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The Limits of Limited Liability: Evidence from Industrial Pollution

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ABSTRACT

We study how parent liability for subsidiaries' environmental cleanup costs affects industrial pollution and production. Our empirical setting exploits a Supreme Court decision that strengthened parent limited liability protection for some subsidiaries. Using a difference-in-differences framework, we find that stronger liability protection for parents leads to a 5% to 9% increase in toxic emissions by subsidiaries. Evidence suggests the increase in pollution is driven by lower investment in abatement technologies rather than increased production. Cross-sectional tests suggest convexities associated with insolvency and executive compensation drive heterogeneous effects. Overall, our findings highlight the moral hazard problem associated with limited liability.

LIMITED LIABILITY IS A DEFINING feature of corporations. Corporate law generally affords limited liability protection not only to the individual shareholders of corporations, but also to corporate parents of subsidiaries. The use of

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subsidiaries is pervasive, both in the United States and globally.[1] However, because parents are generally insulated from the liabilities of their subsidiaries, this organizational form creates incentives to engage in risky behaviors to a socially excessive extent (Shavell (1986)). To mitigate this moral hazard problem, courts can impose liability on parent corporations in some instances (Easterbrook and Fischel (1985)).

In this paper, we study the effects of the limited liability of parents for subsidiaries' environmental cleanup costs. Reducing exposure to environmental liabilities weakens incentives to limit toxic emissions. Such emissions potentially impose significant costs on other stakeholders, including adverse health outcomes (Chay and Greenstone (2003)), decreased worker productivity (Graff Zivin and Neidell (2012)), and lower home prices (Greenstone and Gallagher (2008)). Policymakers in many countries have adopted a "polluter pays" approach to environmental regulation to encourage the internalization of such costs. Esty (2008) writes that the principle has "taken on a quasi-constitutional aura in international environmental law." The effectiveness of this regulatory framework is, however, undercut to an extent by limited liability: If liability truly is limited, a parent will not bear the costs of environmental remediation that exceed the value of its subsidiary's assets.

Our empirical setting uses a Supreme Court case that clarified parent company liability under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), also known as Superfund. CERCLA authorizes the Environmental Protection Agency (EPA) to impose ex post liability on parties responsible for toxic sites. Costs associated with cleaning up such sites are often large and can result in the insolvency of responsible parties (Blair (2011)). In *United States v. Bestfoods* (hereafter *Bestfoods*), the Supreme Court narrowed the circumstances under which parents are responsible for the environmental cleanup costs of insolvent subsidiaries. This case centered on the question of when a parent is liable as an operator of the toxic site of an insolvent subsidiary. Prior to *Bestfoods*, some circuit courts held parents liable as operators under relatively broad circumstances, namely, if they had "actual control" of or the "ability to control" subsidiaries.[2] In the *Bestfoods* decision, the Supreme Court invalidated these tests, holding parents liable as operators only if they directly operated the facility of a subsidiary responsible for emissions (e.g., if a parent is in a joint venture with its subsidiary). We use this decision as a natural experiment in a difference-in-differences setting. The treatment group for our analysis consists of plants of subsidiaries located in circuits that had weaker liability protection for parents prior to *Bestfoods*; the control group consists of plants located in areas where a relatively narrow standard for parent liability was already in place.

[1] In a sample spanning 52 countries, Bennedsen and Zeume (2017) find that 17,731 listed firms have over 200,000 subsidiaries. Ligon and Malm (2018) note that S&P 1500 firms have over 50,000 subsidiaries incorporated in the United States.

[2] In the United States, circuit courts (also called courts of appeals) are intermediate-level courts. Each circuit court covers a geographic area that spans multiple states.

We use plant-chemical–level data on toxic emissions from the EPA to examine changes in environmental behaviors in response to *Bestfoods*. Our main outcome of interest is the amount (in pounds) of toxic ground pollution (e.g., disposals in landfills), as this is the focus of CERCLA enforcement efforts. In total, our sample contains 6,953 parent corporations with on average 2.8 subsidiary plants that emit 3.91 chemicals. Our baseline regression specification controls for time-invariant heterogeneity at the plant level and time-varying heterogeneity at the chemical and parent levels. Thus, our within-plant estimates are relative to plants with the same parent and plants that use the same chemicals but are located in areas that employed a relatively narrow standard for parent liability.

We first examine the extent to which limited liability for future cleanups affects the amount of pollution generated by subsidiaries. We find that treated plants increased ground emissions by approximately 5% to 9% relative to the control group in the five years following *Bestfoods*. This increase is driven by both the intensive and extensive margins of pollution. In addition, the effect is particularly strong for plants with publicly traded parents, consistent with evidence that such firms have a higher propensity to pollute (Shive and Forster (2020)). Stronger liability protection also has a positive effect on the value of parents; cumulative abnormal returns (CARs) around oral arguments for *Bestfoods* were approximately 1% for parents with relatively high exposure to the decision.

Next, we examine the effect of parent liability on the solvency of subsidiaries. In general, limited liability for parents only binds when a subsidiary has liabilities that exceed the value of its assets. *Bestfoods* narrowed the circumstances under which a parent is liable for the cleanup costs of an insolvent subsidiary. Thus, to the extent that the decision led to changes in behavior that increase the likelihood of such liabilities, it may also have a negative effect on the solvency of subsidiaries. Consistent with this idea, we find an increase in the likelihood that subsidiaries have "high risk" credit scores, as measured by the Dun & Bradstreet Paydex score. The economic magnitude of this effect is sizable, corresponding to a drop of 23% relative to the sample mean. We also examine the effect of *Bestfoods* on the long-term likelihood that subsidiaries go out of business (e.g., due to bankruptcy). While the point estimates for this test are positive and economically large, they are statistically indistinguishable from zero.

We consider two (nonmutually exclusive) channels that potentially explain the changes in environmental behavior. First, the increase in emissions may stem from reduced investment in abatement. This may occur because parents do not fully internalize the costs of environmental cleanups, thus weakening incentives to limit pollution. Second, our findings may be a consequence of increased production resulting from lower costs of using pollutive technologies. We explore each of these possible channels in turn.

First, we test whether stronger parent liability protection is associated with changes in pollution abatement activities. We measure abatement at the plant-chemical level using the EPA's Pollution Prevention (P2) database.

Our analysis focuses on the two most common forms of abatement: changes to operating practices (e.g., improved record keeping) and the production process (e.g., modifying equipment or improving chemical reaction conditions). We find evidence that *Bestfoods* decreases incentives to invest in abatement. Specifically, plants decrease production-related abatement by 15% to 17% following the decision. We do not find evidence of a change in abatement related to operating practices.

Second, we examine whether the change in emissions stems from increased economic activity. Specifically, we test whether *Bestfoods* is associated with changes in output using plant-chemical–level production data from the EPA. We also examine whether the decision is associated with changes in plant-level employment using data from the National Establishment Time Series (NETS) database. For both measures, the estimated effect of *Bestfoods* is economically small and statistically indistinguishable from zero. This lack of a change in economic activity in response to stronger parent liability protection is consistent with the notion that costs associated with cleanups and abatement for ground pollution are often fixed in nature and do not affect marginal costs of production (EPA (2011)).

We perform a series of cross-sectional tests to explore heterogeneity related to convexities associated with insolvency and executive compensation. First, consistent with the idea that parents are liable for cleanups only in the event that a subsidiary is unable to pay, the increase in pollution and reduction in abatement concentrate in less-solvent subsidiaries. Second, the effects of *Bestfoods* are driven by the plants of parents that have existing environmental liabilities or are close to financial distress, suggesting that such firms may prioritize short-term financing needs over the avoidance of long-term liabilities. Third, we find evidence that the sensitivity of executive compensation to volatility drives heterogeneity in the findings. Specifically, the increase in emissions is driven by firms with convex managerial payoffs (i.e., high vega), consistent with previous work on the relationship between compensation and firm risk (Gormley, Matsa, and Milbourn (2013)). This finding also suggests that the stronger effects for public firms in our sample may be related to differences in the use of equity-based compensation for public and private firms (Edmans, Gabaix, and Jenter (2017)).

Our paper contributes to the literature on the economics of limited liability. Coase (1960) argues that the initial allocation of liability is irrelevant when transaction costs are negligible and property rights are well defined. Subsequent papers argue that liability protections for individual shareholders play an important role in fostering the development of capital markets. For example, limited liability for shareholders reduces monitoring costs (Jensen and Meckling (1976), Easterbrook and Fischel (1985)), mitigates adverse selection (Woodward (1985), Winton (1993)), and encourages investor diversification (Manne (1967)). Some empirical work also studies the effects of limited liability for shareholders. For example, several papers study the effects of extended liability (i.e., "double liability") for bank shareholders prior to the 1930s (Esty (1998), Grossman (2001), Aldunate et al. (2019)). Other papers examine unlimited liability for individual firms (Weinstein (2008)) and the personal liability of managers (Koudijs, Salisbury, and Sran (2019)).

A related strand of literature studies limited liability for parent corporations. Easterbrook and Fischel (1985) note that many of the benefits of limited liability for shareholders (e.g., lower monitoring costs) do not extend to the parent-subsidiary context, thus explaining the willingness of courts to impose liability on corporate owners but not individual shareholders. Often, the parent-subsidiary organizational form is used to isolate risky activities conducted by a subsidiary. Kahn and Winton (2004) model this behavior in the context of good/bad bank subsidiary structures and argue that it reduces risk-shifting incentives. Dell'Ariccia and Marquez (2010) and Cerutti, Dell'Ariccia, and Martinez Peria (2007) find evidence that banks use subsidiaries to protect against economic risks but use branches to protect against expropriation risks. Ringleb and Wiggins (1990) argue that the risk of large-scale liabilities also incentivizes vertical divestiture. Other papers examine the use of subsidiaries to avoid taxes (Durnev, Li, and Magnan (2016), Bennedsen and Zeume (2017)), enhance financial flexibility (Slovin and Sushka (1997)), and mitigate inefficiencies associated with internal capital allocation (Kolasinski (2009)). In contrast to much of the existing literature, this paper highlights the idea that parent liability protections incentivize risky behaviors that are potentially costly for other stakeholders. Our findings are broadly consistent with theoretical work that discusses moral hazard problems associated with limited liability (e.g., Shavell (1986), Boyer and Porrini (2004), Biais et al. (2010)).

Our paper also contributes to the literature on the economics of industrial pollution. One strand of this literature studies corporate liability for environmental disasters. Previous papers find that *strict* liability, a legal standard that imposes liability on polluters regardless of intent or negligence, is associated with fewer environmental accidents (Alberini and Austin (2002)) and regulatory compliance (Stafford (2002)). Shapira and Zingales (2017) argue that firms are aware of legal liability stemming from industrial pollution, but this does not necessarily deter socially harmful behavior. Other papers study a variety of factors that affect corporate environmental behavior, including third-party auditors (Duflo et al. (2013)), reputational penalties (Karpoff, Lott, and Wehrly (2005)), financial characteristics (Chang et al. (2016), Kim and Xu (2018)), and ownership structure (Shive and Forster (2020)). Our paper contributes to this literature by examining the role of parent liability protections in shaping firms' environmental behaviors.

Finally, our cross-sectional tests highlight the effect of firms' financial strength on their response to the increase in limited liability protection, a finding that is similar to the risk-shifting incentives described by Jensen and Meckling (1976). Evidence consistent with the risk-shifting hypothesis has been documented in a variety of settings (Eisdorfer (2008), Landier, Sraer, and Thesmar (2015), Denes (2016)). However, evidence inconsistent with the hypothesis has also been reported by Andrade and Kaplan (1998), Gilje (2016), and Gormley and Matsa (2011), among others. A related strand of the literature examines how firms' financial conditions impact non-financial stakeholders. For example, previous papers show that distress affects worker safety (Cohn and Wardlaw (2016)) as well as product quality and pricing (Dionne et al. (1997), Phillips and Sertsios (2013)). Similar to these strands of literature, we find that the increase in pollution and the decrease in abatement activities are driven by firms with existing environmental liabilities or firms close to financial distress. One interpretation of our findings is that such firms forgo investment in costly pollution abatement in order to free up funds for more immediate financing needs, thus shifting risk, and potentially harm, to other stakeholders.

I. Background

A. CERCLA

Congress passed CERCLA in 1980 in response to the Love Canal disaster in Niagara Falls, New York (Greenstone and Gallagher (2008)).[3] Rather than implement ex ante restrictions on polluters, the legislation was designed to address the ex post remediation of toxic sites. In many cases, sites targeted by CERCLA enforcement are nonoperating or abandoned. The goal of CERCLA is twofold: to clean up existing toxic sites and to deter the creation of new ones. Deterrence is achieved under CERCLA by broadly imposing liability on parties responsible for pollution, even after a site has shut down. Policymakers argue that the liability provisions in CERCLA "serve as powerful incentives to deter risky industrial and commercial practices that can result in releases" (EPA (2011)) and "induce the highest standard of care" (Senator Stafford, quoted in Healy (1992)).[4]

Under CERCLA, the EPA maintains a National Priorities List (NPL) of toxic facilities that are eligible for cleanup based on threats to human health or the environment. The list currently consists of over 1,300 facilities. Once assigned to the NPL, facilities are further scrutinized by the EPA to determine their levels of environmental and health risks as well as appropriate remedial actions. CERCLA grants the federal government "extraordinary" unilateral power in this regard—the EPA can either undertake a cleanup itself or compel the polluter to do so (Gaba (2015)).

The costs associated with the remediation of NPL sites are substantial, averaging \$43 million per cleanup (Greenstone and Gallagher (2008)). Cleanups of larger and more complex sites can entail significantly higher costs and take decades to complete. For example, Love Canal was removed from the NPL following a cleanup effort that lasted 21 years and cost \$400 million[5]. More recently, the EPA has initiated CERCLA claims in excess of a billion

[3] Love Canal was used as an industrial waste landfill by Hooker Chemical Corporation. In 1978, the site gained national prominence after chemicals seeped out and President Carter ordered the evacuation of 900 local residents.

[4] See Healy (1992), Oswald (1993), and Westerfield (1993) for further discussion on the deterrence function of CERCLA.

[5] Anthony Depalma "Love canal declared clean, ending toxic horror," *Washington Post*.

dollars against a number of companies including Lyondell Chemical Corp. ($4.8 billion), Assarco LLC ($3.6 billion), and Chemtura Corp. ($2.1 billion) (Blair (2011)). However, in each of these cases, the firms filed for bankruptcy and the EPA's recovery was a fraction of the initial claim.

Congress intended the "polluter pays" principle to play a key role in CERCLA. To this end, the legislation imposes two statutory mechanisms to pay for cleanups: Superfund and liability rules. Superfund is a trust fund used by the EPA to pay for site cleanups in instances in which the polluter cannot pay (e.g., due to bankruptcy) or be identified (e.g., "midnight dumping") (Plater et al. (2016)). Revenue for the fund initially came from taxes on firms that use hazardous substances; the U.S. Treasury currently funds the program.

CERCLA also funds cleanups by imposing liability on the "owners or operators" of toxic sites. Owner liability (i.e., indirect liability) under CERCLA is relatively uncontroversial; parents are liable for cleanup costs as owners under the standard veil-piercing doctrine in corporate law. Generally speaking, the owners of a corporation have limited liability for the acts of the corporation. However, courts can impose liability on owners (i.e., pierce the veil separating the parent and subsidiary) in limited circumstances involving abuse of the corporate form (e.g., failing to maintain corporate formalities, fraud; Plater et al. (2016)). Normal behaviors in a parent-subsidiary relationship (e.g., appointing directors and officers, approving capital expenditures, setting performance targets) are not generally grounds for parent liability.

Parents can also be held directly liable as operators of toxic sites under CERCLA. The legislation does not, however, specify a specific legal standard for operator liability. The lack of clarity perhaps stems from CERCLA being "a last minute compromise" that was "hastily and inadequately drafted" (Bartley (2005), quoting *United States v. A. & F. Materials Co.*). Lacking such a directive, federal judges had discretion to impose legal standards for operator liability of parents under CERCLA. The nature of these standards varied across federal circuit courts.[6] Specifically, each of the circuit courts originally adopted one of the following tests for parent liability (Silecchia (1998), Stovall (1998)):

- **Ability-to-Control (ATC)** (also called Authority-to-Control) is the broadest standard and defines an "operator" as any person who has the power to control the activities of the polluter. This standard was adopted by the Fourth, Eight, and Ninth Circuits.
- **Actual-Control (AC)** imposes liability on the parent if the subsidiary does not act independently. This may be the case, for example, if the parent corporation is involved in the day-to-day operations of its subsidiary. This standard for parent corporation liability was adopted by the First, Second, Third, and Eleventh Circuits.

[6] When there is a lack of Supreme Court jurisprudence, individual circuit courts can arrive at different conclusions when presented with an ambiguous legal statute (i.e., a "circuit split").

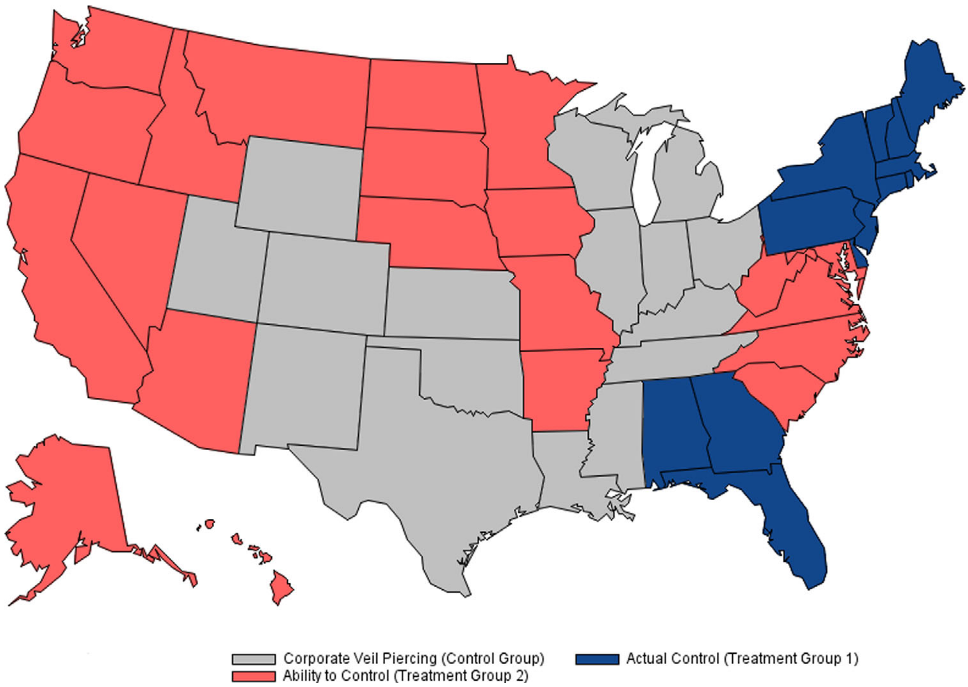


Figure 1. Treatment and control groups. This map shows the states that are in the treatment and control groups. The treatment group consists of states in circuits that adopted the Ability-to-Control or Actual-Control standards for parent liability prior to the *Bestfoods* decision. The control group consists of states in circuits that used the veil-piercing standard. (Color figure can be viewed at wileyonlinelibrary.com)

- **Veil-Piercing** is the narrowest standard. This test effectively "read out the 'operator' part of the statute" and imposed liability only if the corporate veil can be pierced under state law (Cook (1998)). Courts that used this standard argued that the legislative intent of CERCLA was not to "alter so substantially a basic tenant of corporate law" (*Joslyn Manufacturing Co. v. T.L. James & Co., Inc.*). While standards to pierce the corporate veil somewhat vary across states, factors considered usually include whether a corporation is an "alter ego" of its owner or used to promote fraud/injustice (Macey and Mitts (2014)). The veil-piercing standard was adopted by the remaining circuits.

Figure 1 shows the groups of states that used each of the three standards. Because CERCLA claims are usually brought in jurisdictions where a plant is located, the liability standard is based on plant location, not the location of the parent or state of incorporation.[7]

[7] Forum shopping concerns are not significant in this setting. CERCLA claims name, on average, nearly a dozen parties as defendants (e.g., parents, subsidiaries, other firms polluting the

B. Bestfoods *and Its Effects*

In 1998, the Supreme Court resolved the ambiguity surrounding parent liability under CERCLA in *United States v. Bestfoods*. We provide background on the case in Internet Appendix Section IA.A.[8] This unanimous decision rejected the ATC and AC standards that broadened parent liability relative to traditional corporate law standards. The Court ruled that parents are liable for environmental remediation costs under two circumstances. First, as was the case in the pre-*Bestfoods* period, parents can be held liable as owners under the traditional veil-piercing standard. Second, parents are potentially liable as operators if they operated the *facility* responsible for the pollution. Satisfying this condition requires showing involvement that is "eccentric under the accepted norms of parental oversight of a subsidiary's facility" (*U.S. v. Bestfoods*). Such actions may include the parent leasing the site from a subsidiary, a joint-venture with a subsidiary, or direct control of facility operations by an employee of the parent (Plater et al. (2016)). Normal oversight of a subsidiary and its operations that would not give rise to CERCLA parent liability include "appointing a subsidiary's officers and directors, monitoring its performance, supervising the subsidiary's finances, approving budgets and capital expenditures, and even articulating general policies and procedures for the subsidiary" (Plater et al. (2016)).

Thus, relative to the weaker ATC and AC standards, *Bestfoods* significantly increased the difficulty of holding parents liable as operators for environmental cleanup costs (Plater et al. (2016)). In courts that had adopted the weaker standards, plaintiffs often argued that shared officers/directors or parent oversight of a subsidiary gave rise to operator liability; under Bestfoods, such actions are "viewed as indicative of normal parent-subsidiary relationships" and not grounds to impose liability (Plater et al. (2016)). By reducing the liability of parents for cleanup costs that exceed the value of the subsidiary, the *Bestfoods* decision disincentivizes behaviors that make such liabilities less likely. White (1999), for example, notes that the decision creates "perverse incentives" to forgo investments in environmental controls.

Alternative regulatory mechanisms may undercut such incentives, at least in part. In addition to CERCLA, the Resource Conservation and Recovery Act (RCRA) plays an important role in regulating ground pollution. Unlike CERCLA, RCRA regulates the disposal of toxic waste for currently operating sites. It contains two key regulatory mechanisms to this end. First, RCRA provides an ex ante regulatory framework to control the production, management, and disposal of solid waste (from "cradle to grave"). Second, it grants the EPA the ability to initiate "corrective actions" (i.e., cleanups) of toxic sites that are currently in operation.

site, previous owners, arrangers and transporters) (GAO (2009)). Connors (1987) notes that "in a dispute with multiple defendants, the only forum practically available to the EPA may be the site of the toxic waste spill, especially if the multiple defendants have diverse home jurisdictions."

[8] The Internet Appendix may be found in the online version of this article.

However, RCRA provisions are likely an imperfect substitute for the ex ante deterrence function of CERCLA.[9] For one, previous work argues that important complementarities between ex ante and ex post regulatory mechanisms mitigate their individual shortcomings (Shavell (1984), Kolstad, Ulen, and Johnson (1990)). Specifically, regulators have imperfect information about market participants, leading to suboptimal oversight, while bankruptcy undercuts the effectiveness of ex post lawsuits. In addition, RCRA and CERCLA remedial actions generally address different types of situations, RCRA actions target firms that are currently operating, financially solvent, and willing to participate in the cleanup effort (OIG (2002)). In contrast, CERCLA targets nonoperating or abandoned sites (and *Bestfoods* specifically involves situations in which the polluter is unable to cover the cost of a cleanup). Furthermore, RCRA cleanups are usually smaller in scale (in terms of both complexity and expense) than those under CERCLA (Stoll (1990)) as their goal is to prevent "RCRA facilities that pose the greatest risk from becoming Superfund sites" (OIG (2002)).

The effects of *Bestfoods* may have extended beyond firms and influenced the enforcement behavior of the EPA. Enforcement actions and litigation are costly events for both the defendant and the plaintiff. While *Bestfoods* likely had little effect on the EPA's incentive to initiate claims against solvent subsidiaries, the agency may have been reluctant to initiate claims against those close to insolvency due to a higher probability of limited recovery. Thus, it is unclear whether changes in firms' environmental behaviors in response to the decision would necessarily be accompanied by changes in enforcement.

II. Data and Methodology

A. Data

Our sample consists of plants in the EPA's Toxic Release Inventory (TRI) database from 1994 to 2003. This database has been extensively used by economists as well as public policy, environmental, and public health researchers.[10] Since 1987, the EPA has reported chemical-level emissions data in TRI for plants that exceed a minimum number of employees, operate in certain industries, and emit specific hazardous pollutants. The current standard requires reporting if a facility has at least 10 full-time employees, operates in one of roughly 400 industries defined at the six-digit NAICS level, and uses one of nearly 600 chemicals.[11] Internet Appendix Table IA.I lists the

[9] Legal scholars have pointed out that there are important complementarities between the CERCLA and RCRA. Rallison (1987), for instance, argues that "[CERCLA's] liability provisions, in conjunction with those of RCRA, provide significant incentives to current and future waste producers."

[10] See, for example, Banzhaf and Walsh (2008), Bui and Mayer (2003), Currie and Schmieder (2009), Currie (2011), Greenstone (2003), Hamilton (1995), and Konar and Cohen (1997).

[11] Some requirements (e.g., the industries subject to reporting) have changed over the course of our sample, and thus raw total emissions in the TRI database are not directly comparable over time. In a robustness test, we limit the analysis to industries included in the database for the entire sample.

three-digit NAICS industries that are currently included in TRI; the most common are chemical manufacturing (25.1% of sample), fabricated metal product manufacturing (11.0%), primary metal manufacturing (9.1%), and transportation equipment manufacturing (6.9%). For most chemicals, disclosure is triggered if more than 25,000 pounds of a chemical are manufactured or processed or 10,000 pounds are otherwise used during a year, though some substances have more stringent requirements.

While TRI data are self-reported, the EPA conducts audits to investigate anomalies. Misreporting can lead to criminal or civil penalties (Kim and Xu (2018)). However, the only penalties associated with TRI are for false reports, not high emissions (Greenstone (2003)). For example, P4 Production LLC, a wholly owned subsidiary of Monsanto, was fined $600,000 for violating chemical reporting laws in 2015. Nevertheless, previous studies document some evidence of inaccuracies in the TRI database (e.g., Brehm and Hamilton (1996), De Marchi and Hamilton (2006)). Brehm and Hamilton (1996) argue that violations are concentrated in facilities that release a small amount of toxins, which suggests that misreporting is a result of ignorance rather than evasion.[12] Evidence also indicates the aggregate effects of misreporting are marginal; EPA (1998) reports the results of an audit of TRI facilities and finds that facility and surveyor estimates were within 3% of each other for most industries. In addition, Bui and Mayer (2003) note that there is little evidence of systematic over- or underestimation in the TRI data.

For each chemical subject to TRI reporting, plants are required to provide the number of pounds released into the ground, air, and water. Ground emissions consist of waste disposed into underground injection wells, landfills, surface impoundments, or spills and leaks released to land. Air emissions consist of stack or point releases (e.g., through a vent or duct) and fugitive emissions (e.g., evaporative losses). Water emissions consist of releases to streams and other surface bodies of water. Because CERCLA cleanups focus on contamination of the ground or ground water, our analysis focuses on ground emissions.[13] We drop observations with zero air, water, and ground emissions in a chemical-facility-year. Figure 2 plots the time series of aggregate emissions for the three categories over our sample period. Consistent with previous findings (e.g., Shapiro and Walker (2015)), emissions fell through the 1990s, driven primarily by a decrease in air pollution.

We obtain information on the toxicity of emissions from the EPA's Integrated Risk Information System (IRIS). IRIS provides information on potential human health effects from exposure to over 400 chemicals. Chemicals are included in the database based on their potential effects on public health, regulatory implementation needs, and availability of scientific assessments. IRIS also

[12] As a robustness test, we show our results are similar when we drop small facilities from the sample.

[13] Courts have ruled that CERCLA does not apply to air emissions, even if chemicals pollute land or water after being released into the air (see *Pakootas v. Teck Cominco Metals*). In addition, while CERCLA technically does cover disposals into waterways, the EPA only recently began cleanups of such sites on a large scale.

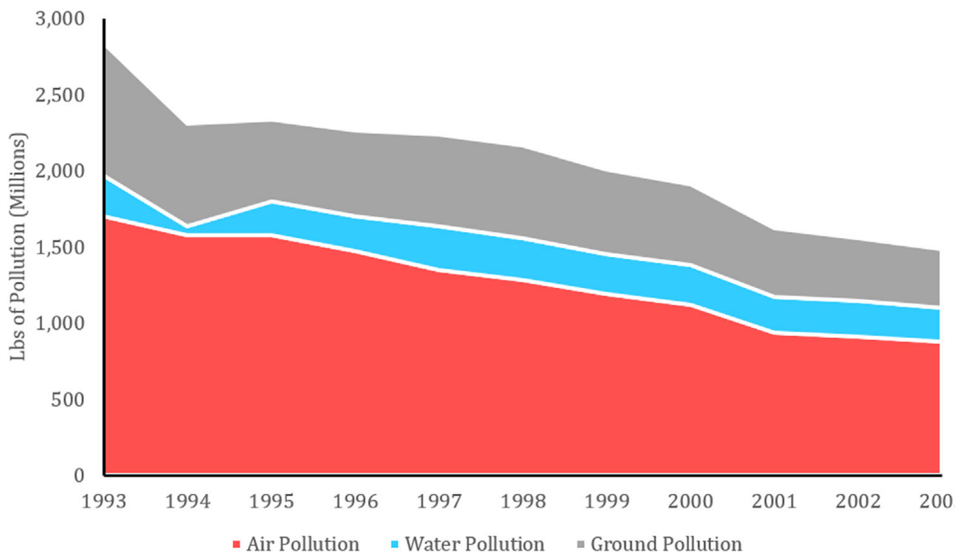


Figure 2. Total emissions by type, 1994 to 2003. This figure shows the total pounds of emissions (in millions) reported by plants in the TRI database from 1994 to 2003. The sample excludes industries that were not required to report over the entire period. (Color figure can be viewed at wileyonlinelibrary.com)

includes information on the primary system affected or tumor site for chemicals (e.g., nervous, respiratory, developmental). We match the IRIS database to TRI using chemical identifiers (i.e., Chemical Abstract Services (CAS) numbers), and we use the database to create an indicator for whether a chemical in TRI poses potential harm to humans as well as indicators for whether particular bodily systems are affected.

We use the EPA's Pollution Prevention P2 database to analyze abatement activities. Plants reporting to the TRI database are required to document source reduction activities at the chemical level that limit the amount of hazardous substances entering the waste stream. "Good operating practices," such as improved maintenance scheduling, record keeping, or procedures represent the most common abatement activity. The second most common type of abatement activity comprises "process modifications," which include actions such as modifications to equipment, layout, or piping. The list of activities included in both types of abatement are provided in Table IA.II in the Internet Appendix. We use these classifications to construct indicators for process-related abatement and operating-related abatement activities.

The P2 database also includes a production ratio that measures changes in the output or outcome of processes in which a chemical is involved. For example, if a chemical is used in the manufacturing of refrigerators, the production ratio for year t is given by $\frac{\#\,Refrigerators\,Produced_t}{\#\,Refrigerators\,Produced_{t-1}}$. If a chemical is used in a capacity not directly related to production (e.g., cleaning), the EPA alternatively requires facilities to report the ratio reflecting changes in this activity. For example, if a chemical is used to clean molds, the activity ratio for year t is given by $\frac{\#MoldsCleaned_t}{\#MoldsCleaned_{t-1}}$. If a particular chemical is used in multiple production processes/activities, firms are required to report a weighted average. Due to apparent errors in the data, we exclude ratios that are not between zero and three (inclusive), but our findings are qualitatively similar using narrower or wider bounds (e.g., [0, 2] or [0, 5]).

Plant-level data come from the NETS database, which is constructed by Walls & Associates using archival data from Dun & Bradstreet. We use the Paydex score and number of employees from NETS. The Paydex score, which ranges from 0 to 100, is a business credit score based on trade credit performance provided to Dun & Bradstreet by a large number of vendors and suppliers. The score is value-weighted according to size of obligations, and a score of 80 indicates that, on average, payments are made according to the loan terms. Our analysis focuses on the minimum score reported over the course of a year. Dun & Bradstreet determines plant employment by directly contacting entities and using statistical models to impute missing values.[14] Financial information for public parent corporations comes from Compustat.

For each plant, we obtain the parent company, defined as the highest-level corporation that owns at least 50% of voting shares, from TRI. To account for possible errors or other discrepancies in names, we identify parents using the first 25 alphanumeric characters and remove common suffixes (e.g., "Corp.," "Incorporated," "LLC"). We match plants to circuit courts to form treatment and control groups. Plants located in ATC and AC circuits form the treatment group, and those located in circuits with the veil-piercing standard comprise the control group.

Figure 3 shows the fraction of observations corresponding to each of the 11 circuit courts and the breakdown between treatment and control groups during our sample period (1994 to 2003). Approximately 22% of plants are located in circuits that adopted the AC standard (the first of our treatment groups), 28.5% are in circuits that adopted the ATC standard (the second of our treatment groups), and 49.5% are in circuits that used the veil-piercing standard (our control group). Despite large differences in the size of some circuits (e.g., the Ninth Circuit contains nine states including California), the number of observations is fairly balanced between the treatment and control groups.

In total, our sample consists of 6,953 parent corporations with an average of 2.80 subsidiary plants. Plants report emissions for an average of 3.91 toxic chemicals. Panel A of Table I reports summary statistics for the main outcomes

[14] Neumark, Wall, and Zhang (2011) find that the correlations between NETS and Current Employment Statistics (CES) and Quarterly Census of Employment and Wages (QCEW) are 0.99 and 0.95 at the county-by-industry level, respectively. However, NETS has some shortcomings relative to establishment employment determined by government statistical agencies. We take steps where possible to mitigate these shortcomings. First, we obtain similar results if we exclude estimated values. Second, Barnatchez, Crane, and Decker (2017) note that NETS over samples small establishments (<10 employees). Such establishments are rare in the TRI database (<5% of observations); and excluding them does not have a material effect on our findings.

Table I

Summary Statistics

Panel A reports summary statistics for the full sample of subsidiaries and the subsample with public parents. Panel B tests the difference between plants in the treatment and control groups in 1997, the year before the *Bestfoods* decision. Emissions data are from the EPA TRI database, abatement and production data are from the EPA P2 database, and employment and Paydex data are from the NETS database. Unless otherwise noted, observations are at the plant-chemical-year level.

Panel A. Pooled Summary Statistics

	All Subs				Subs w/Public Parent			
	Obs	Mean	Median	*SD*	Obs	Mean	Median	*SD*
Lbs Ground Pollution (1000s)	503,275	43.60	0	1,846.80	156,947	47.78	0	1,663.69
Lbs Air Pollution (1000s)	503,279	29.99	520	318.41	156,949	37.98	566	321.87
Lbs Water Pollution (1000s)	503,276	4.35	0	160.08	156,947	5.34	0	205.01
Lbs Total Pollution (1000s)	503,275	77.93	1,000	1,880.72	156,947	91.11	1,419	1,706.03
$\mathbb{1}$*(Ground Pollution)*	503,279	0.12	0	0.33	156,949	0.16	0	0.36
$\frac{\textit{Ground Pollution}}{\textit{Total Pollution}}$	503,275	0.08	0	0.25	156,947	0.11	0	0.30
$\mathbb{1}$*(Abatement - Operating)*	503,279	0.08	0	0.27	156,949	0.09	0	0.28
$\mathbb{1}$*(Abatement - Process)*	503,279	0.05	0	0.23	156,949	0.05	0	0.23
Production Ratio	477,903	0.96	1	0.38	149,081	0.96	1	0.39
Employment (Plant)	93,378	334.23	140	717.85	26,842	446.36	190	971.27
Paydex (Plant)	85,004	67.18	69	9.15	24,687	66.44	68	9.26

Panel B. Treatment vs. Control (1997)

	Control	Treatment	p-Value of Difference
log(Ground Pollution)	0.675	0.549	0.512
	(2.359)	(2.083)	
log(Air Pollution)	6.699	6.699	0.997
	(3.339)	(3.344)	
log(Water Pollution)	0.795	0.985	0.240
	(2.161)	(2.454)	
log(Total Pollution)	7.205	7.211	0.981
	(3.119)	(3.106)	
$\mathbb{1}$*(Ground Pollution)*	0.098	0.086	0.612
	(0.297)	(0.280)	
$\frac{\textit{Ground Pollution}}{\textit{Total Pollution}}$	0.052	0.042	0.412
	(0.208)	(0.185)	
$\mathbb{1}$*(Abatement - Operating)*	0.083	0.100	0.069
	(0.275)	(0.300)	

(*Continued*)

Table I—*Continued*

Panel B. Treatment vs. Control (1997)			
	Control	Treatment	*p*-Value of Difference
𝟙*(Abatement - Process)*	0.061	0.077	0.005
	(0.239)	(0.267)	
Production Ratio	1.042	1.048	0.454
	(0.301)	(0.310)	
Employment (Plant)	5.009	5.011	0.986
	(1.413)	(1.391)	
Paydex (Plant)	67.589	68.286	0.207
	(8.813)	(8.699)	

of interest. The first four columns of the table report statistics for all plants, and the second four limit the sample to plants with public parents. Unless otherwise noted, all summary statistics are at the plant-chemical-year level. For the full sample, plants average 43,000 pounds of ground emissions for each chemical reported in TRI, although nearly 85% do not report ground emissions. Air and water emissions average about 30,000 and 4,000 pounds, respectively. Abatement activities are fairly common: operating and process-related actions are associated with 8% and 5% of plant-chemical-year observations,

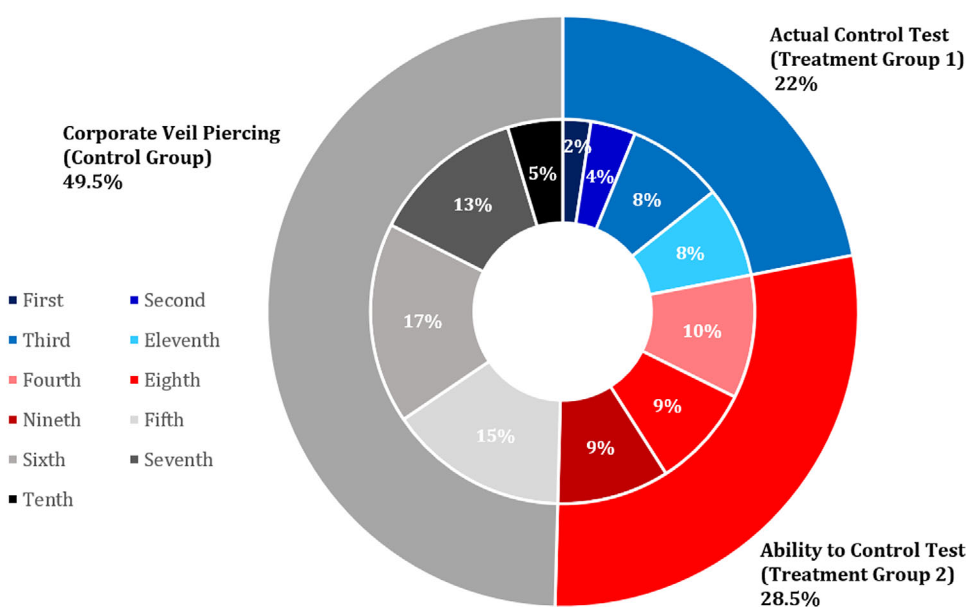


Figure 3. Distribution of plants by circuit courts and treatment assignment. This figure shows the percentage of observations in different circuit courts and the percentage assigned to the treatment and control groups. (Color figure can be viewed at wileyonlinelibrary.com)

respectively. The production ratio averages 0.96 and has a median of 1.0, and the average plant employs 334 workers.

Panel B of Table I examines ex ante differences between plants in the treatment and control groups. Specifically, we report average values of variables used in our analysis for 1997, the year before the *Bestfoods* decision. Plants in the treatment and control groups have similar emissions, production ratios, number of employees, and Paydex scores. However, plants in the treatment group were more likely to conduct abatement activities prior to *Bestfoods*, suggesting that weaker liability protections incentivize behaviors to limit emissions. We present similar comparisons for different groups that we use for cross-sectional tests in Table IA.III of the Internet Appendix.

B. Magnitude of Environmental Liabilities

An important question is whether the costs associated with firms' environmental behaviors affect their financial condition. To shed light on this question, we analyze environmental disclosures for over 900 public parents in our sample. In 1996, the American Institute of Certified Public Accountants required additional disclosures for environmental liabilities. Specifically, Statement of Position 96-1 "Environmental Remediation Liabilities" (SOP 96-1) required that contingent liabilities be accrued for potential environmental obligations, including future remediation costs.[15] Firms have some discretion as to what constitutes a "probable" event for the purpose of such disclosures, but certain events mandate disclosure, such as being designated a Potentially Responsible Party (PRP) of a toxic site under CERCLA.

We hand collect data on environmental disclosures from 10-K or 10-KSB filings for 1997, the year before the *Bestfoods* decision. We do not automate this process because firms differ in terms of how they disclose environmental information. We construct two variables to capture environmental liabilities. First, *Cleanup* takes the value of one if a firm discloses that it is involved in an ongoing remediation or cleanup effort anywhere in its annual report and the value of zero otherwise. These disclosures are generally found in Item 3 of Part 1 of the annual report for ongoing litigation and Item 1 or 7 if the legal proceedings have finished but remediation is ongoing. Second, *Contingent* takes the value of one if a firm discloses that its financial statements include an accrual for expected future environmental costs and the value of zero otherwise. This information is typically found in a footnote to a firm's financial statements. Overall, 48% of firms disclose ongoing environmental remediation (i.e., $Cleanup = 1$) and 30% of firms disclose environmental liabilities (i.e., $Contingent = 1$).

Contingent liabilities are not separately reported in Compustat; they are a component of the Liabilities-Other (LO) variable. This variable contains a

[15] Liabilities should be accrued if "(a) information available prior to issuance of the financial statements indicates that it is probable that an asset has been impaired or a liability has been incurred at the date of the financial statements and (b) the amount of the loss can be reasonably estimated." If a firm discloses a specific accrual, it discusses this in a Contingency footnote to the firm's 10-K. However, firms are not obligated to disclose the specific amount that they accrue.

Table II

Environmental Disclosures and Long-Term Liabilities

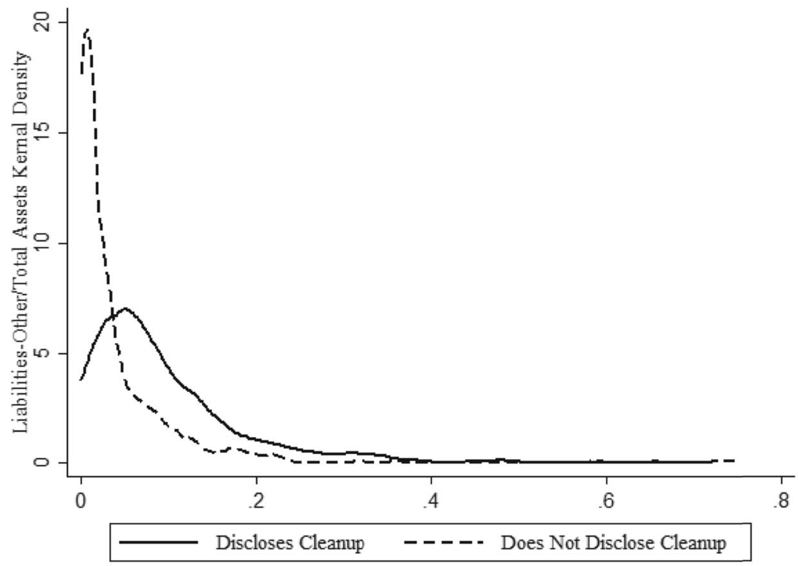
This table uses a cross-sectional OLS regression for 1997, the year prior to the *Bestfoods* decision, to examine the relationship between environmental disclosures and long-term liabilities. The dependent variable is the ratio of liabilities-other to total assets. *Cleanup* is an indicator for whether a firm discloses ongoing environmental remediation activities. *Contingent* is an indicator for whether a firm discloses environmental accruals. *Size* is the log of total assets. Industry is defined at the two-digit SIC level. The sample comprises all public firms in the TRI database that filed a 10-K or a 10-KSB in 1997. Robust standard errors are clustered by industry and reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	Liabilities-Other / Total Assets					
	(1)	(2)	(3)	(4)	(5)	(6)
Cleanup	0.0546***	0.0388***	0.0366***			
	(0.00846)	(0.00722)	(0.00569)			
Contingent				0.0611***	0.0482***	0.0481***
				(0.00857)	(0.00734)	(0.00527)
Size		0.0120***	0.0125***		0.0127***	0.0133***
		(0.00253)	(0.00217)		(0.00255)	(0.00220)
Industry FE			x			x
Observations	947	947	936	947	947	936
R^2	0.094	0.148	0.304	0.099	0.164	0.323

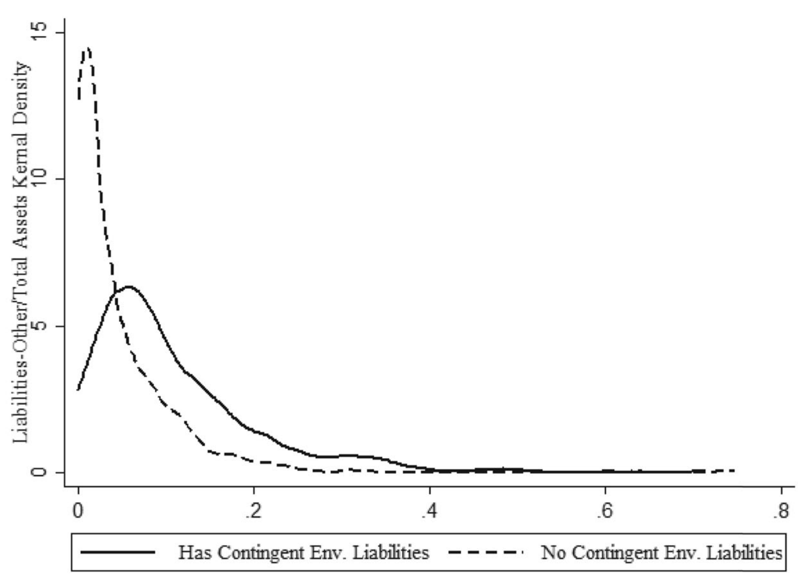
variety of long-term nonfinancial liabilities including contingent liabilities.[16] Overall, 83% of firms in our sample have positive Liabilities-Other/Total Assets in 1997, and the sample average and standard deviation are 0.0657 and 0.0891, respectively.

We analyze the relationship between Liabilities-Other and environmental disclosures to shed light on the magnitude of environmental liabilities. Figure 4 shows kernel density plots of Liabilities-Other/Total Assets for subsamples of firms that do or do not disclose environmental liabilities. Panel A splits firms by whether they disclose ongoing environmental remediation (i.e., *Cleanup* = 1). Panel B splits firms by whether they disclose specific environmental liabilities (i.e., *Contingent* = 1). In both cases, firms that make environmental disclosures tend to have higher long-term liabilities. To quantify this difference, we regress Liabilities-Other/Total Assets on the disclosure variables. Table II reports the results. Column (1) indicates that other liabilities as a fraction of assets are 5.5% higher when firms disclose ongoing cleanup activities. This relationship remains economically and statistically significant when controlling for size and industry in columns (2) and (3), respectively. We

[16] Specifically, the variable includes the following categories of liabilities: accounts payable due after one year, contingent liabilities, accounts receivable assigned, notes receivable discounted, guarantees, customers' deposits on bottles, cases, and kegs, negative goodwill, reserves not shown elsewhere, foreign exchange losses, facility realignment and relocation, reserves for self-insurance, when reported in Other Liabilities, film producers' film contracts, accrued taxes, accrued expenses, dividends payable, and unearned income. The Compustat variable definition notes that it does not include financial liabilities such as notes or long-term debt and shareholders' equity.



Panel A. Liabilities-Other/Total Assets and Cleanup Disclosure



Panel B. Liabilities-Other/Total Assets and Environmental Liability Disclosure

Figure 4. Distribution of liabilities-other by environmental disclosure. This figure shows kernel density plots for Liabilities-Other/Total Assets for public firms in the sample in 1997. Panel A plots the density for firms that disclose and do not disclose ongoing environmental cleanups. Panel B plots the density for firms that disclose and do not disclose accruals for environmental liabilities.

find similar magnitudes for *Contingent* in columns (4) to (6). While these findings are descriptive in nature, they suggest that, among the set of firms with toxic emissions, those that make environmental disclosures have substantially larger long-term liabilities. This idea is consistent with anecdotal evidence indicating that environmental liabilities are often large and potentially have a material effect on firms' balance sheets (e.g., Blair (2011)). Figure 5 provides kernel density plots of the log of total pollution for the same subsamples of firms and shows that environmental disclosures are associated with higher emissions in the TRI database. Specifically, we find that firms that disclose an ongoing remediation or a specific environmental liability have higher levels of pollution. We verify that this relationship also holds at the facility level in Table IA.IV of the Internet Appendix.

C. Regression Specification

We use the *Bestfoods* decision as a natural experiment in a difference-in-differences framework. We define *Bestfoods* to be an indicator that takes a value of one starting in 1999, the first full calendar year following the decision, for plants located in a circuit that previously adopted relatively weaker standards for parent liability (i.e., the AC or ATC legal tests).

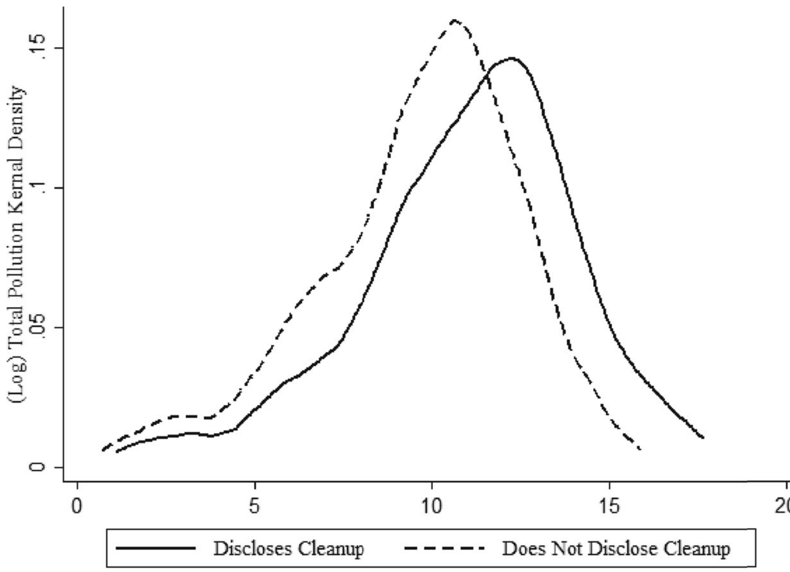
Our initial analysis focuses on ground pollution, as this is the focus of CERCLA enforcement efforts. The main outcome variable is the natural logarithm of one plus the pounds of emissions (chemical level) for each plant.[17] Our main specification takes the form,

$$log(1 + Lbs\,Ground\,Pollution_{c,p,f,i,t}) = \beta\,Bestfoods_{f,t} + \alpha_p + \alpha_{i,t} + \alpha_{c,t} + \epsilon_{c,p,f,i,t},$$

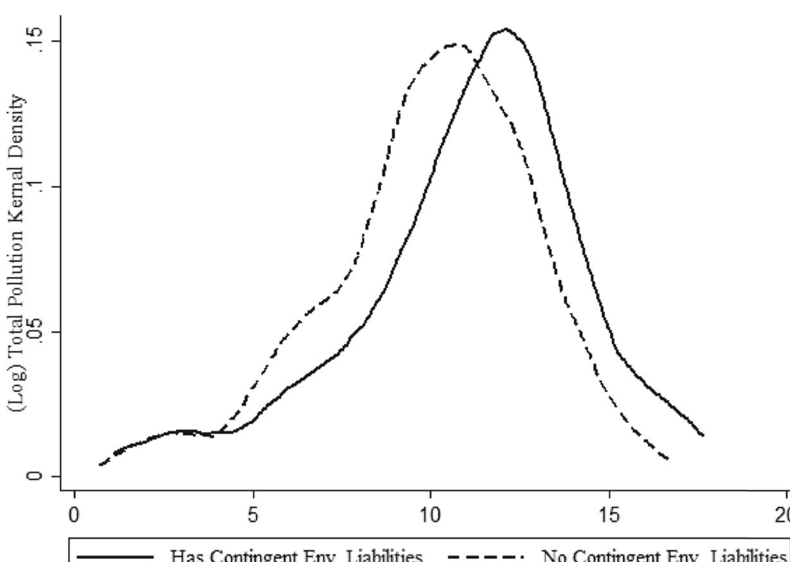
where c indexes a chemical emitted by plant p located in federal circuit f and belonging to parent firm i at time t. We include plant fixed effects (α_p) to control for time-invariant heterogeneity at the facility level. In addition, we include parent-year fixed effects ($\alpha_{i,t}$) to control for time-varying heterogeneity at the parent level. The coefficient estimates for the main specification are therefore relative to plants with the same parent located in areas with a stronger liability standard already in place. We also include chemical-year fixed effects ($\alpha_{c,t}$) to control for time-varying heterogeneity at the chemical-year level. As Chatterji, Levine, and Toffel (2009) and DiGiuli (2013) note, there is no clear way to aggregate pollutants or easily comparing their environmental impact; chemical-year fixed effects allow us to exploit within-chemical-time variation. In some specifications, we also include industry-year fixed effects, defined using the primary four-digit SIC code for each plant, to control for time-varying heterogeneity at the industry level. We cluster robust standard errors at the circuit level.

We also conduct analysis on outcomes related to abatement and production (both at the facility-chemical level) using the above specification. We

[17] In unreported analysis, we rescale pollution levels by adding 1,000 instead of 1 as in Chatterji, Levine, and Toffel (2009). This does not have a material effect on the results.



Panel A. Log Total Emissions and Cleanup Disclosure



Panel B. Log Total Emissions and Environmental Liability Disclosure

Figure 5. Distribution of pollution by environmental disclosure. This figure shows kernel density plots for the natural log of total emissions for public firms in the sample in 1997. Panel A plots the density for firms that disclose and do not disclose ongoing environmental cleanups. Panel B plots the density for firms that disclose and do not disclose accruals for environmental liabilities.

analyze employment at the plant level using a similar specification but excluding chemical-year fixed effects. Finally, we analyze subsets of the main sample based on plant characteristics (e.g., Paydex) or parent characteristics (e.g., Z-score) from 1997, the year before the *Bestfoods* decision. The specification used for these tests is the same as above.

III. Results

A. *Effect of Parent Liability on Emissions*

We first analyze the effect of *Bestfoods* on toxic emissions by the plants of subsidiaries. The main outcome of interest is ground pollution, as this is the focus of CERCLA enforcement efforts. In this section, we examine whether the change in liability standards affected the quantity and toxicity of such emissions.

A.1. Facility Ground Emissions

Table III reports the effect of *Bestfoods* on facility ground emissions. The dependent variable is the natural logarithm of one plus pounds of ground pollution at the plant-chemical level. Columns (1) to (4) indicate that *Bestfoods* is associated with an increase in ground emissions for treated plants that experienced a relative increase in parent liability protection. In addition to the baseline specifications (columns (3) and (4)), we also report coefficients for relatively parsimonious specifications with plant and year (column (1)) or plant and chemical-year fixed effects (column (2)). The point estimates range from 0.047 to 0.086 and are statistically significant at the 1% level in each of the specifications. The increase in emissions is economically large: The average value of the dependent variable is 0.90, indicating an increase of between 5% and 9% relative to the sample mean.

The remainder of Table III analyzes the effect of *Bestfoods* on different subsets of plants. Columns (5) and (6) separately estimate the treatment effect for plants located in areas that used the ATC or AC standards. The indicators *ATC* and *AC* are defined analogously to *Bestfoods* in the baseline specification, but only take a value of one for plants located in circuits that used the respective standards. The results indicate similar effects across both types of jurisdictions. Specifically, the coefficients for both *ATC* and *AC* are statistically significant at the 5% level or lower, and the point estimates for both are of similar magnitude to the baseline specification.

Next, we restrict the sample to subsidiaries with public parents. Shive and Forster (2020) argue that public status is positively associated with pollution. Consistent with their finding, the median output for chemicals with positive ground emissions for all plants is approximately one quarter (2,050 pounds) that of plants with public parents (8,472 pounds). The effects of *Bestfoods* may be particularly strong for this set of facilities because larger emissions potentially lead to larger future liabilities. The point estimates in columns (7) and

Table III

Effect of *Bestfoods* on Ground Emissions

This table uses OLS regressions to test the effect of the *Bestfoods* decision on ground pollution. The dependent variable is the log of one plus pounds of ground pollution. *Bestfoods* is an indicator that takes the value of one after 1998 (the year of the *Bestfoods* decision) for plants located in the circuits that had previously adopted the Ability-to-Control or Actual-Control standards for parent company liability. *AC* and *ATC* are indicators defined similarly to *Bestfoods*, but take the value of one after 1998 for plants in Actual-Control or Ability-to-Control circuits, respectively. Robust standard errors are clustered by court circuit and reported in parentheses. The fixed effects used in each specification are noted in the table. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	Ln(1 + Lbs Ground Pollution)									
	All Subs						Subs w/Public Parent		Non-Subs	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Bestfoods	0.0469***	0.0534***	0.0861***	0.0812***			0.220***	0.224***	−0.0063	−0.0184
	(0.0145)	(0.0162)	(0.0193)	(0.0188)			(0.0309)	(0.0415)	(0.0259)	(0.0324)
ATC					0.0925***	0.0873***				
					(0.0281)	(0.0239)				
AC					0.0773***	0.0727***				
					(0.0177)	(0.0220)				
Plant FE	x	x	x	x	x	x	x	x	x	x
Year FE	x									
Chemical-Year FE		x	x	x	x	x	x	x	x	x
Parent-Year FE			x	x	x	x	x	x	x	x
Industry-Year FE				x		x		x		x
Observations	501,259	500,553	488,739	488,009	488,739	488,009	154,404	153,951	107,695	106,839
R^2	0.559	0.661	0.683	0.688	0.683	0.688	0.741	0.748	0.630	0.654

(8) are nearly triple those of the main sample, corresponding to an increase of approximately 17% relative to the subsample mean. We explore potential explanations related to the incentives of managers for the stronger response of subsidiaries of public firms in Section V.

Columns (9) and (10) restrict the analysis to plants that do not have a parent listed in the TRI database. Consistent with the idea that a change in parent liability should only affect plants with a parent corporation, we find no evidence of an increase in emissions for this set of plants. The point estimates are both economically small (ranging from −0.006 to −0.018) and statistically indistinguishable from zero. This analysis serves as a useful falsification test as it suggests the absence of a confounding shock (e.g., local economic conditions or public attitudes toward pollution) that broadly affected emissions by all plants (both with and without parent corporations) in circuits that previously adopted weaker liability standards.

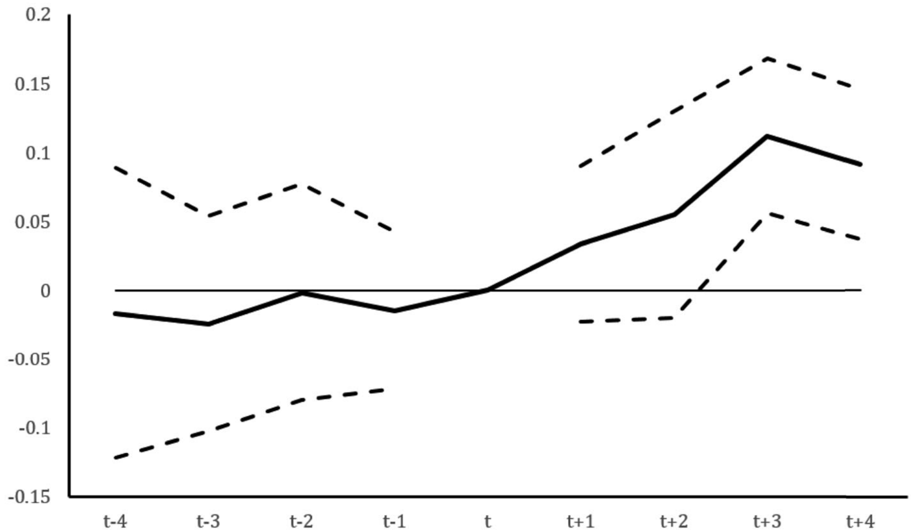
Figure 6 plots the coefficient dynamics around the *Bestfoods* decision. We construct this figure by replacing the pooled treatment variable in the baseline specification with indicators for each year before and after the decision. We present the dynamics for all subsidiaries in Panel A and for subsidiaries of public parents in Panel B. The coefficient trend is relatively flat prior to the decision, but begins to increase following *Bestfoods*, particularly for the sample with public parents. While the "parallel trends" assumption necessary for identification in our setting is untestable, this figure provides evidence that is consistent with the assumption.

We verify that the findings are not driven by any individual circuit by iteratively removing one circuit and rerunning our main analysis. This exercise further mitigates concerns that contemporaneous geographical shocks that are unrelated to the *Bestfoods* decision may confound the analysis. We plot the point estimates and confidence intervals for this analysis in Figure IA.1 of the Internet Appendix. The estimate for each iteration remains positive and statistically significant at the 5% level or lower.

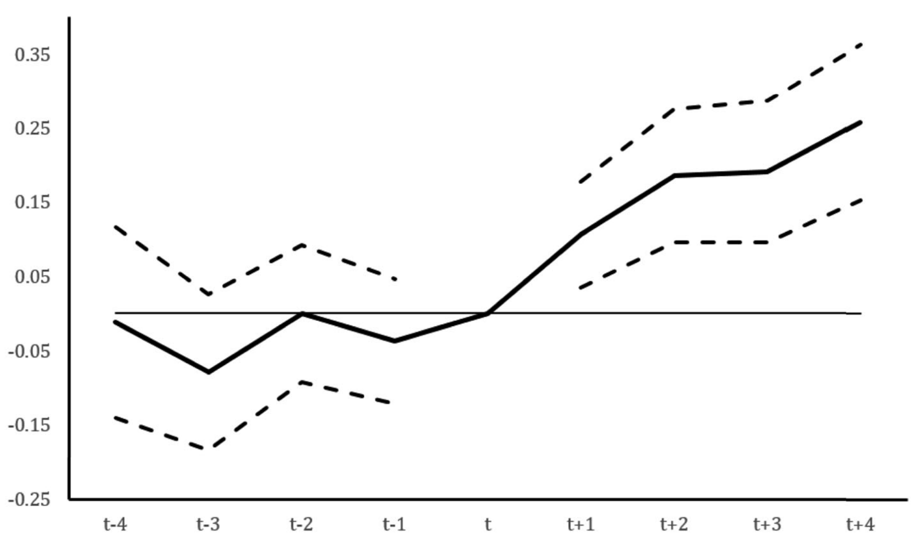
Overall, our findings indicate that *Bestfoods* is associated with an increase in toxic emissions by the plants of subsidiaries. This change in behavior may not be optimal from the perspective of a subsidiary if it increases the probability of future EPA enforcement. However, *Bestfoods* affords parents considerable leeway to influence the behavior of subsidiaries as majority shareholders (see Internet Appendix Section IA.A). Among other things, parents can appoint directors/officers and approve capital expenditures of subsidiaries (Plater et al. (2016)). The ability of a parent to influence its subsidiary in this manner may lead to changes in environmental behavior that would not be optimal for the subsidiary as a standalone firm.

A.2. Intensive and Extensive Margins

Table IV examines whether the increase in emissions is driven by the intensive or extensive margins of pollution. To analyze the intensive margin, columns (1) to (4) restrict the sample to plants that report positive ground



Panel A. All Subsidiaries



Panel B. Subsidiaries with Public Parents

Figure 6. Ground emissions coefficient dynamics. This figure shows the coefficient dynamics for ground emissions around the *Bestfoods* decision. The dependent variable is the log of one plus the pounds of ground emissions. Panel A includes subsidiaries of both public and private firms. Panel B limits the sample to subsidiaries of public firms. The figure is constructed using the baseline regression specification, but replaces *Bestfoods* with indicators for each year around the decision. The regression specification includes plant, parent-year, and chemical-year fixed effects. Standard errors are clustered by circuit court. Dashed lines indicate 95% confidence intervals.

Table IV

Margin of Response to *Bestfoods*

This table uses OLS regressions to test the effects of the *Bestfoods* decision on the intensive and extensive margins of ground emissions. The dependent variable in columns (1) to (4) is the log of one plus pounds of ground pollution for plants with positive emissions in 1997. The dependent variable in columns (5) to (8) is an indicator variable that takes the value of one if a plant pollutes with a given chemical and zero otherwise. *Bestfoods* is an indicator that takes the value of one after 1998 (the year of the *Bestfoods* decision) for plants located in the circuits that had previously adopted the Ability-to-Control or Actual-Control standards for parent company liability. Robust standard errors are clustered by court circuit and reported in parentheses. The fixed effects used in each specification are noted in the table. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	Ln(1+ *Lbs Ground Pollution*), 1997 Pollution > 0				$\mathbb{1}$*(Ground Pollution)*			
	All Subs		Subs w/Public Parent		All Subs		Subs w/Public Parent	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Bestfoods	0.242^{**} (0.101)	0.187 (0.119)	0.729^{***} (0.175)	0.960^{***} (0.219)	0.0084^{*} (0.0038)	0.0070 (0.0044)	0.0289^{***} (0.0041)	0.0305^{***} (0.0056)
Plant FE	x	x	x	x	x	x	x	x
Chemical-Year FE	x	x	x	x	x	x	x	x
Parent-Year FE	x	x	x	x	x	x	x	x
Industry-Year FE		x		x		x		x
Observations	83,755	83,536	24,103	23,942	488,744	488,014	154,407	153,954
R^2	0.568	0.579	0.538	0.555	0.641	0.648	0.690	0.702

emissions in 1997, the year before the *Bestfoods* decision. Because we exclude plants with zero (or missing) ground pollution in 1997, the sample size is considerably smaller than the main test reported in Table III. We find that the change in parent liability protection is associated with an increase in ground emissions along this margin for both the full sample of subsidiaries (columns (1) and (2)) and the sample with public parents (columns (3) and (4)).[18] As in Table III, the point estimates for the sample with public parents are approximately three times larger than those for the full sample. The economic magnitude of this effect is sizable, corresponding to an increase of 7.5% to 9.6% relative to the mean for the full sample.

We next examine the extensive margin of pollution. The dependent variable in columns (5) to (8) is an indicator for ground emissions at the chemical level. For the sample of all subsidiaries (columns (5) and (6)), the likelihood of ground pollution increases by approximately 0.8 percentage points, although this effect is statistically noisy and not significant at conventional levels when we include industry-year fixed effects. The effect is stronger both in terms of economic magnitude (approximately 3 percentage points) and statistical significance ($p < 0.01$) for the sample of subsidiaries with public parents. Taken together, the findings in Table IV indicate that the increase in emissions following the change in liability standards occurs along both the intensive and the extensive margins.

A.3. Chemical Toxicity

We next turn attention to the types of chemicals emitted by subsidiaries. By definition, the chemicals included in the TRI database are toxic, although not all have adverse effects on humans. In this section, we examine whether there is a differential effect for chemicals that are known to be toxic to humans versus those that are not. It is possible, for example, that stronger liability protection afforded firms leeway to increase emissions of some chemicals, but the presence of ex ante regulations (e.g., RCRA) made it costly to increase emissions of chemicals that are hazardous to humans. To this end, we match the chemicals from the TRI database with the EPA's IRIS, which classifies chemicals based on evidence of harm to humans. Approximately 62% of the chemical observations in our sample are known to be harmful to humans.

Table V reports the results. Panel A shows the impact of *Bestfoods* on ground pollution split by chemical type. The sample consists of chemicals that have known adverse health outcomes in columns (1) to (4) and unclassified chemicals in columns (5) to (8). For both samples, we report results for all subsidiaries as well as subsidiaries with public parents. Overall, estimates for both samples are similar to the baseline results in Table III in terms of economic magnitude and statistical significance. Panel B further categorizes harmful chemicals based on biological impact to humans. We document an

[18] This test also addresses concerns that the primary effect is driven by the presence of firms with zero ground emissions.

Table V

Differential Effects of *Bestfoods* for Harmful Chemicals

This table uses OLS regressions to test the differential effects of the *Bestfoods* decision on ground emissions based on the potential harm to humans. The dependent variable is the log of one plus pounds of ground pollution. *Bestfoods* is an indicator that takes the value of one after 1998 (the year of the *Bestfoods* decision) for plants located in the circuits that had previously adopted the Ability-to-Control or Actual-Control standards for parent company liability. Columns (1) to (4) in Panel A use the subsample of chemicals that are harmful to human health, as classified by the EPA's IRIS database. Columns (5) to (8) use the subsample of chemicals that are not classified. Panel B further examines harmful chemicals by biological system. Robust standard errors are clustered by court circuit and reported in parentheses. The fixed effects used in each specification are noted in the table. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

Panel A. Ground Pollution by Human Harm								
	Ln(1 + Lbs Ground Pollution)							
	Harmful Chemicals				Nonclassified Chemicals			
	All Subs		Subs w/Public Parent		All Subs		Subs w/Public Parent	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Bestfoods	0.0721^{***}	0.0685^{**}	0.188^{***}	0.174^{***}	0.0989^{***}	0.0919^{***}	0.269^{***}	0.312^{***}
	(0.0210)	(0.0219)	(0.0413)	(0.0453)	(0.0270)	(0.0273)	(0.0536)	(0.0701)
Plant FE	x	x	x	x	x	x	x	x
Chemical-Year FE	x	x	x	x	x	x	x	x
Parent-Year FE	x	x	x	x	x	x	x	x
Industry-Year FE		x		x		x		x
Observations	294,201	293,527	89,544	89,010	181,320	180,739	62,970	62,398
R^2	0.699	0.706	0.759	0.767	0.721	0.726	0.764	0.771

(*Continued*)

Table V—*Continued*

Panel B. Biological Impact of Chemicals						
	Ln(1 + Lbs Ground Pollution), All Subs					
System Affected =	Nervous (1)	Respiratory (2)	Urinary (3)	Developmental (4)	Heptatic (5)	Hematologic (6)
Bestfoods	0.0701***	0.0847**	0.116***	0.0557***	−0.0024	0.0808
	(0.0126)	(0.0315)	(0.0195)	(0.0123)	(0.0293)	(0.0626)
Plant FE	x	x	x	x	x	x
Chemical-Year FE	x	x	x	x	x	x
Parent-Year FE	x	x	x	x	x	x
Observations	122,062	77,521	60,826	60,280	38,056	36,032
R^2	0.683	0.694	0.829	0.696	0.741	0.860

increase in ground emissions for chemicals that affect a variety of biological systems, especially the nervous, respiratory, urinary, and developmental systems. Overall, our analysis indicates that the increase in ground emissions is not driven by inert substances. Rather, we find little evidence of differences in the estimates for harmful and nonclassified chemicals.

B. Effect of Parent Liability on Firm Value

We next test the effect of *Bestfoods* on the value of parent corporations. Stronger limited liability protection makes it less likely that a parent incurs costs associated with subsidiary environmental cleanups. This may, in turn, have a positive effect on firm value. Moreover, a reduced threat of environmental liability may lead to cost savings (e.g., via lower investment in abatement technologies) or increased production for subsidiaries, both of which may also increase the value of the parent corporation.

For this analysis, we focus on CARs around two important events for the *Bestfoods* case: oral arguments (March 24, 1998) and the Supreme Court's decision (June 8, 1998). These dates represent important milestones in the resolution of uncertainty for a case before the Supreme Court. During oral arguments, justices often ask attorneys questions that indicate their level of skepticism toward a given side of the case. It is plausible that market participants update their beliefs regarding the outcome of a case during such arguments before any residual uncertainty is resolved by the final ruling. This is particularly likely for unanimous decisions, such as *Bestfoods*, where the final outcome did not hinge on the decision of one or two justices.

To estimate the effect on parent value, we compute daily CARs adjusted for the Fama-French three-factor model around both the date of oral arguments and the decision. Results are qualitatively similar using a four-factor model. We estimate each model over the 100 days prior to each event for the public parent corporations in our sample. Because such firms often have plants located in both the treatment and the control groups, we define an indicator, *High Exposure*, that takes the value of one if a parent has relatively more plants (i.e., above median) in the treatment group.

Table VI reports the results. Panel A analyzes CARs for the full sample, while Panel B restricts the sample to multiplant firms for which the effects of *Bestfoods* may be more salient. Columns (1) to (3) report results for the date of oral arguments, and columns (4) to (6) report results for the date of the decision. Overall, we find evidence of higher abnormal returns for firms with high exposure to the decision around the date of oral arguments but no effect around the decision date. Specifically, for the $(-1, 5)$ and $(-1, 10)$ windows, firms with relatively high exposure experienced positive abnormal returns ranging from 82 to 148 bps. The effect is economically smaller and indistinguishable from zero for the $(-1, 1)$ window. However, CARs are somewhat stronger in terms of magnitude and statistical significance for the multiplant firms in Panel B, with effects of 109 and 160 bps for the $(-1, 5)$ and $(-1, 10)$ windows, respectively. We do not, however, find evidence of differences in abnormal returns around

Table VI
Cumulative Abnormal Returns (CARs)

This table uses OLS regressions to test the effect of *Bestfoods* on CARs. CARs are calculated using the Fama-French three-factor model. *High Exposure* is a binary variable that takes the value of one if the parent has an above-median proportion of plants in Ability-to-Control or Actual-Control circuits. Columns (1) to (3) use CARs around the date of oral arguments for *Bestfoods*, and columns (4) to (6) use the date of the unanimous decision. Robust standard errors are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	Oral Argument CARs			Decision (Unanimous) CARs		
	(−1,+1) (1)	(−1,+5) (2)	(−1,+10) (3)	(−1,+1) (4)	(−1,+5) (5)	(−1,+10) (6)
Panel A. All Firms						
High Exposure	0.00344	0.00826*	0.0148**	−0.00274	−0.00220	−0.00368
	(0.00268)	(0.00428)	(0.00619)	(0.00274)	(0.00436)	(0.00580)
Intercept	0.00184	0.00327	0.000367	−0.00365**	−0.0162***	−0.0248***
	(0.00179)	(0.00295)	(0.00405)	(0.00179)	(0.00274)	(0.00372)
Observations	771	771	771	771	771	771
R^2	0.002	0.005	0.007	0.001	0.000	0.001
Panel B. Multiplant Firms						
High Exposure	0.00586*	0.0109**	0.0160**	−0.000830	−0.00347	−0.00236
	(0.00304)	(0.00488)	(0.00660)	(0.00313)	(0.00511)	(0.00721)
Intercept	0.000406	0.00311	0.000105	−0.00187	−0.0125***	−0.0239***
	(0.00199)	(0.00318)	(0.00408)	(0.00203)	(0.00293)	(0.00418)
Observations	501	501	501	500	500	500
R^2	0.007	0.01	0.012	0.000	0.001	0.000

the decision date; the coefficients in columns (4) to (6) are both economically small and statistically indistinguishable from zero for both samples. This finding is consistent with the idea that investors updated their beliefs about the case outcome during or shortly after oral arguments.

C. Effect of Parent Liability on Subsidiary Solvency

We next examine the effect of parent liability protections on subsidiary solvency. Limited liability for a parent only binds if its subsidiary is insolvent. That is, if a subsidiary is solvent, it is liable for its own cleanup costs. Otherwise, parents can potentially be held liable. The *Bestfoods* decision made the insolvency of subsidiaries less costly for parents by strengthening limited liability protection, which suggests the decision may have adversely affected subsidiary solvency. In this section, we use two measures of solvency to test this idea.

First, we examine the effect on subsidiaries' Paydex scores. Previous research indicates that this measure is a strong predictor of business failure (Kallberg and Udell (2003)). For our analysis, we use indicators for three ranges of scores as dependent variables: 0 to 49 (high risk of late repayment), 50 to 79 (medium risk), and 80 to 100 (low risk).[19] *Bestfoods* may have affected this measure of credit risk for several reasons. First, by reducing costs associated with insolvency, *Bestfoods* may have incentivized parents to thinly capitalize their subsidiaries.[20] Moreover, the increased emissions documented above may also increase the likelihood of cleanups or other regulatory penalties that impair the solvency of subsidiaries, but are perhaps of insufficient magnitude to push them into bankruptcy.

Second, we consider the effect of *Bestfoods* on the likelihood of subsidiaries going out of business. We use the NETS database to construct an indicator for whether a subsidiary in our sample goes out of business in a particular year.[21] The increase in emissions documented above may increase the likelihood of future toxic sites that require remediation. As discussed in Sections I.A and I.B, such cleanups are costly. Thus, in addition to increasing the likelihood of cleanups that bankrupt a subsidiary, higher emissions may lead parents to (prematurely) dissolve a subsidiary in response to the threat of future liability (Boyd and Ingberman (2003)). Such effects, however, may be offset by changes in the behavior of the EPA. Specifically, stronger parent liability protections may incentivize the EPA to target solvent subsidiaries for enforcement actions but not insolvent ones, for which a recovery is less likely.

We report the results of these tests in Table VII. Panel A examines the effect of *Bestfoods* on subsidiaries' Paydex scores. We use the baseline regression specification for this analysis but omit chemical-year fixed effects because Paydex scores are at the plant level. Overall, we find that stronger parent liability protections are associated with a deterioration in subsidiary solvency. Columns (1) to (4) indicate that there is no effect of *Bestfoods* on the likelihood of having a low-risk Paydex score. However, columns (5) to (8) indicate that the likelihood of having a medium-risk Paydex score drops by over one percentage point for the full sample, while columns (9) to (12) indicate that the likelihood of a high-risk Paydex score increases by a similar amount. The economic magnitudes of these effects are large. For the full sample, the increase in the likelihood of a high-risk Paydex score corresponds to an increase of 23% relative to the sample mean (4.3%). As with our previous analysis, the findings are also particularly strong for the subset of plants with public parents.

In Panel B, we turn attention to the effect of *Bestfoods* on the likelihood that a subsidiary goes out of business. Because such events (e.g., bankruptcy) are rare (approximately 0.2% of plant-year observations), we extend the sample through 2014 for this analysis. The regression specifications are the same as in Panel A. The coefficients for both the full sample (columns (1) and (2))

[19] These cutoffs match those used by Dun & Bradstreet to assess credit risk. See https://www.dnb.com/resources/db-credit-scores-ratings.html.

[20] Such incentives are potentially weakened by the fact that subsidiary undercapitalization is a common argument in suits against parent corporations. However, Macey and Mitts (2014) notes that it "rarely, if ever, provides an independent basis for piercing the corporate veil."

[21] Specifically, we use the "outofbis" variable in the NETS database, which provides the year a firm filed for bankruptcy or was closed for another reason.

Table VII

Effect of *Bestfoods* on Subsidiary Solvency

This table uses OLS regressions to test the effects of the *Bestfoods* decision on the solvency of subsidiaries. *Bestfoods* is an indicator that takes the value of one after 1998 (the year of the *Bestfoods* decision) for plants located in the circuits that had previously adopted the Ability-to-Control or Actual-Control standards for parent company liability. Panel A reports the effect on Paydex scores. $\mathbb{1}(\text{Paydex} \geq 80)$ is an indicator for whether a subsidiary's Paydex score is greater than or equal to 80. $\mathbb{1}(50 \leq \text{Paydex} < 80)$ is an indicator for whether a subsidiary's Paydex score is less than 80 but greater than or equal to 50. $\mathbb{1}(\text{Paydex} < 50)$ is an indicator for whether a subsidiary's Paydex score is less than 50. Panel B reports the effect on the likelihood of subsidiaries going out of business. $\mathbb{1}$(Out of Business) is an indicator that takes the value of one if the subsidiary is flagged as "out of business" in the NETS database in a given year. Panel B uses an extended sample from 1993 to 2014. The fixed effects used in each specification are noted in the table. Robust standard errors are clustered by court circuit and reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

Panel A. Subsidiary Solvency

	$\mathbb{1}(Paydex \geq 80)$				$\mathbb{1}(50 \leq Paydex < 80)$				$\mathbb{1}(Paydex < 50)$			
	All Subs		Subs w/Public Parent		All Subs		Subs w/Public Parent		All Subs		Subs w/Public Parent	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Bestfoods	0.00333	0.000658	0.00372	0.00244	-0.0127^{**}	-0.0118^{**}	-0.0237^{**}	-0.0203^{*}	0.00938	0.0111^{**}	0.0200^{***}	0.0179^{***}
	(0.00312)	(0.00400)	(0.00818)	(0.00667)	(0.00449)	(0.00465)	(0.00892)	(0.00951)	(0.00525)	(0.00489)	(0.00597)	(0.00521)
Plant FE	x	x	x	x	x	x	x	x	x	x	x	x
Parent-Year FE	x	x	x	x	x	x	x	x	x	x	x	x
Industry-Year FE		x		x		x		x		x		x
Observations	60,385	59,498	21,640	20,677	60,385	59,498	21,640	20,677	60,385	59,498	21,640	20,677
R^2	0.559	0.596	0.511	0.589	0.513	0.549	0.472	0.541	0.494	0.528	0.467	0.529

(Continued)

Table VII—*Continued*

Panel B. Plant Exit and Bankruptcy				
	$\mathbb{1}$(*Out of Business*)			
	All Subs		Subs w/Public Parent	
	(1)	(2)	(3)	(4)
Bestfoods	0.000776	0.00101	0.00111	0.00187
	(0.000956)	(0.000889)	(0.00139)	(0.00154)
Plant FE	x	x	x	x
Parent-Year FE	x	x	x	x
Industry-Year FE		x		x
Observations	195,036	185,863	65,627	62,015
R^2	0.431	0.473	0.384	0.484

and the sample with public parents (columns (3) and (4)) are positive and economically large relative to the sample mean, but statistically indistinguishable from zero. In untabulated analysis, we find similar results for the likelihood of subsidiary bankruptcy using data from Iverson (2017). The statistically noisy estimates potentially reflect the low power of this test given the rarity of plants in our sample going out of business. However, as noted above, they may also reflect changes in EPA enforcement activities in response to stronger parent liability protections.

IV. The Channel

In this section, we investigate why parent liability protection is associated with increased emissions. We consider two nonmutually exclusive channels. First, *Bestfoods* may have reduced the incentives for firms to invest in pollution abatement. While such investments may reduce emissions, the lower likelihood of parent liability for environmental cleanups reduces their expected financial benefits. Second, higher emissions may be a result of an increase in production resulting from a reduction in the expected costs of using pollutive technologies.

A. Pollution Abatement

We first examine pollution abatement activities. Investment in abatement is a considerable expense for industrial firms, ranging from 5% to 7% of new capital expenditures (EPA (2005)). Such investments are undertaken, in part to reduce the costs associated with emissions (e.g., fines for violating regulations, remediation costs). By reducing parent liability for future cleanups, *Bestfoods* may have effectively reduced the cost of polluting, thus reducing the incentives to undertake abatement activities.

We measure abatement activities at the plant-chemical level using the EPA's P2 database. Our specific focus is on the two most common abatement categories: changes in operating practices and process improvements. According to P2 guidelines, good operating practices include activities such as improving maintenance or quality control. For example, a soap manufacturer changing "production schedules to allow for longer run times for similar products to reduce the need for diethanolamine feedstock changeovers" is an abatement activity related to operating practices. Process improvements include activities such as improving chemical reaction conditions or implementing better process controls. For example, the EPA highlights a battery manufacturer that "upgraded its conveyor system to prevent blockage and loss of cobalt material due to contamination." Table IA.II of the Internet Appendix provides a detailed list of activities classified under these types of abatement.

In Table VIII we test whether *Bestfoods* is associated with changes in abatement activities. The dependent variable in columns (1) to (4) is an indicator for abatement related to operating practices, and the dependent variable in columns (5) to (8) is an indicator for abatement related to process

Table VIII

Effect of *Bestfoods* on Pollution Abatement Activities

This table uses OLS regressions to test the effect of the *Bestfoods* decision on pollution abatement. The dependent variables are indicators for whether a plant undertakes operations- or process-related abatement activities. *Bestfoods* is an indicator that takes the value of one after 1998 (the year of the *Bestfoods* decision) for plants located in the circuits that had previously adopted the Ability-to-Control or Actual-Control standards for parent company liability. Robust standard errors are clustered by court circuit and reported in parentheses. The fixed effects used in each specification are noted in the table. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	$\mathbb{1}$(*Abatement - Operations*)				$\mathbb{1}$(*Abatement - Process*)			
	All Subs		Subs w/Public Parent		All Subs		Subs w/Public Parent	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Bestfoods	0.0000	0.0006	0.0000	−0.0013	−0.0083**	−0.0076**	−0.0163***	−0.0176***
	(0.0058)	(0.0077)	(0.0098)	(0.0127)	(0.0033)	(0.0028)	(0.0039)	(0.0041)
Plant FE	x	x	x	x	x	x	x	x
Chemical-Year FE	x	x	x	x	x	x	x	x
Parent-Year FE	x	x	x	x	x	x	x	x
Industry-Year FE		x		x		x		x
Observations	488,744	488,014	154,407	153,954	488,744	488,014	154,407	153,954
R^2	0.615	0.626	0.600	0.622	0.470	0.482	0.418	0.446

improvements. Overall, we find that plants decrease abatement related to the production process but not operations. Specifically, the coefficients for abatement related to operating practices are both economically small and statistically indistinguishable from zero. However, for process-related abatement, estimates are both larger in magnitude (ranging from −0.008 to −0.018) and statistically significant at conventional levels. The economic magnitude of this effect is sizable, implying a reduction of 16% to 35% relative to the sample mean. As with the emissions results, our findings are particularly strong for facilities that have a public parent. In unreported analysis we examine less common types of abatement. We find evidence of a decrease in efforts to improve inventory management, but estimates for other types of abatement are statistically indistinguishable from zero, although such actions are relatively uncommon to begin with.

B. Plant Production and Employment

We next examine whether the increase in emissions results from changes in economic activity. The change in liability standards decreases the likelihood that parents are responsible for future cleanups, therefore reducing the expected cost of current emissions. Depending on the nature of these costs, this may affect firm output. For example, if *Bestfoods* primarily affected the fixed costs associated with emissions (e.g., those pertaining to abatement), the change in liability standards would not lead to changes in production. However, if the decision instead impacted firms' variable costs, standard economic theory predicts increased production.

To address this question, we use two measures of economic activity—the production ratio (i.e., the ratio of current-year to previous-year output at the chemical level) from the TRI database and facility employment data from NETS. Table IX reports the results of this analysis. Columns (1) to (4) indicate little evidence of changes to output as measured by the production ratio. Specifically, coefficients for the full sample of subsidiaries (columns (1) and (2)) are positive but economically small (less than 1 percentage point) and not statistically significant at conventional levels. Point estimates for subsidiaries with public parents (columns (3) and (4)), which have relatively large changes in emissions, are of similar magnitude and also indistinguishable from zero. In untabulated analysis, we also do not find evidence of an effect on cumulative production at the chemical level, which we calculate by normalizing the first year's production to one and multiplying forward by the production ratio.

Columns (5) to (8) report the results for employment, a proxy for plant size. The dependent variable in these columns is the natural logarithm of facility employment. We omit chemical-year fixed effects from the regression specifications because employment is defined at the plant, rather than chemical, level. Overall, we find little evidence of changes to employment. If anything, the estimates for this analysis are negative, although only statistically significant at the 10% level for one specification (column (7)).

Table IX

Effect of *Bestfoods* on Production and Employment

This table uses OLS regressions to test the effect of the *Bestfoods* decision on production and employment. The dependent variable in columns (1) to (4) is the Production Ratio. The dependent variable in columns (5) to (8) is the natural logarithm of plant-level employment. *Bestfoods* is an indicator that takes the value of one after 1998 (the year of the *Bestfoods* decision) for plants located in the circuits that had previously adopted the Ability-to-Control or Actual-Control standards for parent company liability. Robust standard errors are clustered by court circuit and reported in parentheses. The fixed effects used in each specification are noted in the table. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	Production Ratio				*Employment* (Plant Level)			
	All Subs		Subs w/Public Parent		All Subs		Subs w/Public Parent	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Bestfoods	0.00970 (0.00726)	0.00276 (0.00619)	0.00776 (0.00971)	0.0103 (0.0100)	−0.0146 (0.0178)	−0.0191 (0.0201)	−0.0535* (0.0267)	−0.0429 (0.0267)
Plant FE	x	x	x	x	x	x	x	x
Chemical-Year FE	x	x	x	x	x	x	x	x
Parent-Year FE	x	x	x	x	x	x	x	x
Industry-Year FE		x		x		x		x
Observations	463,955	463,336	146,572	146,141	60,190	59,329	21,605	20,670
R^2	0.482	0.502	0.450	0.491	0.922	0.930	0.909	0.923

Taken together, we find little evidence that *Bestfoods* is associated with changes in production or employment. This finding is consistent with the idea that costs associated with the abatement and remediation of ground pollution are often fixed in nature and therefore do not affect marginal production decisions. Indeed, a report from the EPA (2011) notes that environmental remediation costs for ground pollution "often involves upfront expenditures on costly equipment. Such sunk costs are unrelated to current production decisions, unlike variable costs that firms often incur when complying with air and water regulations." In addition, abatement efforts related to process modifications often include investments in new production technologies, which likely have a sizable fixed-cost component.

V. Cross-Sectional Heterogeneity

In this section, we study heterogeneity in responses to the *Bestfoods* decision. First, we examine differential effects based on the solvency of subsidiaries. Parents are potentially liable for a subsidiary's cleanup costs only if the subsidiary is insolvent. We therefore hypothesize that the effects of *Bestfoods* are stronger for less-solvent subsidiaries. Second, we test whether the results vary based on the financial condition of parents. Highly levered firms in poor financial health have incentives to shift risk from shareholders to debtholders (Jensen and Meckling (1976)). Such firms may similarly have incentives to shift economic harm to other stakeholders (e.g., the local community) via higher emissions. Accordingly, we hypothesize that the effects of *Bestfoods* concentrate in parents with existing environmental liabilities and those that are close to financial distress. Third, we examine heterogeneity based on compensation incentives. Consistent with previous work that examines the relationship between executive compensation and firm risk (Gormley, Matsa, and Milbourn (2013)), we hypothesize that a decrease in left tail risk via stronger parent liability protections has a particularly strong effect for managers with convex payoffs. However, in Table IA.III we document that treatment and control subsidiaries differ along several dimension within these subsamples, so these results should be interpreted with caution.

A. Subsidiary Solvency

First, we examine heterogeneity with respect to the solvency of subsidiaries. Because parents are potentially liable for cleanup costs only if a subsidiary is insolvent, we conjecture that the effects of *Bestfoods* concentrate in less-solvent subsidiaries. To test this prediction, we measure solvency using Paydex scores. We compare the effects on ground pollution and process-related abatement for plants with above/below-median Paydex scores in 1997, the year before the *Bestfoods* decision. The minimum 1997 Paydex score for the median firm in the sample is 69, which indicates that payments to suppliers of trade credit arrive two weeks beyond terms.

Table X

Differential Effects by Subsidiary Solvency

This table uses OLS regressions to examine differential effects of the *Bestfoods* decision based on subsidiary solvency. The dependent variables are the log of one plus pounds of ground emissions and an indicator for process-related abatement. *Bestfoods* is an indicator that takes the value of one after 1998 (the year of the *Bestfoods* decision) for plants located in the circuits that had previously adopted the Ability-to-Control or Actual-Control standards for parent company liability. The sample is split based on median Paydex scores from 1997. Robust standard errors are clustered by court circuit and reported in parentheses. The fixed effects used in each specification are noted in the table. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	Ln(1+ Lbs Ground Pollution)		$\mathbb{1}$(*Abatement - Process*)	
	(1)	(2)	(3)	(4)
		Low Plant Paydex		
Bestfoods	0.0859**	0.0893*	−0.0170**	−0.0168**
	(0.0365)	(0.0491)	(0.0062)	(0.0069)
Observations	154,256	153,809	154,256	153,809
R^2	0.666	0.677	0.524	0.547
		High Plant Paydex		
Bestfoods	−0.0503*	−0.0563	0.00829	0.0194
	(0.0270)	(0.0325)	(0.0143)	(0.0132)
Observations	140,396	140,032	140,398	140,034
R^2	0.708	0.714	0.519	0.544
Plant FE	x	x	x	x
Chemical-Year FE	x	x	x	x
Parent-Year FE	x	x	x	x
Industry-Year FE		x		x

Table X reports the results. The dependent variable in columns (1) and (2) is the natural logarithm of one plus pounds of ground emissions, and the dependent variable for columns (3) and (4) is an indicator for process-related abatement. Columns (1) and (3) use the baseline regression specification, and columns (2) and (4) add industry-year fixed effects. We find that our previous results for both emissions and abatement are driven by plants with below-median Paydex scores. Specifically, the point estimates for the effect of *Bestfoods* on ground emissions in columns (1) and (2) are nearly 0.09 for the low-Paydex sample, but they are negative (though not generally robust) for the high-Paydex sample. There are similar patterns in columns (3) and (4), where the point estimates for the effect of *Bestfoods* on abatement are negative and statistically significant for the low-Paydex sample but statistically indistinguishable from zero for the high-Paydex sample. The differences between the coefficients for these samples are statistically significant at the 10% level or lower across the different specifications. Figure IA.2 of the Internet Appendix plots the coefficient dynamics for the high- and low-Paydex samples (and other groups used for in cross-sectional tests) for ground emissions.

B. Ongoing Environmental Remediation and Liabilities

Next, we examine how our results vary across parents based on whether they have existing environmental liabilities. Section II. B provides evidence indicating that environmental liabilities are a meaningful component of firms' balance sheets. These liabilities are of a similar seniority to junior debt and can be discharged in bankruptcy, particularly if owed by a specific subsidiary that declares bankruptcy.[22] We hypothesize that the effects of *Bestfoods* concentrate in firms with environmental liabilities because, all else equal, such firms are closer to default and may view investment in pollution abatement as having a higher short-term value if directed toward immediate financing needs. Moreover, the existence of environmental liabilities may also indicate that firms tend to engage in risky environmental practices that could eventually require costly cleanups.

We compare the effects of *Bestfoods* on emissions and abatement based on the disclosure of ongoing environmental cleanups or contingent environmental liabilities in 1997, the year before the decision. The sample for this test includes public parents used for the analysis in Section II. B. Table XI reports our findings. Panel A presents results based on disclosure of ongoing environmental remediation. Panel B presents results based on disclosure of contingent environmental liabilities. In both panels, columns (1) and (2) report results for ground emissions, and columns (3) and (4) report results for process-related abatement. Across both panels, we find that our main results are driven by firms that disclose environmental liabilities. For example, in column (1) of Panel A, the point estimate for the effect of *Bestfoods* on emissions is 0.249 for firms that disclose cleanups, compared to 0.057 for those that do not. Similarly, the effect on abatement is −0.018 for firms that disclose cleanups, compared to 0.0004 for those that do not. These differences are even larger when we split firms based on the disclosure of contingent environmental liabilities in Panel B. Across all of the specifications, the point estimates are statistically significant at the 5% level or lower for firms with environmental disclosures and statistically indistinguishable from zero for firms without disclosures. The differences between these groups is generally significant at the 10% level.

C. Parent Distress Risk

We also examine heterogeneous responses based on parents' distress risk. Similar to our analysis of environmental liabilities, we hypothesize that parents with relatively high risk of distress may disproportionately respond to *Bestfoods* because of their incentives to shift harm to other stakeholders. To test this idea, we repeat the analysis from Table XI but analyze firms with above/below-median parent unlevered Z-scores in 1997.

Table XII reports our findings. The dependent variables in columns (1) to (2) and (3) to (4) are ground emissions and process-related abatement, respectively. The increase in emissions and decrease in abatement concentrate in

[22] See Ohlrogge (2019) for details on the seniority of environmental claims in bankruptcy.

Table XI

Differential Effects by Parent Environmental Liabilities

This table uses OLS regressions to examine differential effects of the *Bestfoods* decision based on environmental disclosures by parents. The dependent variables are the log of one plus pounds of ground emissions and an indicator for process-related abatement. *Bestfoods* is an indicator that takes the value of one after 1998 (the year of the *Bestfoods* decision) for plants located in the circuits that had previously adopted the Ability-to-Control or Actual-Control standards for parent company liability. The sample is split based on the disclosure of ongoing environmental remediation (Panel A) or specific accruals for a long-term environmental liabilities (Panel B) by plants' parents in 1997. Robust standard errors are clustered by court circuit and reported in parentheses. The fixed effects used in each specification are noted in the table. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	Ln(1+ Lbs Ground Pollution)		$\mathbb{1}$(*Abatement - Process*)	
	(1)	(2)	(3)	(4)
Panel A. Ongoing Remediation				
	Discloses Ongoing Remediation			
Bestfoods	0.249***	0.228***	−0.0184***	−0.0212***
	(0.0549)	(0.0622)	(0.00490)	(0.00564)
Observations	100,859	100,433	100,860	100,434
R^2	0.738	0.743	0.362	0.400
	Does Not Disclose Ongoing Remediation			
Bestfoods	0.0574	0.0429	0.000426	0.000362
	(0.0535)	(0.0440)	(0.0157)	(0.0235)
Observations	27,910	27,471	27,912	27,473
R^2	0.688	0.703	0.536	0.594
Plant FE	x	x	x	x
Chemical-Year FE	x	x	x	x
Parent-Year FE	x	x	x	x
Industry-Year FE		x		x
Panel B. Contingent Environmental Liabilities				
	Discloses Environmental Liabilities			
Bestfoods	0.321***	0.338***	−0.0244***	−0.0287***
	(0.0634)	(0.0712)	(0.00578)	(0.00682)
Observations	73,487	73,106	73,487	73,106
R^2	0.707	0.713	0.343	0.383
	Does Not Disclose Environmental Liabilities			
Bestfoods	0.0619	−0.00570	0.000553	−0.00113
	(0.0376)	(0.0324)	(0.00851)	(0.0125)
Observations	55,211	54,795	55,214	54,798
R^2	0.772	0.780	0.497	0.546
Plant FE	x	x	x	x
Chemical-Year FE	x	x	x	x
Parent-Year FE	x	x	x	x
Industry-Year FE		x		x

Table XII
Differential Effects by Parent Solvency

This table uses OLS regressions to examine differential effects of the *Bestfoods* decision based on parent solvency. The dependent variables are the log of one plus pounds of ground emissions and an indicator for process-related abatement. *Bestfoods* is an indicator that takes the value of one after 1998 (the year of the *Bestfoods* decision) for plants located in the circuits that had previously adopted the Ability-to-Control or Actual-Control standards for parent company liability. The sample is split based on the median Altman's unlevered Z-score for parents in 1997. Robust standard errors are clustered by court circuit and reported in parentheses. The fixed effects used in each specification are noted in the table. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	Ln(1+ Lbs Ground Pollution)		$\mathbb{1}$*(Abatement - Process)*	
	(1)	(2)	(3)	(4)
		Low *Z*-Score		
Bestfoods	0.378***	0.389***	−0.0300***	−0.0300***
	(0.0756)	(0.111)	(0.0078)	(0.0059)
Observations	69,690	69,225	69,690	69,225
R^2	0.782	0.787	0.454	0.497
		High *Z*-Score		
Bestfoods	0.125**	0.111*	−0.0090	−0.0116
	(0.0489)	(0.0554)	(0.0083)	(0.0143)
Observations	65,753	65,345	65,754	65,346
R^2	0.584	0.605	0.413	0.454
Plant FE	x	x	x	x
Chemical-Year FE	x	x	x	x
Parent-Year FE	x	x	x	x
Industry-Year FE		x		x

firms with low *Z*-scores (i.e., those closest to distress). For ground pollution, the coefficients for the sample with low *Z*-scores are approximately three times larger than those for the sample with high *Z*-scores (e.g., 0.378 versus 0.125 in column (1)). We find a similar difference for abatement. The difference between the coefficients for the samples with high/low *Z*-scores is statistically noisy in column (4) but otherwise significant at conventional levels.

D. Compensation Convexity

Finally, we examine heterogeneous responses to *Bestfoods* based on managers' incentives. A rich literature in financial economics studies the relationship between compensation convexity and firm risk (Coles, Daniel, and Naveen (2006), Gormley, Matsa, and Milbourn (2013), Shue and Townsend (2017)). In particular, Gormley, Matsa, and Milbourn (2013) argue that managers with convex payoffs are less likely to take actions to offset an unexpected increase in left tail risk. Similar to this idea, we hypothesize that a decrease in left tail risk via stronger parent liability protections will have a particularly strong

Table XIII

Differential Effects by Parent Compensation Vega

This table uses OLS regressions to examine differential effects of the *Bestfoods* decision based on the sensitivity of parent executive compensation to volatility. The dependent variables are the log of one plus pounds of ground emissions and an indicator for process-related abatement. *Bestfoods* is an indicator that takes the value of one after 1998 (the year of the *Bestfoods* decision) for plants located in the circuits that had previously adopted the Ability-to-Control or Actual-Control standards for parent company liability. The sample is split based on median compensation vega for parent executives in 1997. Robust standard errors are clustered by court circuit and reported in parentheses. The fixed effects used in each specification are noted in the table. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	Ln(1+ Lbs Ground Pollution)		$\mathbb{1}$(*Abatement - Process*)	
	(1)	(2)	(3)	(4)
		High Vega		
Bestfoods	0.333***	0.384***	−0.0310**	−0.0363***
	(0.0649)	(0.0743)	(0.0104)	(0.00972)
Observations	56,768	56,350	56,768	56,350
R^2	0.697	0.709	0.340	0.386
		Low Vega		
Bestfoods	0.0734	0.0705	0.00342	0.00602
	(0.0427)	(0.0423)	(0.0110)	(0.0128)
Observations	57,631	57,204	57,632	57,205
R^2	0.786	0.794	0.477	0.540
Plant FE	x	x	x	x
Chemical-Year FE	x	x	x	x
Parent-Year FE	x	x	x	x
Industry-Year FE		x		x

effect for managers with convex payoffs. To measure payoff convexity, we use the average vega (i.e., dollar change in compensation for a 0.01 change in the standard deviation of returns) for a firm's top executives (Core and Guay (2002)) as calculated by Coles, Daniel, and Naveen (2006).

Table XIII reports our findings. Similar to the other cross-sectional tests, we split the sample based on the average vega of executives in 1997. The top half of the table includes firms with above-median vega, and the bottom half includes firms with below-median vega. The sample for this test includes public firms with compensation data from Coles, Daniel, and Naveen (2006). The dependent variables in columns (1) to (2) and (3) to (4) are ground pollution and process abatement, respectively. We find evidence that the increase in emissions and decrease in abatement are driven by firms with high compensation sensitivity to volatility. More specifically, the coefficients for both ground pollution and abatement are economically large and statistically significant at the 5% level or lower for firms with high vega, but statistically indistinguishable from zero for firms with low vega. The differences between the coefficients is statistically significant at the 10% level or lower, except for column (3). Internet Appendix

Table IA.V shows that the effects on emissions and abatement are similar for firms with high/low delta, which indicates that sensitivity to volatility, not performance, is what drives the heterogeneous effects in this setting.

Our findings suggest that executives with compensation that is sensitive to volatility respond to stronger liability protections by taking actions to offset this decrease in tail risk. This finding sheds light on a possible explanation for why the effects of *Bestfoods* are relatively stronger for the sample of public firms. Specifically, executives of private firms receive less equity-linked compensation than those of public firms (Edmans, Gabaix, and Jenter (2017)), which suggests that their response to a negative shock to tail risk may be muted.

VI. Robustness Tests

We report additional robustness tests in the Internet Appendix. First, we show that our findings are robust to using an alternative measure of ground pollution. The dependent variable in Table IA.VI is the proportion of ground emissions to total emissions. The regression specifications in this table are otherwise identical to Table III. We find that *Bestfoods* is associated with an increase in this alternative measure for both the full sample (columns (1) to (6)) and the sample of plants with a public parent (columns (7) to (8)). As before, we find no evidence of a change in behavior for standalone plants that do not have a parent (columns (9) to (10)).

Next, we analyze the effect of *Bestfoods* on air and water emissions. Because the focus of CERCLA enforcement is ground pollution, it is unlikely that changes to liability standards under this legislation directly affect other types of emissions. However, there could be an indirect effect on nonregulated emissions if they serve as complements or substitutes for regulated emissions. Table IA.VII reports the results of this analysis. We find little evidence that the decision affected water (columns (1) to (4)) or air (columns (5) to (8)) emissions. While the point estimates are positive across different specifications for both outcomes, they are not statistically different from zero. These findings are consistent with Greenstone (2003), who finds no change in nonregulated emissions in response to the adoption of the Clean Air Act.

Several pieces of evidence suggest that our findings are not driven by unobserved, time-varying geographic heterogeneity (e.g., local economic conditions). Perhaps most importantly, in Table III we use standalone plants as a falsification test and show that their emissions do not change in response to the *Bestfoods* decision. As an additional test, we limit our sample to those plants that are located in a control state that shares a border with a treatment state or vice versa. Table IA.VIII reports the results of this analysis. Although the sample size for this test decreases by a third relative to the baseline, we obtain similar results in terms of both economic magnitude and statistical significance.

We also show that our findings are not affected by changes in industries included in the TRI database over time. In Table IA.IX, we omit industries added to the TRI database after the *Bestfoods* decision. The estimated coefficients for ground pollution and process-related abatement are similar, in terms of both magnitude and statistical significance, to the main analysis.

In addition, we show that our findings are not driven by the smallest plants in the sample, which are most likely to misreport TRI data (Brehm and Hamilton (1996)). In Table IA.X, we limit the sample to plants with above-median total emissions. The estimated coefficients remain statistically significant and are of similar magnitude to the main analysis.

We next conduct tests to address potential correlation in the standard errors of our estimates. First, in Table IA.XI we collapse the data to contain only one pretreatment and one posttreatment time period, as suggested by Bertrand, Duflo, and Mullainathan (2004). The point estimates for both ground emissions and process abatement are similar to the main analysis and remain statistically significant at conventional levels. We further verify that our results are robust to our method of computing standard errors. Panel A of Table IA.XII reports our main results with state-level clustering, which preserves much of the panel structure of our treatment unit (e.g., Circuit Courts) but has a larger number of clustering units. Panel B clusters by parent-firm in addition to state, to account for correlation in the standard errors of subsidiaries that share a parent. Coefficients remain statistically significant at conventional levels across the different tests.

Finally, Table IA.XIII aggregates plant-chemical–level observations at different levels to address concerns related to spillovers between plants. Specifically, parents may have shifted the use of chemicals from control to treatment plants in response to *Bestfoods*, thus violating the stable unit treatment value assumption (SUTVA). We conduct two tests to address this concern. In Panel A, we test whether within-chemical transfers between plants drive the findings. The dependent variable is the natural logarithm of one plus pounds of ground emissions at the parent-chemical level (as opposed to the *plant*-chemical level). The independent variable, *Bestfoods (Parent-Chemical)*, is an indicator that takes a value of one after 1998 for any chemical used in a treated plant (i.e., those located in ATC/AC circuits). The change in level of aggregation, combined with the definition of the independent variable, has the effect of assigning treatment to *all* use of a chemical that was potentially exposed to the *Bestfoods* decision, thus accounting for potential within-chemical spillovers between plants. Columns (1) and (3) include parent-chemical and chemical-year fixed effects; columns (2) and (4) also include parent-year fixed effects. This test yields similar results as the main analysis. Specifically, the coefficients range from 0.058 to 0.11 for the full sample and 0.18 to 0.26 for the sample with public parents, with the coefficients statistically significant at the 5% level or lower. The similar magnitudes as in the main analysis are likely a consequence of most parents not using the same chemical in multiple plants. Specifically, the same chemical is used in multiple plants with the same parent in only 30% of parent-chemical observations.

In Panel B, we test whether our findings are driven by a reallocation of chemicals between plants that perform similar functions within a firm. For example, a firm may produce inputs to its final product in facilities located in treatment and control circuits. One concern may be that the effects that we observe result from parents reallocating economic activity, and therefore pollution, across the two plants that perform similar functions. To conduct this test, we aggregate chemicals at the parent-industry level, where industry is defined using *plants'* three-digit SIC codes. The dependent variable is pounds of ground emissions (by chemical) at the parent-industry level. The independent variable *Bestfoods (Firm-Industry)* is an indicator that takes a value of one for all plants owned by a parent that operate in an industry where at least one plant was treated (i.e., located in ATC/AC circuits).[23] Similar to Panel A, all specifications include parent-chemical and chemical-year fixed effects. We also include industry-year fixed effects in all specifications, as well as parent-year fixed effects in columns (2) and (4). The effects of *Bestfoods* remain positive and significant at conventional levels for this alternative test. The magnitudes of the coefficients are smaller than in the main analysis, ranging from 0.030 to 0.040 for the full sample and 0.055 to 0.075 for the sample of public firms. However, this method of aggregation assigns treatment to a number of observations not directly impacted by *Bestfoods*, so there is likely attenuation bias for the estimates. Overall, these findings suggest that spillovers between treatment and control plants are unlikely to drive the main findings.

VII. Conclusion

Limited liability is a ubiquitous feature of modern economic organization. However, because their potential losses are limited, corporate owners do not bear all costs associated with risky activities. Such risks are therefore borne by other stakeholders, including creditors, employees, the surrounding community, and society at large. Admati (2017) argues that lack of accountability for managers further exacerbates these misaligned incentives.

In this paper, we use industrial emissions as a setting to study limited liability in the parent-subsidiary context. Our identification strategy uses a Supreme Court case (*United States v. Bestfoods*) that clarified parent liability for subsidiary environmental cleanup costs. We find that stronger liability protection for parents is associated with an increase in ground emissions of 5% to 9% for plants of subsidiaries. The effect operates on both the intensive and the extensive margins, and is driven in part by chemicals with known toxicity to humans. Evidence also suggests that stronger liability protection negatively affects the solvency of subsidiaries but increases parent value.

We conduct a number of tests to shed light on the potential channels driving the results. We find that the increase in emissions stems from lower investment in pollution abatement rather than increased economic activity. Our

[23] This definition has the effect of assigning treatment to chemicals that may not have been directly impacted by *Bestfoods*. For example, a firm may have two plants in the same industry that use different chemicals and operate in treatment and control circuits. For this test, *all* observations would be classified as treated since the two plants operate in the same industry and one of them was directly impacted by the *Bestfoods* decision.

analysis also highlights several important sources of heterogeneity. First, consistent with the idea that parents are potentially liable for cleanup costs only if a subsidiary is insolvent, our findings are driven by less-solvent subsidiaries. Second, the results are driven by parents with existing environmental liabilities and those that are closer to distress, consistent with the idea that such firms have incentives to shift harm to other stakeholders. Finally, the effects of this shock to left-tail risk concentrate in firms in which compensation is more sensitive to volatility.

Overall, our findings highlight the moral hazard problem associated with limited liability. While our setting precludes a rigorous welfare analysis, the results suggest that strengthening limited liability for parents leads to an increase in the costs borne by other stakeholders. Thus, efforts by policymakers to strengthen liability protections should carefully weigh the interests of the owners of corporations against the interests of other stakeholders.

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