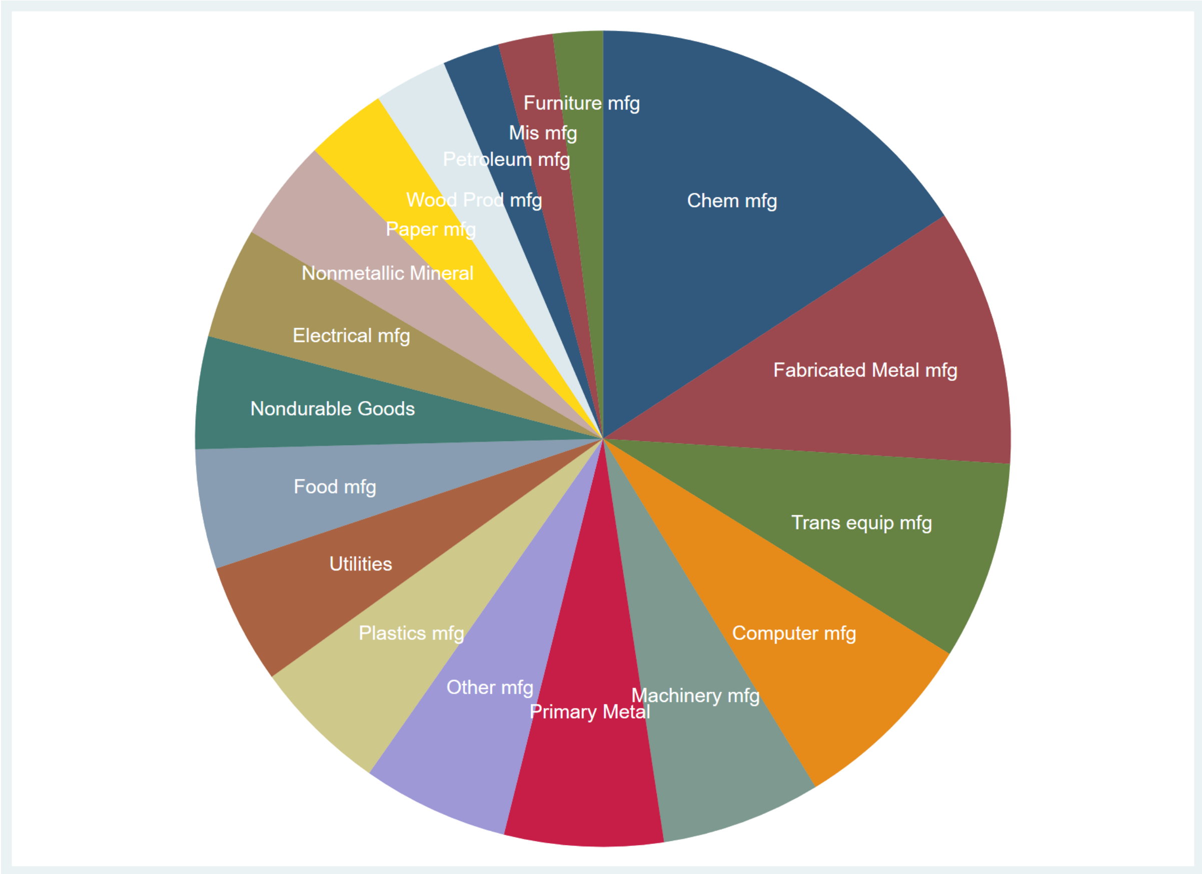


Figure 2: **Fraction of Covenant Violation**

This figure plots the annual percent of TRI reporting firms that report a violation (black-solid) and a new covenant violation (blue-dashed) between years 1998 to 2007. Violation is defined as firms that reported a financial covenant violation in any quarter of a calendar year. New violation is violation by a firm that did not violate a covenant in the previous year.

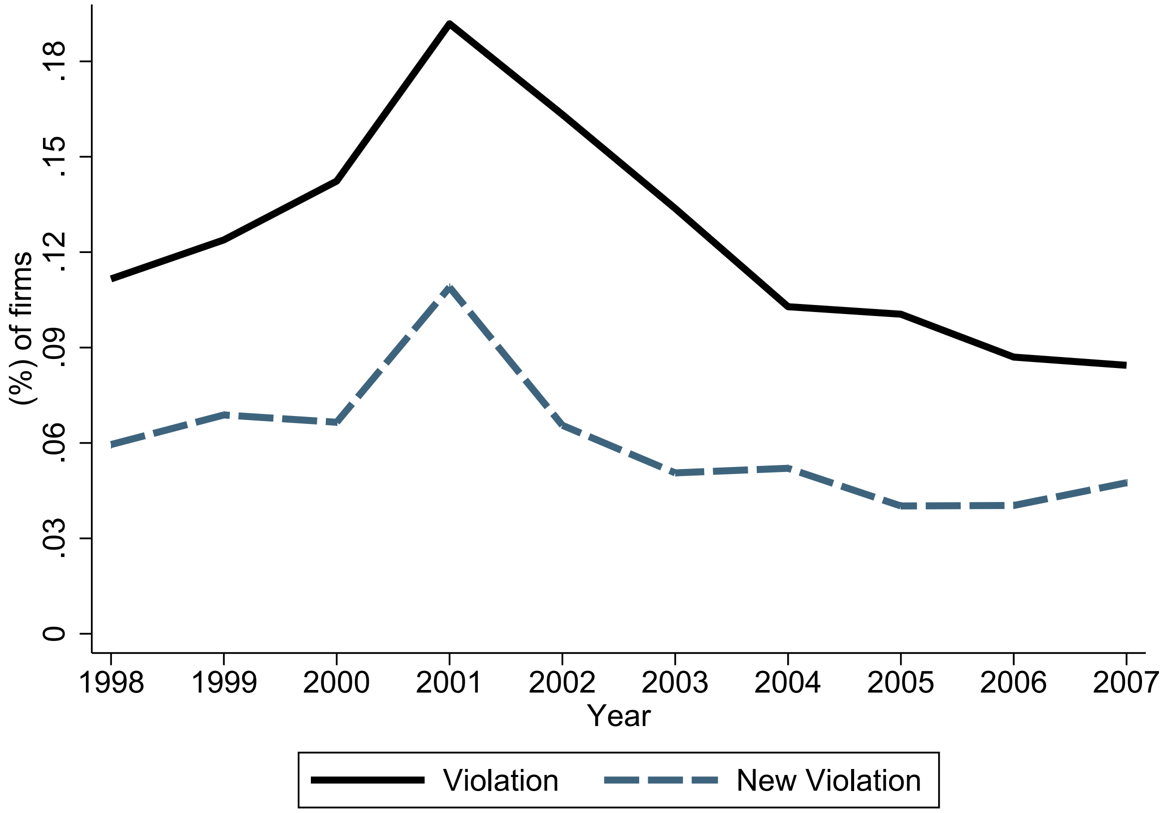


Figure 3: **Violator vs. non-Violator Ground Pollution Dynamics**

The figure plots coefficients for two dynamic difference-in-difference regressions (Equation 3) that estimates the effect of *BFPP* on ground pollution for violators and non-violators. The blue (orange) connected line plots coefficients for covenant violators (non-violators). The specifications include plant-chemical, parent-chemical, chemical-year, and industry (of the plant) fixed effects. Vertical bars represents 90% confidence intervals based on standard errors that are clustered at the industry-year level. The vertical (red) dashed line separates pre and post 2002 years.

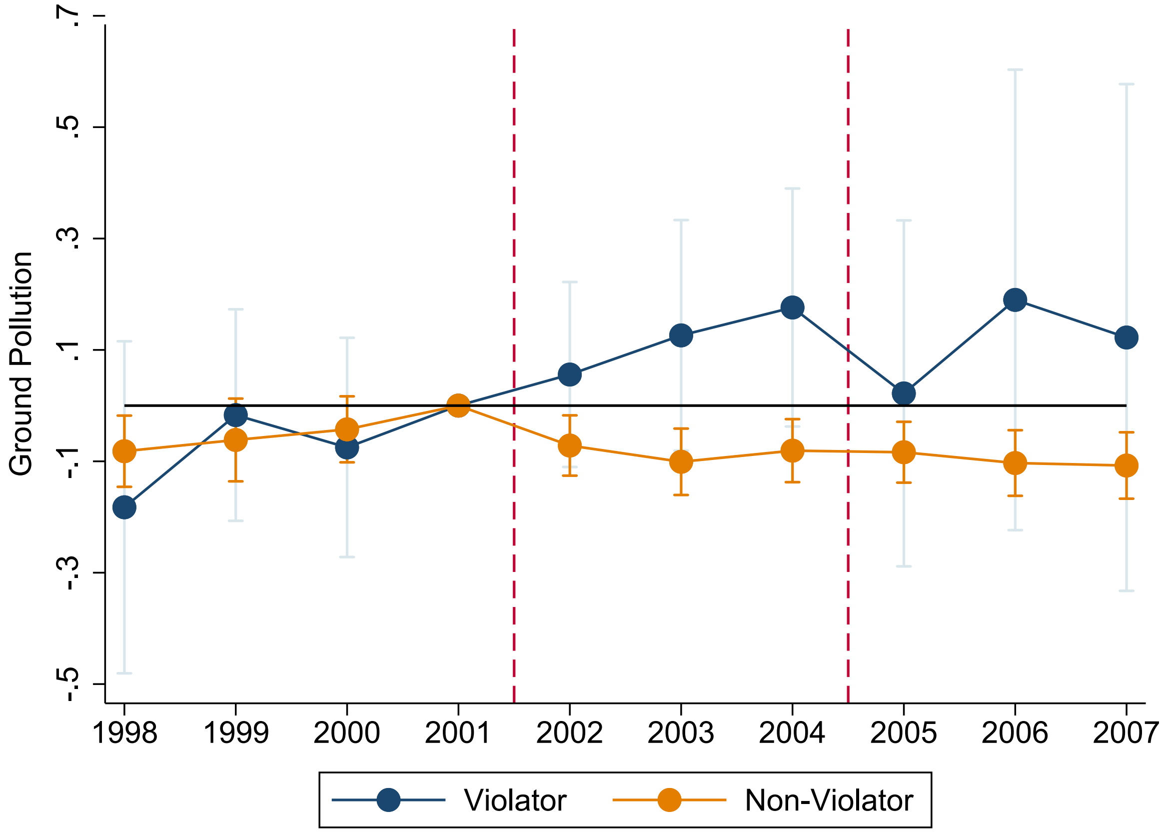
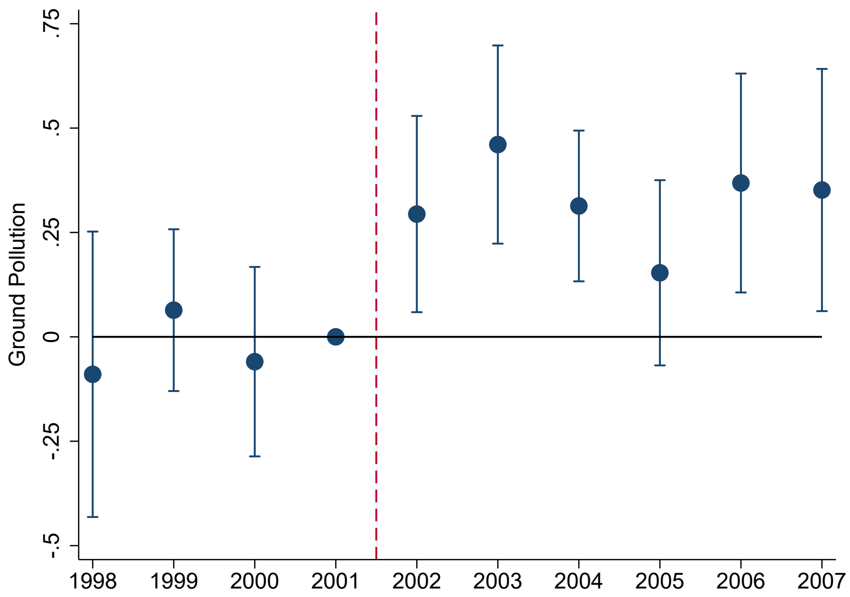


Figure 4: **Ground Pollution Dynamics: Triple-Difference**

The figure plots the dynamics for the effect of covenant violation on BFFP protected and non-protected ground emissions surrounding the introduction of the BFPP defense. The outcome variable is the log of one plus the pounds of ground pollution. Panel A measures BFPP protection at the industry level (of the plant) . Panel B measures BFPP protection at the chemical level. Coefficients are estimated using equation Equation 2. The specifications includes plant-chemical, parent-chemical, chemical-year, and industry-year fixed effects. Standard errors are clustered by parent-industry(chemical)-year level in Panel A and B, respectively. Vertical bars display 90% confidence intervals. The vertical (red) dashed line separates pre and post 2002 years.

(a) Industries



(b) Chemicals

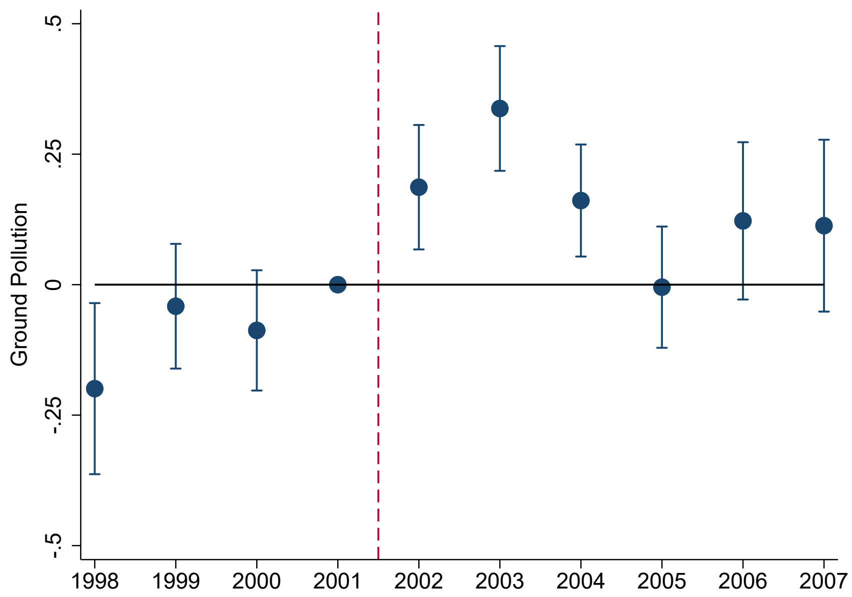


Table 1: **Summary Statistics**

Panel A reports summary statistics at the chemical-plant level. Panel B reports the summary statistics at the parent firm level. Panel C reports the summary statistics at the deal level. Table A1 in the Appendix lists definitions for variables

Panel A: Chemical-Plant level				
Variable	**Mean**	**Median**	**SD**	**N**
Ground Pollution (1000s)	32.13	0.00	1082,34	224794
Air Pollution(1000s)	34.35	0.27	329,00	224794
Water Pollution(1000s)	5.01	0.00	182,29	224794
Total Pollution(1000s)	71.49	0.57	1145,04	224794
$\mathbb{1}$(Ground Pollution)	0.16	0.00	0,37	224794
$\mathbb{1}$(Air Pollution)	0.89	1.00	0,32	224794
$\mathbb{1}$(Water Pollution)	0.23	0.00	0,42	224794
log(1+Ground Pollution)	1.22	0.00	3,21	224794
log(1+Air Pollution)	5.38	5.58	3,74	224794
log(1+Water Pollution)	1.01	0.00	2,38	224794
Production Ratio Index	0.96	1.00	0,43	218244
$\mathbb{1}$(Abatement)	0.12	0.00	0,32	224794
$\mathbb{1}$(Ground Abatement)	0.03	0.00	0,16	224794
Panel B: Parent level				
Variable	**Mean**	**Median**	**SD**	**N**
Viol	0.127	0.000	0.33	7437
Total assets	6315.223	985.023	27784.63	7433
Leverage	0.288	0.269	0.23	7422
Z-score	1.597	1.822	7.39	7285
Financial constraint	-0.027	-0.033	0.08	5851
Panel C: Deal level				
Variable	**Mean**	**Median**	**SD**	**N**
In Violation	0.1	0.00	0.294	2299
# Lenders	10.4	8.00	9.300	2385
Deal Amount ($ mil)	642.8	300.00	932.360	2385
Secured	0.59	1.00	0.493	2039
Maturity (months)	45.8	60.00	19.923	2384

Table 2: **Frequency of Environmental Information Covenant**

This table reports the fraction of loan agreements that have environmental information covenants. The sample consists of a sample of 2,385 loan agreements from TRI reporting firms in EDGAR between 1998 and 2014. Firm size is based on real (2000 dollars) total assets.

	N	$\mathbb{1}$(Environmental info covenant)
All loan agreements	2,385	0.28
Covenant violation		
In violation	220	0.52
Not in violation	2079	0.25
Borrower size		
$\leq$ \$500M	576	0.43
\$500M to \$5,000M	1316	0.29
$\geq$ \$5,000M	493	0.09
Borrower rating		
Investment-grade	742	0.06
Speculative-grade	732	0.43
No rating	911	0.35
Collateral		
Unsecured	847	0.08
Secured	1192	0.47
# TRI Plants / Assets		
1st quartile	497	0.12
2nd or 3rd quartile	994	0.27
4th quartile	499	0.42

Table 3: **Acquisition of Environmental Information**

This table examines the relation between environmental and financial covenant violation. The dependent variable is an indicator variable equal to one if the loan agreement contains an environmental information covenant, and zero otherwise. *In violation* is an indicator variable that equals to 1 if the firm reported a financial covenant violation within the previous three quarters, and is zero otherwise. Continuous variables are standardized. Fixed effects are indicated in the table. Industry is 3-digit NAICS. Table A1 in the Appendix lists definitions for variables definitions for other variables. Continuous variables are winsorized at the 1 and 99% level. Heteroskedasticity-consistent standard errors clustered by parent company are reported in parentheses. The symbols $*$, $**$, and $***$ indicate significance at the 10%, 5%, and 1% level, respectively.

	$\mathbb{1}$*(Environmental info covenant)*			
	(1)	(2)	(3)	(4)
In Violation	0.163***	0.104**	0.097**	0.087*
	(0.042)	(0.048)	(0.048)	(0.053)
Log(Total Assets)		-0.087***	-0.091***	-0.071**
		(0.021)	(0.031)	(0.034)
Current ratio		0.017	0.012	0.014
		(0.015)	(0.016)	(0.017)
Leverage		0.035*	0.021	0.013
		(0.019)	(0.019)	(0.022)
Operating cash flows / assets		-0.006	-0.009	-0.012
		(0.017)	(0.016)	(0.018)
Market-to-Book ratio		-0.020	-0.014	-0.005
		(0.014)	(0.015)	(0.017)
Z-score		-0.069***	-0.058***	-0.048**
		(0.020)	(0.021)	(0.024)
log(# Lenders)			-0.006	-0.019
			(0.021)	(0.022)
log(Deal amount)			0.048*	0.049
			(0.029)	(0.031)
log(Maturity)			0.036**	0.038**
			(0.015)	(0.016)
Secured			0.224***	0.243***
			(0.035)	(0.039)
High # TRI Plants				0.032*
				(0.019)
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Rating FE	Yes	Yes	Yes	Yes
Deal purpose FE	Yes	Yes	Yes	Yes
Adjusted R^2	0.173	0.218	0.263	0.276
Observations	2293	1645	1399	1162

Table 4: **Creditor Control and the BFPP defense**

This table estimates the effect of covenant violation on BFPP protected ground pollution before and after the introduction of BFPP. Observations are at the chemical level. The dependent variable is log of one plus pounds of ground emissions. $Viol$ is an indicator variable that equals one if the parent firm reported a new financial covenant violation in the most recent two years, and is zero otherwise. In columns (1)-(4) ((5)-(8)), $BFPP$ is an dummy variable that equals one if the plant's industry (chemical) is more likely to be protected by BFPP and zero otherwise. $Post$ is a dummy variable that takes value one after 2002 and is zero otherwise. Fixed effects are indicated in the table. Industry is 4-digit NAICS. Standard errors clustered by parent-plant (chemical) levels in columns (1)-(4)((5)-(8)) is reported in parentheses. The symbols $*$, $**$, and $***$ indicate significance at the 10%, 5%, and 1% level, respectively.

Outcome:	*log(1+Ground Pollution)*							
	Industries				Chemicals			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$Viol \times BFPP \times Post$	0.284***	0.313***	0.264***	0.171*	0.218***	0.225***	0.212***	0.164***
	(0.088)	(0.087)	(0.079)	(0.088)	(0.048)	(0.048)	(0.047)	(0.045)
$Viol \times BFPP$	-0.172***	-0.199***	-0.169***	-0.166**	-0.110***	-0.103***	-0.102***	-0.066*
	(0.058)	(0.058)	(0.057)	(0.074)	(0.037)	(0.038)	(0.037)	(0.036)
$Viol \times Post$	-0.092	-0.108*	-0.082		-0.060**	-0.067**	-0.056**	
	(0.059)	(0.059)	(0.050)		(0.028)	(0.028)	(0.027)	
$Viol$	0.044	0.067*	0.054		0.023	0.031	0.030	
	(0.040)	(0.038)	(0.034)		(0.024)	(0.025)	(0.024)	
Chemical×Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Plant×Chemical FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Parent×Chemical FE	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Industry×Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State×Year FE	No	No	Yes	Yes	No	No	Yes	Yes
Parent×Year FE	No	No	No	Yes	No	No	No	Yes
Adjusted R^2	0.928	0.930	0.930	0.935	0.928	0.925	0.926	0.930
Observations	223042	222258	222258	221150	223042	222258	222258	221150

Table 5: **Intensive and Extensive Margins**

The table estimates the effect of covenant violation on the extensive and intensive margins of ground pollution after the introduction of BFPP. Observations are at the chemical level. In columns (1)-(4), the dependent variable is log of pounds of ground emissions. In columns (5)-(5), the dependent variable is an indicator variable that takes value of one if a plant emits positive amounts of a given chemical and is zero otherwise. $Viol$ is an indicator variable that equals to one if the parent firm reported a new financial covenant violation in the most recent two years, and is zero otherwise. In columns (1), (2), (5), and (6) ((3), (4), (7), and (8)), $BFPP$ is an dummy variable that equals one if the plant's industry (chemical) is more likely to be protected by BFPP and is zero otherwise. $Post$ is a dummy variable that takes value one after 2002 and is zero otherwise. Fixed effects are indicated in the table. Industry is 4-digit NAICS. Standard errors clustered by parent-plant (chemical) levels in columns columns (1), (2), (5), and (6) ((3), (4), (7), and (8)) is reported in parentheses. The symbols $*$, $**$, and $***$ indicate significance at the 10%, 5%, and 1% level, respectively.

Outcome:	*log(Ground Pollution)*				$\mathbb{1}$*(Ground Pollution)*			
	Industries		Chemicals		Industries		Chemicals	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$Viol \times BFPP \times Post$	0.404	0.543*	0.393**	0.393**	0.039***	0.031**	0.025***	0.025***
	(0.322)	(0.294)	(0.174)	(0.179)	(0.014)	(0.013)	(0.007)	(0.007)
$Viol \times BFPP$	-0.453*	-0.468*	-0.252*	-0.275*	-0.021**	-0.016	-0.012**	-0.014**
	(0.267)	(0.262)	(0.138)	(0.146)	(0.011)	(0.010)	(0.006)	(0.006)
$Viol \times Post$	-0.241	-0.311	-0.333**	-0.291*	-0.017*	-0.012	-0.010**	-0.008*
	(0.223)	(0.202)	(0.152)	(0.153)	(0.010)	(0.008)	(0.005)	(0.005)
$Viol$	0.375**	0.244	0.319***	0.189	0.006	0.005	0.003	0.004
	(0.177)	(0.165)	(0.116)	(0.120)	(0.007)	(0.006)	(0.004)	(0.004)
Chemical×Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Plant×Chemical FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Parent×Chemical FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry×Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State×Year FE	No	Yes	No	Yes	No	Yes	No	Yes
Adjusted R^2	0.931	0.936	0.924	0.928	0.853	0.855	0.843	0.846
Observations	33357	33331	33357	33331	213490	213490	213490	213490

Table 6: **Air and Water Emissions**

The table estimates the effect of covenant violation on the air and water pollution after the introduction of BFPP. In columns (1)-(4), the dependent variable is log of one plus pounds of air pollution. In columns (5)-(8), the dependent variable is log of one plus pounds of surface water emissions. $Viol$ is an indicator variable that equals to one if the parent firm reported a new financial covenant violation in the most recent two years, and is zero otherwise. In columns (1), (2), (5), and (6) ((3), (4), (7), and (8)), $BFPP$ is an dummy variable that equals one if the plant's industry (chemical) is more likely to be protected by BFPP and is zero otherwise. $Post$ is a dummy variable that takes value one after 2002 and is zero otherwise. Fixed effects are indicated in the table. Industry is 4-digit NAICS. Standard errors clustered by parent-plant (chemical) levels in (1), (2), (5), and (6)((3),(4),(7), and (8)) is reported in parentheses. The symbols $*$, $**$, and $***$ indicate significance at the 10%, 5%, and 1% level, respectively.

Outcome:	*log(1+Air Pollution)*				*log(1+Water Pollution)*			
	Industries		Chemicals		Industries		Chemicals	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$Viol \times BFPP \times Post$	-0.085	-0.073	-0.044	-0.052	-0.013	0.004	0.052	0.059
	(0.084)	(0.080)	(0.050)	(0.050)	(0.074)	(0.070)	(0.055)	(0.055)
$Viol \times BFPP$	0.015	-0.005	-0.001	0.009	-0.026	-0.042	-0.074	-0.075
	(0.066)	(0.062)	(0.041)	(0.041)	(0.066)	(0.063)	(0.049)	(0.049)
$Viol \times Post$	0.057	0.049	0.034	0.031	0.008	0.007	-0.025	-0.021
	(0.069)	(0.062)	(0.036)	(0.036)	(0.048)	(0.049)	(0.024)	(0.025)
$Viol$	-0.022	-0.005	-0.015	-0.011	0.002	0.009	0.024	0.025
	(0.054)	(0.048)	(0.028)	(0.028)	(0.038)	(0.040)	(0.022)	(0.023)
Chemical×Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Plant×Chemical FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Parent×Chemical FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry×Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State×Year FE	No	Yes	No	Yes	No	Yes	No	Yes
Adjusted R^2	0.946	0.947	0.943	0.943	0.887	0.888	0.880	0.880
Observations	213490	213490	213490	213490	213490	213490	213490	213490

Table 7: **The Effect on Production**

The table estimates the effect of covenant violation on production after the introduction of BFPP. The dependent variable is production ratio. $Viol$ is an indicator variable that equals to one if the parent firm reported a new financial covenant violation in the most recent two years, and is zero otherwise. In columns (1)-(3) ((4)-(6)), $BFPP$ is an dummy variable that equals one if the plant's industry (chemical) is more likely to be protected by BFPP and is zero otherwise. $Post$ is a dummy variable that takes value one after 2002 and is zero otherwise. Fixed effects are indicated in the table. Industry is 4-digit NAICS. Standard errors clustered by parent-plant (chemical) levels in columns (1)-(3)((4)-(6)) is reported in parentheses. Standard errors clustered by parent-industry (parent-chemical) level in columns (1)-(3) ((4)-(6)) is reported in parentheses. The symbols $*$, $**$, and $***$ indicate significance at the 10%, 5%, and 1% level, respectively.

Outcome:	*Production ratio*					
	Industries			Chemical		
	(1)	(2)	(3)	(4)	(5)	(6)
$Viol \times BFPP \times Post$	0.029	0.028	0.037	-0.030	-0.032	-0.025
	(0.051)	(0.049)	(0.058)	(0.025)	(0.024)	(0.019)
$Viol \times BFPP$	-0.071	-0.067	-0.043	0.022	0.021	0.030*
	(0.045)	(0.044)	(0.043)	(0.023)	(0.022)	(0.017)
$Viol \times Post$	-0.049	-0.048		-0.031	-0.028	
	(0.044)	(0.041)		(0.019)	(0.018)	
$Viol$	0.047	0.045		0.009	0.009	
	(0.040)	(0.037)		(0.018)	(0.016)	
Chemical×Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Plant×Chemical FE	Yes	Yes	Yes	Yes	Yes	Yes
Parent×Chemical FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry×Year FE	Yes	Yes	Yes	Yes	Yes	Yes
State×Year FE	No	Yes	Yes	No	Yes	Yes
Parent×Year FE	No	No	Yes	No	No	Yes
Adjusted $R2$	0.582	0.588	0.613	0.554	0.560	0.586
Observations	213490	213490	212438	213490	213490	212438

Table 8: **The Effect on Pollution Abatement**

The table estimates the effect of covenant violation on pollution abatement investment after the introduction of BFPP. The dependent variable is an indicator that equals to one if a plant implemented ground abatement for a chemical and is equal to zero otherwise. An abatement is classified as ground abatement if the plant reported positive amount of ground pollution for a chemical in at least one year between 1998 and 2007. $Viol$ is an indicator variable that equals to one if the parent firm reported a new financial covenant violation in the most recent two years, and is zero otherwise. In columns (1)-(3) ((4)-(6)), $BFPP$ is an dummy variable that equals one if the plant's industry (chemical) is more likely to be protected by BFPP and is zero otherwise. $Post$ is a dummy variable that takes value one after 2002 and is zero otherwise. Fixed effects are indicated in the table. Industry is 4-digit NAICS. Standard errors clustered by parent-plant (chemical) levels in columns (1)-(3)((4)-(6)) is reported in parentheses. Standard errors clustered by parent-industry (parent-chemical) level in columns (1)-(3) ((4)-(6)) is reported in parentheses. The symbols $*$, $**$, and $***$ indicate significance at the 10%, 5%, and 1% level, respectively.

Outcome:	$\mathbb{1}$*(Ground Abatement)*					
	Industries			Chemical		
	(1)	(2)	(3)	(4)	(5)	(6)
$Viol \times BFPP \times Post$	0.009	0.004	-0.015	0.005	0.003	0.001
	(0.009)	(0.008)	(0.016)	(0.005)	(0.005)	(0.005)
$Viol \times BFPP$	-0.005	-0.002	-0.008	0.003	0.004	0.006
	(0.007)	(0.007)	(0.010)	(0.004)	(0.004)	(0.005)
$Viol \times Post$	-0.005	-0.000	0.000	-0.003	-0.000	
	(0.007)	(0.007)		(0.003)	(0.003)	
$Viol$	0.006	0.003		0.002	0.000	
	(0.006)	(0.006)		(0.003)	(0.003)	
Chemical×Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Plant×Chemical FE	Yes	Yes	Yes	Yes	Yes	Yes
Parent×Chemical FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry×Year FE	Yes	Yes	Yes	Yes	Yes	Yes
State×Year FE	No	Yes	Yes	No	Yes	Yes
Parent×Year FE	No	No	Yes	No	No	Yes
Adjusted $R2$	0.582	0.588	0.613	0.554	0.560	0.586
Observations	213490	213490	212438	213490	213490	212438

Table 9: **Cross-Sectional Analysis**

The table performs subsample analysis that estimates differential effects of the impact of covenant violation on ground pollution after the introduction of BFPP based on financial leverage (columns (1) and (2)), distance to default (columns (3) and (4)), and financial constraint (columns (5) and (6)). High (Low) indicates subsample that contain observations where the parent company has leverage, Z-score, or financial contraint (prior-year) in the top (bottom) quartile. $Viol$ is an indicator variable that equals to one if the parent firm reported a new financial covenant violation in the most recent two years, and is zero otherwise. $BFPP$ is an dummy variable that equals one if the plant's industry is more likely to be protected by BFPP and is zero otherwise. $Post$ is a dummy variable that takes value one after 2002 and is zero otherwise. Fixed effects are indicated in the table. Industry is 4-digit NAICS. F-statistics and p-value test the whether the difference of coefficients ($Viol \times BFPP \times Post$) in the subsamples are statistically significant. Standard errors clustered by parent-industry levels is reported in parentheses. The symbols $*$, $**$, and $***$ indicate significance at the 10%, 5%, and 1% level, respectively.

Outcome:	*log(1+Ground Pollution)*					
	Leverage		Z-score		Financial constraint	
	(1)	(2)	(3)	(4)	(5)	(6)
	High	Low	High	Low	High	Low
$Viol \times BFPP \times Post$	0.513***	0.041	0.212	0.503**	0.932**	-0.220
	(0.174)	(0.149)	(0.164)	(0.240)	(0.407)	(0.211)
$Viol \times BFPP$	-0.354***	0.114	-0.024	-0.287*	-0.427	0.110
	(0.134)	(0.097)	(0.092)	(0.146)	(0.371)	(0.191)
$Viol \times Post$	-0.150	0.019	-0.098	-0.084	-0.612*	0.014
	(0.095)	(0.101)	(0.097)	(0.197)	(0.326)	(0.074)
$Viol$	0.103	-0.069	-0.030	0.032	0.488	0.021
	(0.086)	(0.050)	(0.075)	(0.114)	(0.327)	(0.067)
Chemical×Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Plant×Chemical FE	Yes	Yes	Yes	Yes	Yes	Yes
Parent×Chemical FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry×Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.944	0.914	0.815	0.946	0.939	0.915
Observations	48900	48317	45956	46438	30383	30552
F-stats	4.27		1.01		6.40	
p-value	0.04		0.32		0.01	

Appendix

Table A1: **Description of Variables**

Variable	**Description**
TRI data	
Ground pollution	Lbs of ground pollution
Water pollution	Lbs of surface water pollution
Air pollution	Lbs of air pollution (stack + fugitive emissions)
Total Releases	Lbs of total releases (Air + Water + Ground)
Post	Indicator that equals one for years after 2002 (including), and zero otherwise. 2002 is the year in which the BFPP was introduced.
BFPP	*Industry level:* Indicator that equals one industries (4-digit NAICS) subject to low RCRA enforcement and is zero otherwise. *Chemical level:* Indicator that equals one if a chemical is not covered by RCRA and is zero otherwise.
$\mathbb{1}$*(Abatement)*	An indicator that equals one if a plant implemented pollution investment for a chemical and is equal to zero otherwise.
$\mathbb{1}$*(Ground Abatement)*	An indicator that equals one if a plant implemented ground abatement for a chemical and is equal to zero otherwise. An abatement is classified as ground abatement if the plant reported positive amount of ground pollution for a chemical in at least one year between 1998 and 2007.
Production ratio	Output in year t relative to output in $t-1$
Firm variables	
Viol	Indicator that equals one if the firm reported a *new* financial covenant violation in the current or previous year, and is zero otherwise
Z-score	Altman's Z score (3.3×pre-tax income(*pi*) + sales (*sale*) + 1.4×retained earnings+ 1.2×current ratio)/assets
Assets	total assets (*at*)
Book value of equity	Total assets (*at*) minus total liabilities (*lt*) plus deferred taxes and investment tax credits (*txditc* if available, 0 if missing)
Current ratio	Total current assets (*act*) divided by total current liabilities (*lct*)
Leverage	Long-term debt (*dltt*) plus debt in current liabilities (*dlc*), divided by total assets
Market value of assets	Market value of equity minus book value of equity plus total assets
Market value of equity	Common shares outstanding (*csho*) times the fiscal year closing price (*prcc_f*)
Market-to-book ratio	Ratio of market value to book value of total assets
Operating cash flows	Operating income before depreciation (*oibdp*)

Variable	Description
Financial constraint	A textual measure of financial constraint (*delaycon*) developed by Hoberg and Maksimovic (2015)
Deal variables	
$\mathbb{1}$(Environmental info covenant)	An indicator equal to one if a loan agreement includes environmental information covenant, and is zero otherwise
#Lenders	Number of Lenders
Maturity	The maximum maturity (in months) in a deal
Deal Amount	Deal amount
Secured	Is this an indicator that equal one if the loan is secured
# TRI plant / Assets	Number of TRI plants for a firm divided by total assets

Table A2: **Abatement Categories**

This table list and describes various abatement categories

Abatement category	**Example**
Good Operating Practices	Improved maintenance scheduling, record keeping, or procedures; Changed production schedule to minimize equipment and feedstock changeovers; Introduced in-line product quality monitoring or other process analysis system
Inventory Control	Instituted procedures to ensure that materials do not stay in inventory beyond shelf-life
Spill and Leak Prevention	Installed overflow alarms or automatic shut-off valves; Improved procedures for loading, unloading, and transfer operations; Improved storage or stacking procedures
Raw Material Modifications	Increased purity of raw materials; Substituted raw materials
Process Modifications	Used a different process catalyst; Modified equipment, layout, or piping
Cleaning and Degreasing	Changed to mechanical stripping/cleaning devices (from solvents or other materials); Modified stripping/cleaning equipment
Surface Preparation and Finishing	Modified spray systems or equipment; Substituted coating materials used
Product Modifications	Changed product specifications; Modified design or composition of product; Modified packaging

Table A3: **Environmental Information Clauses**

This sample consists of a random set of 322 loan agreements from U.S. non-financial firms that have ever reported to the TRI database between 1998 and 2014. "Environmental Info" indicates whether the loan agreement contain environmental information covenants. Loan agreement can give lenders the right to acquire environmental information upon request ("Non-Contingent") and/or contingent on some event ("Contingent"). Contingent events include (i) producing an environmental report ("Produce Report") (ii) origination or extension of credit ("Origination"), (iii) in the event of default ("Default"), (iv) violation of environmental law(s) or when emissions could hurt lenders claim("Environmental"), and (v) acquisition of new assets or the addition of collateral ("Acquisition"). Table A3 reports the summary statistics of these contingent events. #Environmental phrases = the frequency in which phrases (e.g., environmental report and environmental audit) appear in a loan agreement.

			Environmental Info=1	
	N	Environmental Info	Non-Contingent	Contingent
# Environmental phrases =0	165	8%	21%	85%
# Environmental phrases ≥1	157	96%	32%	75%
Total	322	0.51%	31%	76%

Table A4: **Contingent Events**

This table reports the summary statistics of contingent events that allow lenders to acquire environmental information. The sample further restricts the 322 loan agreements in Table A2 to 165 loan agreements with clauses that allow lenders to acquire environmental information contingent on some event.

	Produce Report	Origination	Default	Environmental	Acquisition
$\mathbb{1}$(Contingent)=1	15%	19%	8%	27%	28%