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Sweeping it under the rug: Positioning and managing pollution-intensive activities in organizational hierarchies

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Abstract

Research Summary: Many corporate groups have multiple layers with parent companies owning subsidiaries, which own other subsidiaries, and so forth, in a pyramid-like ownership structure. We argue that corporate groups perform their pollution-intensive activities at the lower levels of the corporate hierarchy to buffer the parent from pollution-related regulatory risks. Our analysis of 7400 US-based business establishments owned by the 67 largest US-headquartered chemical manufacturing corporate groups supported this argument. We also found that they were even more likely to do so in states with greater environmental stringency, whether it be in the home state of the parent or the host state of the subsidiary. Our research calls into question the effectiveness of environmental regulations if companies have the opportunity to shift polluting activities lower in their corporate hierarchy.

Managerial Summary: Many commentators assert that firms offshore or outsource pollution-intensive activities to avoid environmental regulations. In this research, we suggest a third approach in avoiding environmental regulations: locating pollution lower in the hierarchy of

multilayered corporate groups, which are companies that own subsidiaries that own other subsidiaries and so on. By analyzing data on the 67 largest US-headquartered chemical manufacturing corporate groups, we found support for this assertion. We also found that pollution is more likely to be located lower in multilayered corporate groups when they are subject to stringent environmental regulations. The multilayered corporate form allows parent companies to insulate themselves from the regulatory risks of pollution-intensive activities of their subsidiaries through their limited liability status.

KEYWORDS

corporate environmental practices and performance, multilayered corporate groups, organizational buffering, state environmental stringency

1 | INTRODUCTION

Since the mid-1980s, multilayered corporate groups have emerged as a dominant corporate form in the United States (Belenzon et al., 2019; Bethel & Liebeskind, 1998; Prechel, 2000). By the early 2000s, they accounted for 85 % of the 500 largest US companies (Prechel & Morris, 2010). The silent rise in this organizational form is important to study as it may be an opportunity for firms to mask their polluting activities.

Multilayered corporate groups are firms, which own subsidiaries that own other subsidiaries and so on, in a hierarchically cascading structure (Belenzon et al., 2019; Prechel, 2000; Witting, 2018). Each business entity of a corporate group—either the parent company or subsidiaries—has the single legal form of the corporation and is legally independent of each other. This legal separation creates a liability firewall among the business entities within the corporate group, including between the parent company and its subsidiaries. Although the parent company has ultimate decision-making authority over subsidiaries, corporate law does not impose legal responsibility, other than in exceptional circumstances, of subsidiary actions on the parent company (see Erens et al., 2008, for exceptions). The parent company is therefore exempt from compensating for, or paying the penalties related to, environmental damages caused by its subsidiaries (Prechel & Zheng, 2012; Witting, 2018).

This hierarchical corporate structure triggers significant economic, social, and environmental consequences. On the one hand, the legal independence of business entities within a corporate group facilitates the growth of the firm by compartmentalizing the risks arising from diversified business lines (Belenzon et al., 2023). On the other hand, the liability firewall allows the parent company to contain business-related risks within legally independent and resource-constrained subsidiaries (Boomhower, 2019; Roe, 1986; Shavell, 1986). It permits the parent company to buffer itself from the negative legal, reputational, and punitive outcomes related to risky activities and, thereby, shift the costs to the society as a whole (Akey & Appel, 2021; Prechel & Zheng, 2012).

Prechel and Zheng (2012) showed that corporate groups with a greater number of subsidiary layers pollute more than those with fewer subsidiary layers. They offered two plausible explanations for this finding. First, the parent company might be negligent in managing pollution-intensive activities in its lower-level subsidiaries because the limited liability of the parent company protects the parent from its subsidiaries' negative environmental impacts. Second, a complex organizational structure might hamper the parent's ability to monitor subsidiaries' environmental performance. They, however, acknowledged that their corporate group-level analysis could not isolate the more likely explanation for why taller corporate groups performed poorly than shorter corporate groups.

Our paper extends and deepens Prechel and Zheng's (2012) work by shifting the unit of analysis from corporate groups to business establishments,[1] which refer to an individual physical location at which corporate groups perform a variety of business activities, including low-polluting administrative or commercial activities and high-polluting industrial activities. Our empirical focus on business establishments allows us to conduct fine-grained analysis of the hierarchical position of pollution-intensive activities in corporate groups. Prior granular analysis at the level of business establishments has not been able to assess the hierarchical position of polluting activities within corporate groups because they used relatively easily accessible data about only pollution-intensive business establishments (e.g., Grant et al., 2010; Gray & Shadbegian, 2007; Kassinis & Vafeas, 2006). We overcame this limitation by collecting and combining data from various databases.

Building on the buffering literature, we hypothesize that parent companies locate pollution-intensive activities lower in their corporate hierarchy to buffer themselves from regulatory risks associated with negative environmental externalities. We expect that parent companies are more likely to do so when they are subject to stringent environmental standards in home and host jurisdictions, because they have a greater need to insulate themselves from such stringent environmental requirements. In addition, we suggest that pollution-intensive business establishments that are hierarchically distant from their parent companies create more serious environmental pollution than those hierarchically close to parent companies. We test our hypotheses with a purpose-built dataset of fine-grained data on all business establishments that operated in the United States under the ownership of the 67 largest US-headquartered chemical manufacturing corporate groups.

Our research shines the spotlight on multilayered corporate groups as an important contemporary mechanism in shaping the business approach to pollution-intensive activities. Prior research has shown that firms offshore their pollution-intensive activities in environmentally lenient jurisdictions (Berry et al., 2021; Brunnermeier & Levinson, 2004; Li & Zhou, 2017), often referred to as the pollution-haven hypothesis, or outsource their activities to other firms (Barney et al., 1992). In this article, we suggest a new mechanism by which firms can sidestep government environmental policies and regulations—specifically, parent companies protect themselves from pollution-related regulatory risks using the limited liability of parent companies for subsidiaries. In addition, and maybe more importantly, our findings also suggest that environmental policies and regulations may not always have the intended effect, quite likely because of the limited liability of parents in corporate groups. The complex structures of corporate groups permit parents to simply shift pollution-intensive activities lower in their corporate hierarchy.

[1]The term *business establishment* should not be confused with the term *business entity*. Business establishment is a geography-based concept while business entity highlights a legal boundary of corporate organizations (see Figure 1 for the details).

2 | LITERATURE REVIEW

2.1 | Buffering from government regulations

Governments have the authority to regulate corporate activities through laws or policies, which do not always align with corporate interests and preferences. Corporations may choose to *either* conform to these regulatory expectations *or* respond strategically (Edelman & Suchman, 1997; Meznar & Nigh, 1995; Oliver, 1991; Scott, 1995). Buffering is an organization's strategic attempt to reduce the extent to which organizations are exposed to the influence of the external environment (Lynn, 2005; Oliver, 1991). In this article, we are interested in the buffering strategy because organizations are more likely to adopt this strategy, rather than complying with government expectations, when they see greater risks and uncertainties in the regulatory environment (Darnall et al., 2010; Meznar & Nigh, 1995).

We build on prior research that examines how firms use their organizational structures to minimize the risks and uncertainties related to government intervention. Firms can build an umbrella organization that assigns the task of dealing with government regulations (Fennell & Alexander, 1987). They can create suborganizations to insulate core activities from external influences. For example, the cigarette industry established the Tobacco Institute to deal with pressures from external stakeholders (Dunbar & Wasilewski, 1985). In addition, corporate groups operating under an authoritarian government regime compartmentalize parts of their corporate groups to manage political ties in order to reduce the risks inherent in relationships with political figures (Dieleman & Boddewyn, 2012).

Extending this prior research, we suggest that multilayered corporate groups help to buffer parent companies from the external environment. By locating pollution-intensive activities lower in the corporate hierarchy, corporate groups can build several layers of limited liability that insulate the core of their organizations, that is, parent companies, against the negative environmental externalities created by their pollution-intensive business establishments. Accordingly, parent companies can protect themselves from regulatory risks and uncertainties associated with the pollution-intensive activities in their lower-level business establishments.

2.2 | Corporate groups

Figure 1 illustrates the corporate groups with several layers of subsidiaries, which has also been referred to as multilayered subsidiary form (Prechel, 2000; Prechel & Morris, 2010; Prechel & Zheng, 2012). This corporate group in Figure 1 consists of a parent company at the top of the corporate hierarchy and six subsidiaries, such as three first-level subsidiaries (subsidiaries A, B, and C); two second-level subsidiaries (D and E); and one third-level subsidiary (F).

The parent company and each of the subsidiaries have their own headquarters and several business establishments at different geographic locations. For example, according to the 2013 Dun and Bradstreet Corporate Family Tree Data, the Dow Chemical Company was the parent company with 33 US-headquartered subsidiaries that were structured into five layers. The Dow Chemical Company had its headquarters in Michigan (i.e., what we call *parent headquarters*) and 124 domestic business establishments that operate under the direct responsibility of the parent headquarters (*parent establishments*). And, Union Carbide Corporation, a first-level subsidiary of the Dow Chemical Company, had its headquarters in Texas (*subsidiary headquarters*) and 23 business establishments in the United States (*subsidiary establishments*). We will use the

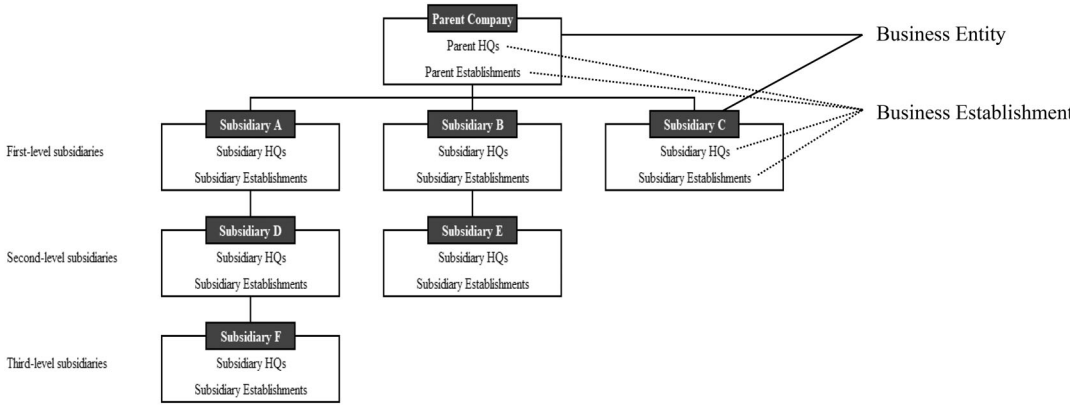

FIGURE 1 An example of corporate group with multiple subsidiary layers. Terms and definitions. (1) Corporate group: Corporate group refers to a whole set of the parent company and its subsidiaries. (2) Business entity: A single legal form of the corporation. This is a legal concept that refers to a corporate organization that has separate and distinct legal rights and responsibilities. This could be either parent companies, subsidiaries, or independent firms that are not affiliated with other business entities. (3) Business establishment: A single physical location at which business activities are performed. A company (or a business entity) consists of one or more business establishments operating in different geographic places. For example, a parent company may have one business establishment if the parent company does not have branches in other geographic places. Or the parent company may have multiple business establishments, which includes one headquarters (i.e., what we call parent headquarters) and one or more branches (i.e., parent establishments). This geography-based definition of business establishments is offered by the US Census.

term *parent company or parent* when we refer to a business entity that consists of parent headquarters and parent establishments. And the term *subsidiary* is used to refer to both subsidiary headquarters and subsidiary establishments together.

The parent company owns more than 50 % of the first-level subsidiary's stock; the same ownership structure applies to the relationship between first- and second-level subsidiaries, between second- and third-level subsidiaries, and so on. Despite this ownership structure; however, each box in Figure 1 (either the parent company or subsidiaries) is a legally independent corporate entity with *limited liability* from other affiliated corporate entities. This means that the parent company is not responsible for the acts of its subsidiaries, even when the parent company owns 100 % of the subsidiaries' stock (Matheson, 2009; Prechel & Zheng, 2012; Witting, 2018). For example, the responsibility for the environmental damage caused by Subsidiary A's business establishments rests not with the parent company but with Subsidiary A.

This basic rule in corporate law—that is, the parent company is not liable for the acts of subsidiaries—is a defining feature of corporate groups not only in the United States but also in several other countries (Akey & Appel, 2021; Belenzon et al., 2023; Erens et al., 2008). The US Supreme Court clarified that a parent company's routine supervision of a subsidiary—such as appointing a subsidiary's officers and directors, overseeing the subsidiary's finance, and providing general policies and procedures for the subsidiary—does *not* prove that the parent company is liable for the acts of subsidiaries. This implies that the parent company can exert a substantial influence over subsidiaries, but the parent company can be exempted from the responsibility for the acts of subsidiaries.

Indeed, large firms have used subsidiaries since the late 1880s. However, after the *Tax Reform Act of 1986* eliminated the tax on capital transfers from subsidiaries to parents, firms started organizing more of their business operations as multiple layers of subsidiaries (for details, see Bethel & Liebeskind, 1998; Boies & Prechel, 2002; Prechel & Boies, 1998).[2] And, this corporate structure is different from the multidivisional form, which was the prevalent form of corporate groups in the 1980s and 1990s (Davis et al., 1994). Whereas the multidivisional form organizes business units as unincorporated divisions, the multilayered corporate form of interest in the present research incorporates business units as subsidiaries that are legally independent from the parent company and other affiliated subsidiaries (Belenzon et al., 2019; Prechel, 2000).

3 | HYPOTHESES

Focusing on the limited liability of the parent company for its subsidiaries, we develop hypotheses about how firms organize and manage pollution-intensive activities in the context of corporate groups.

3.1 | Hierarchical distance from the parent company

The first hypothesis examines the position of pollution-intensive activities within the corporate hierarchy. In general, the parent company is the most important corporate entity of corporate groups because it concentrates corporate assets in their hands,[3] defines subsidiaries' business objectives and strategies, and allocates corporate resources to subsidiaries (Belenzon et al., 2019; Prechel, 2015). In most cases, therefore, it is the parent company that needs to be protected from risks and uncertainties arising from the external environment.

Using the limited liability of the parent company, the parent company can buffer itself from government regulations by assigning pollution-intensive activities to its subsidiaries that are legally independent from the parent company. Moreover, the lower pollution-intensive

[2]Kandel et al. (2019) argued that pyramidal corporate groups no longer exist in the United States since the 1950s, which is different from the phenomenon we are exploring in the present paper. This discrepancy comes from different empirical approach; we consider both public and private subsidiaries while their research considers publicly traded subsidiaries only. We double-checked the types of subsidiaries (public vs. private) that were affiliated with the sampled 67 parent companies using the Mergent Intellect database. The data show that only 7% of subsidiaries are publicly traded and 93% of subsidiaries are privately held. Therefore, if we exclude privately held subsidiaries from our observation, we would reach the same conclusion as Kandel et al.'s (2019) study; "although conglomerates of various types do exist in the United States, groups with multiple tiers of partially-owned *listed* affiliates are conspicuously absent" (Kandel et al., 2019, p. 782; emphasis added). However, we believe that we should consider both publicly traded and privately held subsidiaries to advance a more comprehensive understanding of corporate structure. And our approach shows that the pyramidal structure of corporate groups *still* exists at least in the United States.

[3]In some corporate groups, the parent companies may not be the most important entity as they can structure corporate groups in ways that nonoperating subsidiaries hold valuable assets (Witting, 2018). As we discussed in the previous footnote, most subsidiaries are privately held so we were not able to get access to subsidiary-level data on corporate assets. Instead, we used total annual sales recorded at the levels of parents and subsidiaries to assess where the most valuable business entity is in the corporate hierarchy. In the 61 of the 67 corporate groups in the sample, the parent company reported the largest volume of sales. We therefore conclude that the parent company is generally the most important corporate entity.

activities are in the corporate hierarchy, the more effectively the parent company can protect itself from government-related risks and uncertainty. We describe two mechanisms related to legal and organizational complexity, which ensure that multiple subsidiary layers are more effective than single subsidiary layer for buffering the parent company.

The basic principles of corporate laws define the limited liability of the parent company for its subsidiaries. In some exceptional circumstances, however, a court can pierce the corporate veil that shields the parent company from the liability that may arise from its subsidiaries' actions. The propensity of the court to pierce the corporate veil varies from country to country; lowest in Great Britain and highest in Germany (Belenzon et al., 2023). In the United States, the parent company can be held liable for the acts of subsidiaries (1) when the subsidiary is used for a fraudulent purpose and (2) when the parent company actively participates in the operations of the subsidiary to the extent that the subsidiary fails to maintain its corporate formalities (Plater et al., 2010; Witting, 2018). The key to piercing the corporate veil of the parent company is therefore to demonstrate the substantial involvement of the parent company in its subsidiaries.

The corporate structure consisting of multilayered subsidiaries shows a great degree of organizational complexity, which makes it difficult to identify and verify how and to what extent the parent company has been involved in its subsidiaries' negative environmental consequences. The supply chain literature shows that complex supply chain, especially multi-tiered supply chain, makes the complete supply chain less observable and less traceable (Choi & Krause, 2006; Kim & Davis, 2016; Skilton & Robinson, 2009). Similarly, when multiple intermediary subsidiaries exist between pollution-intensive subsidiaries and their parent company, external stakeholders face a greater challenge to demonstrate the active participation of the parent company in the operation of subsidiary establishments, which is the key to hold the parent company liable for the acts of subsidiaries (Plater et al., 2010). Moreover, the parent company with this complex organizational structure would find it easier to argue that the parent company does not directly operate subsidiary establishments and to justify its ignorance of the subsidiary establishments' negative impact on the environment.

Multiple liability firewalls between the parent company and its polluting subsidiaries also present additional legal barriers for liability to be ascribed to the parent company for actions taken by its subsidiaries (Prechel & Zheng, 2012; Schlissel et al., 2002). Subsidiary headquarters that have a direct responsibility for pollution-intensive establishments often do not have assets or other financial resources to address the issues (Boomhower, 2019; Shavell, 1986; Witting, 2018). In such cases, the aggrieved party needs to identify the corporate entities responsible for, and capable of, addressing the issues, and may target at the next higher subsidiaries than the ones that may become insolvent by addressing the issues, other intermediary subsidiaries between the insolvent subsidiaries and the parent company, or the parent company (Witting, 2018). This complexity makes it arduous for the aggrieved party to demonstrate the responsibility of the parent company among other corporate entities. To complicate matters, the aggrieved party may also need to deal across the multiple jurisdictions in which these business entities are located (Schlissel et al., 2002). Therefore, it is difficult to hold the parent company liable for environmental damage caused by hierarchically distant subsidiaries than hierarchically proximate subsidiaries.

A corporate group involving numerous layers of subsidiaries not only buffers the parent from legal responsibility but also reputational damage. The reasons are similar to those that apply to legal responsibility; it is hard to infer how much influence the parent had in the subsidiary's activities. Further, subsidiaries do not need to share the same name as their parent companies. Then, 30 % of subsidiaries in our sample have names that are quite different from

their parent company, making it difficult for observers to quickly associate these subsidiaries with their parent company.

Taken together, parent companies can be protected from the legal and reputational risks of pollution-intensive activities by assigning pollution-intensive activities to lower-level business establishments. Based on these arguments, we predict that:

> **Hypothesis 1.** Establishments lower in the corporate hierarchy will be more likely to perform pollution-intensive activities than establishments higher in the corporate hierarchy.

3.2 | The moderating effect of environmental regulatory stringency in home and host states

In the next two hypotheses, we further test the buffering mechanism presented in Hypothesis 1 by examining how the tendency for lower-level business establishments to perform pollution-intensive activities varies by the environmental stringency of (1) the home states where the parent headquarters are located and (2) the host states where affiliated business establishments are located. We argue that stronger environmental standards are related to pollution-intensive activities being located lower in the corporate hierarchy. In other words, lower-level establishments are more likely than higher-level establishments to perform pollution-intensive activities especially (1) when the parent headquarters are subject to higher environmental standards and (2) when their business establishments operate in environmentally stringent jurisdictions.

Stringent environmental policies and regulations create greater risks of environmental liabilities to firms. In environmentally stringent jurisdictions, firms are required to meet high environmental standards. If they fail to comply with such requirements, their violations are likely to be caught by regulatory agencies. One of the corporate responses is to avoid pollution-intensive operations in environmentally stringent jurisdictions, as suggested by the pollution haven hypothesis (Brunnermeier & Levinson, 2004). In this article, however, we highlight another mechanism through which firms protect themselves from government environmental stringency: parent companies can simply place their pollution-intensive activities lower in the corporate hierarchy.

In the United States, state governments design and implement environmental programs, which are at least as stringent as the national standards set by the Environmental Protection Agency (EPA). Such a decentralized system creates substantial variation across states in government commitment to environmental protection (Hall & Kerr, 1991; Konisky & Woods, 2012), which provides an opportunity to assess the interaction between government environmental stringency and the level of pollution-intensive activities in the corporate hierarchy. We expect that stringent environmental standards intensify the tendency of firms to perform pollution-intensive operations in lower-level establishments. Consequently, government commitment to the environment may end up creating unintended consequences; firms seek to buffer parent companies from environmental regulatory stringency by locating pollution-intensive activities lower in the corporate hierarchy, rather than addressing the issue of industrial pollution.

3.2.1 | Regulatory stringency in home states

We argue that parent headquarters in strong environmental states are more likely than parent headquarters in weak environmental states to perform pollution-intensive activities at the lower

levels of the corporate hierarchy. In addition to higher regulatory risks described above, parent companies headquartered in environmentally stringent jurisdictions face greater responsibility for their supply chain (Hartmann & Moeller, 2014). Because of the unknown risks lurking in the supply chain, firms are often reluctant to assign pollution-intensive activities to other independent firms where they have no control over the production process (Mayer, 2006). Parent companies can resolve this dilemma by assigning pollution-intensive activities to subsidiaries that are hierarchically distant from parent companies. While parent companies maintain control of subsidiaries' business activities, the liability firewall between parents and subsidiaries allows parent companies to sidestep any risks associated with pollution-intensive activities. We therefore expect that the environmental stringency of home states strengthens the relationship stated in Hypothesis 1.

> **Hypothesis 2A.** The environmental stringency of the home states strengthens the relationship between the lower level of subsidiary layers and the higher probability of performing pollution-intensive activities.

3.2.2 | Regulatory stringency in host states

Whereas Hypothesis 2A is about the home states where parent headquarters are located, Hypothesis 2B concerns the host states where their business establishments are operated. Pollution-intensive establishments operating in environmentally stringent states will likely be located lower in the corporate hierarchy than those in states with lenient environmental standards. If business establishments in environmentally stringent states are found to be pollution-intensive, the parent will want to have organizational distance between itself and these polluting business establishments.

We assume that parents must sometimes locate their polluting activities in environmentally stringent states and cannot easily move those operations for various reasons, including the costs associated with transportation of raw materials and manufactured products and the benefits of agglomeration economies (Ederington et al., 2005). Moreover, once firms start their operations in certain locations, sunk costs related to physical investments make firms less footless (Ederington et al., 2005).

In this situation, parents can buffer themselves from strict environmental policies and regulations by capitalizing on the liability firewalls among affiliated business entities (Belenzon et al., 2023; Witting, 2018). Specifically, they locate pollution-intensive operations at the lower levels of the corporate hierarchy, especially when such operations need to be done in environmentally stringent places.

> **Hypothesis 2B.** The environmental stringency of the host states strengthens the relationship between the lower level of subsidiary layers and the higher probability of performing pollution-intensive activities.

3.3 | Environmental consequences of buffering effect

In the previous hypotheses, we argued that firms would locate their polluting operations lower in the corporate hierarchy. Yet, the question is not only where pollution-intensive establishments

are organized in the corporate hierarchy, but also about the pollution intensity among these pollution-intensive establishments. Hypothesis 3 focuses on *industrial facilities*—business establishments that manufacture, process, or use toxic chemicals—and examines their toxic emissions depending on the hierarchical location of industrial facilities in the corporate structure. Whereas Hypothesis 1 only tested if a business establishment was polluting or not, this hypothesis extends that logic to suggest that, among industrial facilities that generate pollution, the ones with greater pollution will be lower in the corporate hierarchy. And, by excluding non-industrial facilities that focus on commercial or administrative activities, we were able to analyze longitudinal data.

The logic for this hypothesis concerning toxic emissions mirrors the logic for Hypothesis 1. Because each subsidiary layer creates a buffer for parent companies against the risks of environmental liabilities, it is best for parent companies to ensure the largest number of buffers are put between themselves and the very heavy polluting industrial facilities. An additional mechanism underlying this relationship is that parent companies will direct their limited resources to improve the environmental performance of industrial facilities closer to them rather than lower-level facilities (Schlissel et al., 2002; Travis, 2019). Such resource allocation leads to unintended consequences where lower-level industrial facilities show poor environmental performance. Therefore, we predict that:

> **Hypothesis 3.** Industrial facilities lower in the corporate hierarchy generate greater toxic emissions than industrial facilities higher in the corporate hierarchy.

4 | METHODS

To test the hypotheses, we analyzed the data on the 67 largest US headquartered chemical manufacturing corporate groups and their business establishments in the United States. We completed two different sets of analyses: the first was a cross-sectional analysis of both pollution-intensive and nonpolluting business establishments that were affiliated with the 67 corporate groups; the second was a longitudinal analysis of pollution-intensive business establishments only. Details are provided below.

The first *cross-sectional* analysis examined the hierarchical location of pollution-intensive business establishments in the corporate structure (Hypotheses 1, 2A, and 2B). For this analysis, we analyzed the 67 corporate groups' 7400 business establishments in the United States, which included both pollution-intensive and nonpolluting business establishments. The second *longitudinal* analysis investigated the environmental performance of pollution-intensive facilities (Hypothesis 3). We analyzed 9832 facility-year observations of 1186 pollution-intensive facilities, which had been affiliated with the sampled corporate groups during the period of 2010–2019.

Our research design for the first part of the analysis has an important feature distinctive from prior work on corporate environmental performance. Specifically, we analyzed all business establishments owned by corporate groups, which include *both* those that pollute *and* those that do not pollute. Prior research on corporate environmental performance analyzed data for only polluting industrial facilities, which restricted the sample in such a way that made it difficult to assess the hierarchical location of pollution-intensive activities in the corporate structure (e.g., Grant et al., 2010; Gray & Shadbegian, 2007; Kassinis & Vafeas, 2006). To the best of our knowledge, our research is the first to investigate the polluting activities of all business establishments operating under the ownership of parent companies. As we will

demonstrate, pollution-intensive activities are performed by only a small number of business establishments. Accordingly, this type of analysis on all affiliated business establishments is necessary to isolate the types of business establishments that are likely to carry out pollution-intensive activities.

4.1 | Data sources

We constructed our dataset by combining five major data sources: Dun and Bradstreet's Corporate Family Tree Data; National Establishment Time-Series (NETS) Database's Toxic Release Inventory (TRI) Establishments Database; the US EPA's TRI program; the US Census Bureau's Census of Governments, and the US EPA's Enforcement and Compliance History Online (ECHO).

Dun and Bradstreet's Corporate Family Tree Data offer a full list of business establishments operating under the ownership of the parent company, corporate linkages among these establishments, and basic information on individual establishments, such as location, number of employees, and industrial sectors. As Dun and Bradstreet does not provide historical data on corporate family tree at the level of business establishments, we were only able to draw data from 2013, which was the latest available data at the time we started this study.

Since 1987, *the EPA's TRI program* has annually tracked toxic chemicals handled by industrial establishments and emitted into the environment. Industrial establishments must report to the TRI program if they belong to specific industrial sectors (e.g., manufacturing, mining, and electric power generation), employ 10 or more full-time workers, and manufacture, process, or use a quantity of chemicals greater than the threshold values set by the TRI program. These data have been used frequently in assessing the environmental impact of industrial establishments (e.g., Doshi et al., 2013; Grant et al., 2010; King & Shaver, 2001). We supplemented the EPA's TRI program with *the NETS Database's TRI Establishments Database* to create a longitudinal variable of the level of TRI facilities in the corporate hierarchy, as well as variables about basic organizational characteristics, such as the number of employees.

We relied on two data sources for measuring government environmental stringency. The *US Census Bureau's Census of Governments* provides data on federal, state, local governments' expenditures broken down by functions, such as education, social services, and transportation. The US EPA's *ECHO* provides data on regulatory activities done by federal, state, and local governments.

4.2 | Sample

The sample for the analysis consists of the 67 largest US-headquartered chemical manufacturing corporate groups and their business establishments in the United States. Researchers have long been interested in chemical manufacturing because of its significant impact on communities and the environment (Freudenburg, 2005; Grant et al., 2004; Grant et al., 2010). This sector has the largest number of TRI facilities in the United States; the 2013 TRI program shows that approximately 3500 TRI facilities (15.74 % of all TRI facilities) engage in chemical manufacturing. As well, chemical manufacturing is one of the three largest polluters along with metal mining and electric utilities, the three of which are responsible for more than two thirds of toxic releases in the United States.

Using the 2013 TRI program, we first chose US-headquartered corporate groups that operate at least five domestic chemical manufacturing establishments required to report to the TRI program. This sampling strategy resulted in 71 corporate groups and their 23,321 business establishments in the United States, including 1413 TRI facilities. Next, we excluded four firms that did *not* have subsidiaries from the initial sample, which resulted in 67 corporate groups and their 23,292 domestic business establishments. Of these 23,292 business establishments, we limited our sample to 7522 business establishments that had 10 or more employees for the first set of analysis where we intended to determine which business establishments were likely to be TRI facilities. These business establishments with 10 or more employees are at risk of being reported as TRI facilities because the TRI program does not require those with less than 10 employees to report to the TRI program. Because of missing values in dependent and independent variables, we analyzed 7400 business establishments for the first set of analysis (Hypotheses 1, 2A, and 2B) and 9832 facility-year observations (i.e., 1186 TRI facilities affiliated with 63 corporate groups during the period of 2010–2019) for the second set of analysis (Hypothesis 3).

4.3 | Dependent variables

The dependent variable of the first part of analysis (Hypotheses 1, 2A, and 2B) is a dichotomous indicator of whether the business establishments perform pollution-intensive activities. We created this variable by manually comparing the 2013 Dun and Bradstreet's Corporate Family Tree Data and the EPA's 2013 TRI program. Specifically, this variable has a value of one if the business establishment in Dun and Bradstreet data was also listed in the TRI program (and zero otherwise).

For the second part of analysis (Hypothesis 3), we analyzed the logged toxicity-weighted amount of toxic emissions as the dependent variable. The TRI program provides data at the level of each toxic chemical released into the environment. We first multiplied the pounds of toxic emissions to the air, water, and land by chemical-specific toxicity weights, which were obtained from the EPA's Risk Screening Environmental Indicators. We then aggregated toxicity-weighted amounts of chemical emissions at the level of facilities and took their natural logarithm to address the right-skewness in the distribution of this variable.

4.4 | Independent variables

4.4.1 | Level of subsidiary layers

For each establishment, we first counted the number of subsidiary layers that exist between an establishment and its parent headquarters: "0" for the parent headquarters and parent establishments that operate under the direct authority of the parent headquarters; "1" for the first-level subsidiary headquarters and their establishments, "2" for the second-level subsidiary headquarters and establishments, and so on. A higher value of this variable means that a given establishment occupies a lower level in the corporate hierarchy with a greater organizational distance from the parent company. In terms of liability, its higher value means a greater number of protection layers available for the parent company against adverse events occurring in subsidiaries, such as environmental litigation.

4.4.2 | State environmental stringency

Prior research has employed a variety of measures to assess state commitment to environmental protection, including government expenditures, regulatory enforcement actions, programmatic indicators (e.g., Green Index), and private sector spending on environmental pollution abatement (e.g., Levinson Index) (Konisky & Woods, 2012). We applied the first two of these measures for our analysis, as the last two indices (i.e., Green Index and Levison Index) were constructed in the 1970s–1990s and do not match well with the time frame of the TRI data we are analyzing.

We assessed state environmental stringency by calculating the average z-score of government environmental expenditures and inspection activities. We measured per capita state-level government expenditures on the environment using the US Census Bureau's Census of Governments. We measured state-level government inspection activities by counting the state-level number of inspections standardized by the number of manufacturing establishments operating in the state. Data were drawn from the US EPA's ECHO. Then, we calculated the average z-score of these two measures of government environmental expenditures and inspection activities for home and host states, respectively.

4.5 | Control variables

We have included the same set of establishment-level control variables for the first and the second parts of analysis with one exception explained in the next paragraph.

4.5.1 | Establishment-level characteristics

The organizational characteristics of establishments may determine the probability of performing pollution-intensive activities and the degree of toxic emissions. We controlled for *establishment size* (measured with logged number of employees), *establishment age* since incorporated, and a series of dummy indicators for *industrial sectors*. And, for the second part of analysis (Hypothesis 3), we included one additional control variable labeled as *log toxic chemicals present on-site*: the logged toxicity-weighted amount of toxic chemicals used, processed, or stored by industrial facilities. The volume of toxic emissions tends to depend on the size of toxic chemicals handled by industrial facilities.

Several geographic attributes may influence the establishments' pollution-intensive activities. A dichotomous indicator for establishments outside the parent headquarters' state, that is, *out-of-state establishment*, controls for the tendency that firms locate pollution-intensive operations, and pollute more, geographically away from parent headquarters (Grant et al., 2004). A variable of *TRI facility density* considered the effects of the geographic agglomeration of pollution-intensive establishments. We constructed this variable by counting the number of TRI facilities within the 15 miles of each establishment. We also included a variable of *state manufacturing intensity*, which we measured with the percentage of state gross domestic product from manufacturing, to consider the state's economic reliance on pollution-intensive industries.

The characteristics of neighborhoods surrounding business establishments also influence corporate environmental behaviors (Grant et al., 2010; Mohai et al., 2009). We included a

dichotomous indicator for *metropolitan areas* where we expect that firms are less likely to generate toxic emissions. We considered *neighborhood income level* by measuring the median household income of the Census tracts that host business establishments using data from the US Census Bureau's American Community Survey (2009–2013).

4.5.2 | Firm-level characteristics

For the first part of analysis, we controlled for several important firm characteristics that may affect establishment-level environmental behaviors: *logged number of subsidiary layers*, *logged number of establishments*, *logged number of employees*, *firm age*, *publicly traded firm* (vs. private firm), and *participation in the Responsible Care program*, which is an initiative taken by the chemical industry to improve its environmental and safety performance.

4.6 | Statistical estimation

We estimated a series of random-effects logistic regression models to test Hypotheses 1, 2A, and 2B. The data for this analysis include 7400 business establishments (level-one unit) that belong to the 67 largest chemical-manufacturing corporate groups (level-two unit). Given the multilevel structure of the data, we introduced a random intercept term to address the similarity among business establishments affiliated with the same parent headquarters. We chose random-effects estimation over fixed-effects estimation because Hypothesis 2A includes a corporate group-level attribute that does not vary across establishments within the corporate group, that is, the environmental stringency of the home states.

The model for Hypothesis 1 takes the following form:

$$\begin{aligned}\log\frac{P_{ij}}{1-P_{ij}} = {} & \beta_1 + \beta_2 \text{level of subsidiary layers}_{ij} + \beta_3 \text{home state environmental stringency}_j \\ & + \beta_4 \text{host state environmental stringency}_{ij} + \beta_5 \text{establishment level controls}_{ij} \\ & + \beta_6 \text{firm level controls}_j + \alpha_j + \varepsilon_{ij}\end{aligned} \quad (1)$$

where P_{ij} is the probability that a business establishment i affiliated with the parent company j performs pollution-intensive activities (or the probability of being TRI facilities); α_j represents random intercepts for firms; and ε_{ij} is a random disturbance term.

To test Hypothesis 2A, we added a cross-level interaction term between the level of subsidiary layers and the environmental stringency of the home states (i.e., β_7 level of subsidiary layers$_{ij}$ × home state environmental stringency$_j$) to Equation (1). For Hypothesis 2B, we added an interaction term between the level of subsidiary layers and the environmental stringency of the host states (i.e., β_8 level of subsidiary layers$_{ij}$ × host state environmental stringency$_{ij}$).

The model for Hypothesis 3 estimates the following equation using fixed-effects generalized least square regression:

$$y_{it} = \beta_1 + \beta_2 \text{level of subsidiary layers}_{it} + \beta_3 \text{establishment level controls}_{it} + \alpha_i + \varepsilon_{it} \quad (2)$$

where y_{it} is the logged toxicity-weighted amount of toxic chemicals released into the environment by industrial facility i at time t, α_i represents the unknown intercept for each industrial facility, and ε_{it} is the error term. Firm fixed effects and year fixed effects were included.

5 | RESULTS

5.1 | Descriptive analysis

Table 1 presents the means and standard deviations of all variables included for the first part of statistical analysis. Our data reveal that only a small number of establishments conduct pollution-intensive operations. The number of TRI facilities in the sample was 1393. These TRI facilities accounted for 6% of all 23,292 business establishments owned by the 67 largest US chemical manufacturing corporate groups, as well as 15 % of their 7522 business establishments that have 10 or more employees.

As shown in Table 2, a firm-level descriptive analysis confirmed the prevalence of multilayered corporate groups. Of the 67 corporate groups, 49 firms (73%) had two or more layers of subsidiary corporations. Specifically, 16 firms had two levels of subsidiaries, 10 firms had three levels of subsidiaries, and 23 firms had four or more levels of subsidiaries. Table 3 shows the percentage of TRI facilities by the level of subsidiary layers at the business establishment level. Even this simple descriptive statistic shows that the percentage of TRI facilities gets higher among lower-level business establishments.

5.2 | The main effect of the level of subsidiary layers

Table 4 reports the results from random-effects hierarchical linear modeling, which tested Hypotheses 1, 2A, and 2B. Model 1 presents the main effect of the level of subsidiary layers on the probability of being TRI facilities. Models 2A and 2B show how the association between the level of subsidiary layers and the probability of being TRI facilities is moderated by the environmental stringency at home and in host states, respectively. Model 3 examines the moderating effects of *both* home and host state environmental stringency in the same model.

Model 1 demonstrated that firms were likely to perform pollution-intensive activities in establishments that were hierarchically distant from parent companies ($\beta = .115$, $p = .035$). To facilitate the understanding of the substantive significance of this finding, we calculated the predicted probability of being a TRI facility based on the establishment's level of subsidiary layers, holding all other continuous and categorical variables at their means and mode values, respectively (Hoetker, 2007). The predicted probability of being TRI facilities among parent establishments was 0.144, but this estimate went up substantially with an increase in the number of subsidiary layers that exist between an establishment and its parent company. For example, the predicted probabilities were 0.158, 0.173, 0.190, and 0.208 for the first-, second-, third-, and fourth-level subsidiary establishments. This finding supports Hypothesis 1.

There are three plausible explanations for this finding. First, corporate groups may organize managerial tasks at a hierarchical position higher than production tasks to ensure effective coordination and control (Chandler, 1977). TRI facilities are therefore likely to be located lower in the corporate hierarchy. Second, the attention literature suggests that lower-level establishments are more likely than higher-level establishments to engage in pollution-intensive

TABLE 1 Descriptive statistics for the first part of analysis (Models 1–3 in Table 4).

	Mean	S.D.	Min	Max	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent variable											
(1) Being TRI facilities Independent variables	0.146	0.353	0	1	1						
(2) Level of subsidiary layers	0.723	0.845	0	9	0.051 (.000)	1					
(3) Home state environmental stringency	0.101	0.78	−0.971	7.388	0.086 (.000)	−.074 (.000)	1				
(4) Host state environmental stringency	0.002	0.745	−0.692	5.574	0.008 (.477)	0.022 (.057)	0.083 (.000)	1			
Control variables											
(5) Establishment size	0.102	0.167	0.011	2.773	0.092 (.000)	−0.028 (.017)	0.029 (.014)	−3.038 (.001)	1		
(6) Establishment age	65.584	54.262	1	213	−0.049 (.000)	−0.511 (.000)	0.090 (.000)	−0.052 (.000)	0.046 (.000)	1	
(7) Out-of-state establishments	0.835	0.371	0	1	0.045 (.000)	0.053 (.000)	−0.019 (.105)	0.141 (.000)	−0.102 (.000)	−0.062 (.000)	1
(8) TRI facility density	5.416	6.687	0	42	0.067 (.000)	−0.016 (.172)	0.034 (.003)	−0.090 (.000)	0.041 (.000)	0.059 (.000)	−0.204 (.000)
(9) State manufacturing density	0.133	0.051	0.002	0.286	0.067 (.000)	−0.015 (.183)	0.001 (.957)	−0.141 (.000)	−0.020 (.083)	−0.025 (.029)	−0.015 (.208)
(10) Metropolitan area	0.874	0.332	0	1	−0.108 (.000)	−0.053 (.000)	−0.046 (.000)	−0.101 (.000)	0.008 (.468)	0.108 (.000)	−0.027 (.020)
(11) Neighborhood income level	57.937	29.237	0	233.929	−0.108 (.000)	−0.009 (.440)	−0.013 (.264)	−0.049 (.000)	0.064 (.000)	0.059 (.000)	−0.082 (.000)
(12) Log number of subsidiary layers	1.52	0.426	0.693	2.565	−0.072 (.000)	0.177 (.000)	−0.125 (.000)	−0.043 (.000)	0.064 (.000)	−0.095 (.000)	0.000 (.000)
(13) Log number of establishments	6.285	1.145	1.946	8.409	−0.236 (.000)	−0.143 (.000)	−0.041 (.000)	0.005 (.664)	−0.025 (.034)	0.161 (.000)	0.000 (.000)
(14) Log number of employees	3.31	1.025	0.151	5.129	−0.207 (.000)	−0.122 (.000)	0.041 (.000)	−0.010 (.390)	0.166 (.000)	0.140 (.000)	0.090 (.000)
(15) Firm age	91.126	48.472	1	213	−0.070 (.000)	−0.237 (.000)	0.142 (.000)	−0.054 (.000)	0.045 (.000)	0.604 (.000)	0.005 (.676)
(16) Publicly traded firm	0.895	0.307	0	1	−0.103 (.000)	−0.191 (.000)	−0.147 (.000)	0.005 (.667)	−0.006 (.586)	0.192 (.000)	−0.038 (.001)
(17) Participation in Responsible Care	0.51	0.5	0	1	0.006 (.614)	−0.155 (.000)	0.167 (.000)	−3.038 (.001)	0.055 (.000)	0.316 (.000)	0.006 (.628)

	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
Dependent variable										
(1) Being TRI facilities Independent variables										
(2) Level of subsidiary layers										
(3) Home state environmental stringency										
(4) Host state environmental stringency										
Control variables										
(5) Establishment size										
(6) Establishment age										
(7) Out-of-state establishments										
(8) TRI facility density	1									
(9) State manufacturing density	0.006 (.609)	1								
(10) Metropolitan area	0.257 (.000)	−0.083 (.000)	1							
(11) Neighborhood income level	0.060 (.000)	−0.174 (.000)	0.170 (.000)	1						
(12) Log number of subsidiary layers	−0.041 (.000)	−0.046 (.000)	0.044 (.000)	0.083 (.000)	1					
(13) Log number of establishments	−0.058 (.000)	−0.059 (.000)	0.050 (.000)	0.000 (.971)	0.130 (.000)	1				
(14) Log number of employees	−0.058 (.000)	−0.086 (.000)	0.048 (.000)	0.076 (.000)	0.299 (.000)	0.759 (.000)	1			
(15) Firm age	0.041 (.000)	−0.057 (.000)	0.093 (.000)	0.112 (.000)	0.117 (.000)	0.260 (.000)	0.269 (.000)	1		
(16) Publicly traded firm	0.028 (.017)	−0.059 (.000)	0.110 (.000)	0.081 (.000)	0.086 (.000)	0.127 (.000)	0.014 (.214)	0.321 (.000)	1	
(17) Participation in Responsible Care	0.079 (.000)	−0.006 (.596)	0.052 (.000)	0.033 (.005)	0.160 (.000)	0.037 (.002)	0.108 (.000)	0.386 (.000)	0.237 (.000)	1

Note: *p*-Values are in parentheses (two-tailed test).

TABLE 2 Number of corporate groups by the total number of subsidiary layers.

Total number of sub. layer at the corporate group level	Frequency	Percent
1	18	26.87
2	16	23.88
3	10	14.93
4+	23	34.33
Total	67	100

TABLE 3 Number and percentage of TRI facilities by the level of subsidiary layers.

Subsidiary layer	Non-TRI establishments	TRI establishments	Total
0	2991 (87.3%)	434 (12.7%)	3425 (100%)
1	2534 (82.8%)	527 (17.2%)	3061 (100%)
2	650 (82.2%)	141 (17.8%)	791 (100%)
3	158 (87.3%)	23 (12.7%)	181 (100%)
4+	49 (76.6%)	15 (23.4%)	64 (100%)
Total	6382 (84.8%)	1140 (15.2%)	7522 (100%)

Note: Numbers *without* parentheses indicate the number of non-TRI/TRI establishments at each level of subsidiary layers. Numbers *with* parentheses indicate the percentage of non-TRI/TRI establishments to total establishments.

activities because they receive less attention from parent headquarters (Belenzon et al., 2019). Third, our finding may indicate a firm's strategic choice that intends to shield its parent company from environmental liabilities inherent in pollution-intensive operations.

Model 1 does not tell us which explanation is more likely, but we argue that the third buffering argument is part of the story by examining the interaction effects of state environmental stringency in Models 2A and 2B—how the probability of performing pollution-intensive activities at the lower levels of the corporate hierarchy varies depending on the extent to which firms need to buffer parent companies from regulatory risks.

5.3 | The moderating effect of state environmental stringency at home and host states

Model 2A examined how the environmental stringency of the home states moderates the relationship between the level of subsidiary layers where an establishment is organized and the probability that the establishment is a TRI facility. Our data show that, when parent headquarters experienced stringent regulatory pressure at home, they were more likely to assign pollution-intensive activities to establishments lower in the corporate hierarchy ($\beta = .201$ $p = .003$). This finding supports Hypothesis 2A.

Figure 2 illustrates that the probability of being TRI facilities by the level of subsidiary layers depends on the environmental stringency of the home states where parent companies are headquartered. The steep solid line, as compared to the gradual dashed line, indicates that the positive relationship between the level of subsidiary layers and the probability of performing

TABLE 4 Random-effects hierarchical linear modeling of the probability of being TRI facilities.

Dependent variable: Being TRI facilities	Model 1	Model 2A	Model 2B	Model 3
Independent variables				
Level of subsidiary layers	0.115 (.035) [0.055]	0.129 (.021) [0.056]	0.108 (.051) [0.055]	0.121 (.031) [0.056]
Home state environmental stringency	0.103 (.155) [0.072]	0.016 (.838) [0.076]	0.110 (.129) [0.073]	0.024 (.753) [0.077]
Host state environmental stringency	0.056 (.277) [0.052]	0.058 (.263) [0.052]	−0.058 (.401) [0.070]	−0.053 (.443) [0.070]
Level of subsidiary layers × home state environmental stringency		0.201 (.003) [0.069]		0.197 (.004) [0.069]
Level of subsidiary layers × host state environmental stringency			0.153 (.009) [0.059]	0.149 (.011) [0.058]
Establishment-level control variables				
Establishment size	1.530 (.000) [0.194]	1.539 (.000) [0.194]	1.545 (.000) [0.194]	1.553 (.000) [0.194]
Establishment age	−0.003 (.002) [0.001]	−0.002 (.036) [0.001]	−0.003 (.001) [0.001]	−0.002 (.027) [0.001]
Out-of-state establishments	0.793 (.000) [0.119]	0.799 (.000) [0.119]	0.795 (.000) [0.119]	0.802 (.000) [0.119]
TRI facility density	0.034 (.000) [0.005]	0.035 (.000) [0.005]	0.035 (.000) [0.005]	0.035 (.000) [0.005]
State manufacturing density	1.581 (.035) [0.750]	1.569 (.037) [0.750]	1.574 (.036) [0.751]	1.560 (.038) [0.752]
Metropolitan area	−0.720 (.000) [0.105]	−0.709 (.000) [0.105]	−0.726 (.000) [0.105]	−0.714 (.000) [0.105]
Neighborhood income level	−0.011 (.000) [0.002]	−0.011 (.000) [0.002]	−0.011 (.000) [0.002]	−0.011 (.000) [0.002]
Dependent variable: Being TRI facilities	**Model 1**	**Model 2A**	**Model 2B**	**Model 3**
Firm-level control variables				
Log number of subsidiary layers	−0.192 (.329) [0.197]	−0.179 (.351) [0.192]	−0.183 (.355) [0.198]	−0.171 (.376) [0.193]
Log number of establishments	−0.099 (.392) [0.116]	−0.127 (.261) [0.113]	−0.104 (.373) [0.117]	−0.130 (.252) [0.114]
Log number of employees	−0.464 (.001) [0.146]	−0.421 (.003) [0.141]	−0.460 (.002) [0.146]	−0.419 (.003) [0.142]
Firm age	0.003 (.157) [0.002]	0.002 (.284) [0.002]	0.003 (.158) [0.002]	0.002 (.282) [0.002]
Publicly traded firm	−0.498 (.035) [0.237]	−0.458 (.047) [0.231]	−0.510 (.032) [0.238]	−0.471 (.043) [0.233]
Participation in responsible care	0.316 (.060) [0.168]	0.324 (.047) [0.163]	0.329 (.051) [0.169]	0.336 (.040) [0.164]

TABLE 4 (Continued)

Dependent variable: Being TRI facilities	Model 1	Model 2A	Model 2B	Model 3
Constant	1.055 (.014) [0.430]	1.017 (.016) [0.421]	1.068 (.013) [0.431]	1.030 (.015) [0.423]
Log likelihood	−2543	−2538	−2539	−2535
Intra-class correlation	0.0684	0.0628	0.0692	0.0639
Number of establishments	7400	7400	7400	7400
Number of firms	67	67	67	67

Note: *p*-Values are in parentheses (two-tailed test); standard errors clustered at the corporate group level are included in square brackets. In addition to the control variables reported here, these models include a series of dummy indicators for industrial sectors.

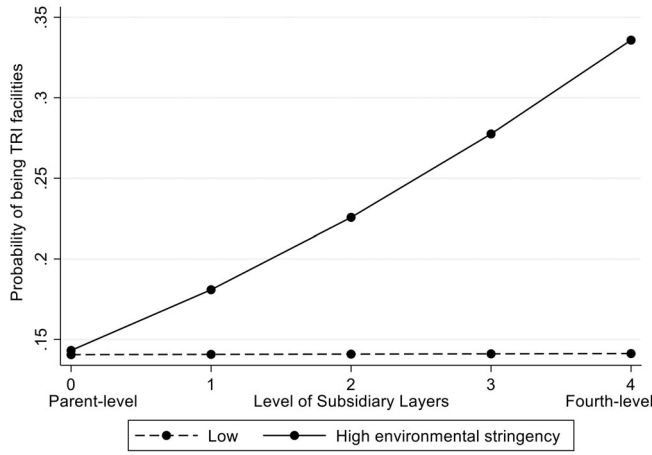

FIGURE 2 Predicted probability of being Toxic Release Inventory (TRI) facilities among establishments at different levels of the corporate hierarchy by the environmental stringency of *home* states.

pollution-intensive activities was much more pronounced when parent headquarters were subject to stringent environmental policies and regulations. Specifically, when parent companies were headquartered in weak environmental states, the probability of being TRI facilities among lower-level subsidiary establishments was almost the same as the one among parent establishments (see the dashed line in Figure 2). In contrast, when parent companies were headquartered in strong environmental states, the predicted probability was 0.143 for parent establishments and it increases up to 0.336 for the fourth-level subsidiary establishments (see the solid line in Figure 2). This suggests that stringent environmental policies and regulations at home are associated with a greater probability that lower-level establishments will carry out pollution-intensive activities than higher-level establishments.

In Model 2B, we included an interaction term between an establishment's level of subsidiary layers and the environmental stringency of the host states where the establishments are located. We found that greater environmental stringency in host states reinforced the tendency that establishments hierarchically distant from parent companies were more likely to perform pollution-intensive activities than establishments closer to parent companies ($\beta = .153$, $p = .009$). This finding supports Hypothesis 2B.

Figure 3 represents the interactive relationship between the level of subsidiary layers and the environmental stringency of the host states. The substantive difference in the slopes between solid and dashed lines indicates that the effects of the level of subsidiary layers on the probability of being TRI facilities were greater among establishments in strong environmental states than those in weak environmental states. In weak environmental states, the probability of being TRI facilities was 0.147 for parent establishments and 0.157 for the fourth-level subsidiary establishments (see the dashed line in Figure 3). In strong environmental states, however, the probability was estimated to be 0.139 for parent establishments, but 0.251 for the fourth-level subsidiary establishments (see the solid line in Figure 3). The difference in predicted probabilities between lower-level and higher-level establishments was more noticeable for business establishments operating in strong environmental states than those in weak environmental states.

To summarize the first part of our analysis, we demonstrated that firms tend to perform pollution-intensive operations at business establishments lower in the corporate hierarchy. And firms are more likely to do so when they face stringent environmental regulations in home and host states. As shown in Model 3 of Table 4, the moderating effects of *both* home state environmental stringency and host state environmental stringency remained the same when both interaction terms were included together in the same model.

5.3.1 | Alternative explanations

As discussed above, prior research suggests two alternative explanations for the location of pollution-intensive activities in the corporate hierarchy, which focus on efficiency and headquarters attention, respectively. These two alternative accounts for Hypothesis 1 would offer different scenarios than what we presented in Figures 2 and 3.

If firms seek efficient coordination and control rather than buffering from environmental liabilities, they will locate pollution-intensive activities under the direct authority of the parent company in order to ensure the type or amount of support appropriate to high environmental

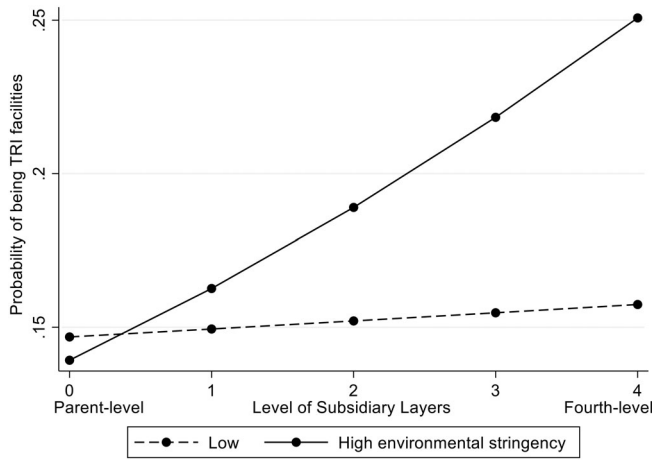

FIGURE 3 Predicted probability of being Toxic Release Inventory (TRI) facilities among establishments at different levels of the corporate hierarchy by the environmental stringency of *host* states.

expectation in home and host states. Higher-level establishments are therefore *more* likely to perform pollution-intensive activities than lower-level establishments. In contrast to this prediction from the efficiency argument, Figures 2 and 3 showed that establishments hierarchically closer to parent companies were *less* likely to perform pollution-intensive activities than establishments hierarchically more distant from parent companies when their home and host states had stringent environmental policies and regulations.

In addition, parent companies will pay greater attention to their establishments in strong environmental states than those in weak environmental states because of greater regulatory risks in environmentally stringent states. If the lack of headquarters attention leads to polluting activities, lower-level establishments in environmentally stringent jurisdictions would be *less* likely to perform pollution intensive activities than lower-level establishments in environmentally lenient jurisdiction. However, our analysis showed that lower-level establishments in strong environmental states are *more* likely to perform pollution intensive activities than lower-level establishments in weak environmental states.

For these reasons, we argue that the moderating effects of state environmental stringency provide evidence for the buffering argument, as opposed to the explanations of efficiency and headquarters attention.

5.4 | The effect of the level of subsidiary layers on toxic emissions

In Model 1 of Table 5, focusing on a subsample of TRI facilities, we investigated how the toxicity-weighted amount of toxic chemicals released by TRI facilities varies depending on the level of subsidiary layers where the TRI facilities are situated during the period of 2010–2019. Supporting Hypothesis 3, the result indicates a positive association between the level of subsidiary layers and the degree of toxic emissions ($\beta = .331$, $p = .002$). The coefficient from the analysis indicates that one increase in the hierarchical distance from parent companies was associated with a 39 % increase in the degree of toxic emissions. We argue that the buffering mechanism leads TRI facilities at the lower levels of the corporate hierarchy to create a greater degree of environmental hazards than those closer to parent companies.

5.5 | Robustness analyses

We verified the robustness of our findings for Hypotheses 1, 2A, and 2B using the sample of all business establishments and fixed effects, as well as for Hypothesis 3 with an absolute volume of toxic emissions (without toxicity weights). All result tables are available upon request.

5.5.1 | All business establishments (Hypotheses 1 and 2)

For the robustness analysis, we analyzed all 23,292 business establishments affiliated with the 67 chemical manufacturing corporate groups, rather than 7400 business establishments at greater risk of reporting to the TRI program in the main analysis.

The results from this robustness analysis remained the same as our main results. Like the main analysis, lower-level business establishments were more likely to perform pollution-intensive activities than higher-level business establishments ($\beta = .143$, $p = .001$).

TABLE 5 Fixed-effects regression predicting the degree of toxic emissions.

Dependent variable: Log toxic emissions (toxicity-weighted)	Model 1
Independent variable	
Level of subsidiary layers	0.331 (.002) [0.104]
Facility-level control variables	
Log toxic chemicals on-site (toxicity-weighted)	0.241 (.000) [0.007]
Log number of employees	−0.000 (.640) [0.000]
Facility age	−0.018 (.283) [0.017]
Out-of-state facility	−1.473 (.023) [0.647]
TRI facility density	−0.002 (.519) [0.003]
State manufacturing intensity	−6.868 (.017) [2.882]
Metropolitan area	−0.326 (.331) [0.335]
Neighborhood income	−0.000 (.877) [0.000]
Host state environmental stringency	−0.147 (.224) [0.121]
Constant	12.903 (.000) [1.584]
R-squared	.131
rho	0.782
Number of observations (TRI-year)	9832
Number of TRI facilities	1186
Number of corporate groups	63

Note: *p*-Values are in parentheses (two-tailed test); standard errors clustered at the corporate group level are included in square brackets. In addition to the control variables reported here, these models include a series of dummy indicators for industrial sectors and for years.

And this relationship was more pronounced when business establishments are subject to higher environmental standards at home and in host states ($\beta = .172$, $p = .001$ for the interaction term with home states' environmental stringency; $\beta = .157$, $p = .000$ for the interaction term with host states' environmental stringency). Therefore, regardless of the definition of the sample (i.e., a subset of affiliated establishments at greater risk of reporting to the TRI program versus all affiliated establishments), firms performed pollution-intensive activities lower in the corporate hierarchy and firms were more likely to do so when they were subject to strong environmental regulations at home and in host states.

5.5.2 | Fixed effects (Hypotheses 1 and 2)

Instead of random-effect models used in the main analysis, we also used a corporate group-level fixed effect for the robustness check. The corporate group-level fixed effect explores how the level of subsidiary layers is associated with the probability of being TRI facilities within a corporate group. Therefore, the variation across corporate groups in the height of the corporate hierarchy (either tall with many subsidiary layers or short with a few subsidiary layers) would not bias the results.

Consistent with the main analysis, this supplementary analysis suggests that, *among business establishments within corporate groups*, lower-level business establishments are more likely to perform pollution-intensive activities than higher-level establishments ($\beta = .125$, $p = .033$). This relationship was more salient when business establishments are operating in environmentally stringent states ($\beta = .159$, $p = .007$). Note that we were not able to test the moderating effect of *home* state environmental stringency because a fixed effects model does not allow us to include a variable that does not vary within corporate groups (i.e., home state environmental stringency).

5.5.3 | Absolute volume of toxic emissions (Hypothesis 3)

We provided additional evidence supporting Hypothesis 3 by using the absolute volume of toxic emissions without considering the toxicity of toxic chemicals. The US EPA does not provide toxicity weights for every toxic chemical, which generates missing values in the dependent variable. This results in observations dropping out from the analysis and may bias the analysis. In this robustness test with the absolute, unweighted volume of toxic emissions, we were able to analyze 16,145 facility-year observations from 1843 facilities affiliated with 67 corporate groups (as opposed to 9832 observations from 1186 facilities and 63 corporate groups in the main analysis). The result from this analysis was the same as the result from the main analysis; lower-level facilities emit greater volume of toxic chemicals than higher-level facilities ($\beta = .128$, $p = .000$).

6 | DISCUSSION

This study examined how the hierarchical structure of corporate groups is related to their environmental practices and performance. Using data on the 67 largest US-headquartered chemical manufacturing corporate groups and their business establishments operating in the United States, we found that corporate groups performed pollution-intensive activities lower in the corporate hierarchy. Corporate groups were more likely to do so when they experienced stringent environmental policies and regulations at home and in host states. In addition, the longitudinal analysis of the environmental performance of 1186 pollution-intensive facilities during the period of 2010–2019 revealed that lower-level facilities polluted more than higher-level facilities.

Based on these findings, we argued that corporate groups seek to buffer parent companies from regulatory risks and uncertainties associated with pollution-intensive activities. When corporate groups face a greater need to insulate parent companies from stricter environmental standards, they are more likely to perform pollution-intensive activities at the lower levels of the corporate hierarchy where they can put up higher liability firewalls for parent companies. In addition, this buffering effect leads lower-level establishments to create more serious environmental pollution than higher-level establishments.

Our study is particularly important, as it suggests that tighter environmental regulations are not necessarily related to greater compliance by corporations, but to the hiding of polluting activities lower in the organizational hierarchy, where the polluting activities are harder to associate to the parent company.

6.1 | Theoretical implications

By shedding light on the hierarchical structure of corporate groups, our study makes several theoretical contributions to the understanding of corporate environmental practices and performance. First, we provide a new answer to the old question of how firms avoid government environmental policies and regulations. Prior research has suggested two business strategies: offshoring and outsourcing. In the case of offshoring, which is often called the pollution haven hypothesis, firms exploit interjurisdictional differences in environmental requirements and locate their pollution-intensive operations in environmentally lenient jurisdictions (Brunnermeier & Levinson, 2004; Copeland & Taylor, 2004). In the case of outsourcing, firms divest pollution-intensive activities to other firms, often small ones, to avoid their responsibility for negative environmental consequences (Alberini & Austin, 2002; Barney et al., 1992; Becker & Henderson, 2000; Ringleb & Wiggins, 1990).

Our study supports this prior work and offers a third business strategy: a hierarchical approach. Whereas the offshoring and outsourcing approaches highlight an *exit* mechanism, we propose a *buffering* mechanism where corporate groups insulate their core parent companies from the external environment. Specifically, corporate groups perform pollution-intensive activities at business establishments that are hierarchically distant from parent companies and, therefore, limit the extent to which parent companies are subject to government policies and regulations anywhere, not only in pollution havens but also in environmentally stringent jurisdictions. In addition, the hierarchical approach is different from the outsourcing strategy. Parent companies retain pollution-intensive activities within their corporate boundaries, rather than pushing them outside the boundaries. In doing so, they can influence the production process and circumvent the responsibility for the ecological footprint left by pollution-intensive subsidiaries.

Second, we offer an establishment-level explanation of the multilayered corporate groups' environmental practices and performance. Prechel and Touche (2014) and Prechel and Zheng (2012) pointed the spotlight on the increasing complexity of corporate groups, and showed that corporate groups with more subsidiary layers pollute more than their counterparts. Their corporate group-level analysis, however, treated the corporate group as a black box and does not reveal what is going on inside. Our analysis at the level of business establishments permitted us to look inside that black box and assess where in the hierarchy corporate groups were locating their pollution-intensive activities. We found that pollution-intensive activities were more prevalent in lower-level business establishments than higher-level establishments.

In addition to deepening the understanding of corporate environmental behaviors, our study also contributes to the buffering literature on how organizations protect themselves from the influence of the external environment. Our study proposes multilayered corporate groups as an organizational structure that permits buffering. We theorized how corporate groups protect core activities in their parent companies from risks and uncertainties arising from the external environment, using the liability firewall between parents and subsidiaries. We believe this organizational form requires substantially more research attention.

6.2 | Limitations

Despite these contributions, our study has a few limitations that can be tackled in future research. First, we cannot directly test a firm's intention to buffer parent companies from

environmental policies and regulations. Our argument rests upon empirical evidence that stronger environmental standards are *associated with* a greater tendency of corporate groups to locate pollution-intensive activities hierarchically distant from parent companies. Even in-depth interviews with corporate decision makers are not likely to yield candid insights about their motivations for offloading their environmental externalities on society (Barney et al., 1992). Therefore, we believe that the approach we took in this article—which examines how the tendency of performing pollution-intensive activities at the lower levels of the corporate hierarchy varies in relation to different regulatory stringencies—is a reasonable alternative to make an argument for the buffering mechanism.

Second, we cannot offer empirical evidence of the causal relationship between the level of subsidiary layers and pollution-intensive activities. Indeed, we anticipate a bidirectional relationship between multilayered subsidiary structure and pollution-intensive activities. In one direction, a tall hierarchical structure could lead corporate groups to pollute more because their parent company has less oversight and limited responsibility (Prechel & Zheng, 2012). In the other direction, corporate groups with pollution-intensive operations may seek to develop a tall hierarchical structure (Prechel & Boies, 1998). Similarly, our data suggested a reciprocal relationship between the height of corporate hierarchy and the degree of environmental pollution at the corporate group level. Corporate groups with a taller hierarchy generated greater toxic emissions in the next 1 or 2 years and corporate groups with greater toxic emissions became taller in the next 1 or 2 years (results available upon request).

Finally, we did not analyze longitudinal data to test Hypotheses 1, 2A, and 2B because our buffering argument does not require a longitudinal analysis. Based on the associative relationship among three key variables, that is, an indicator for TRI facilities, the level of subsidiary layers, and state environmental stringency, we argue that corporations locate pollution-intensive activities lower in the corporate hierarchy to buffer parent companies from regulatory risks. We do *not* argue that firms create multiple subsidiary layers. In addition, a meaningful longitudinal analysis is difficult because corporate organizations are constantly evolving as subsidiaries are often acquired, merged, or sold.

6.3 | Broader implications

Regardless of these limitations, the present study speaks to other industries beyond pollution-intensive industries. Corporate groups need to protect their parent companies or other important corporate entities not only from pollution-related regulatory expectations but also from ethical, legal, or financial risks and uncertainties inherent in their business operations (Belenzon et al., 2023; Prechel & Boies, 1998). Such a need for buffering is salient in pharmaceutical or manufacturing industries that are traditionally considered to be prone to liability (Prechel & Boies, 1998; Witting, 2018). Moreover, corporate groups that are into artificial intelligence and other new technologies might protect their well-established core business from greater risks and uncertainties related to such newly emerging technologies. Therefore, the organizational form of interest in this study can be found in a variety of industries and the implications of our study can be applicable to such various industries.

More importantly, this study offers important insights to a variety of actors, especially government regulatory agencies, environmental movement organizations, and other stakeholders concerned about social and environmental issues related to corporate activities. We suggest that even stringent environmental regulations may not be as effective as they are intended to be, unless

environmental regulations hold parent companies responsible for subsidiaries' environmental practices and performance. In other words, the liability firewall in multilayered corporate groups can hamstring the effectiveness of government policies and regulations that are based on a traditional organizational form. Indeed, novel organizational structures are becoming more mainstream with a proliferation of new financing options (e.g., private equity, cryptocurrencies, etc.). Government regulations that fail to consider new corporate structures may, in fact, simply "hide" the environmental harm, rather than reduce the harm. It is important, therefore, to consider the firms' organizational form to develop future environmental governance.

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DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from Walls & Associates. Restrictions apply to the availability of these data, which were used under license for this study. Data are available from the authors with the permission of the Wall & Associates.

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REFERENCES

Akey, P., & Appel, I. (2021). The limits of limited liability: Evidence from industrial pollution. *The Journal of Finance*, *76*(1), 5–55.

Alberini, A., & Austin, D. (2002). Accidents waiting to happen: Liability policy and toxic pollution releases. *Review of Economics and Statistics*, *84*(4), 729–741.

Barney, J. B., Edwards, F. L., & Ringleb, A. H. (1992). Organizational responses to legal liability: Employee exposure to hazardous materials, vertical integration, and small firm production. *Academy of Management Journal*, *35*(2), 328–349.

Becker, R., & Henderson, V. (2000). Effects of air quality regulations on polluting industries. *Journal of Political Economy*, *108*(2), 379–421.

Belenzon, S., Hashai, N., & Patacconi, A. (2019). The architecture of attention: Group structure and subsidiary autonomy. *Strategic Management Journal*, *40*(10), 1610–1643.

Belenzon, S., Lee, H., & Patacconi, A. (2023). Managing risk in corporate groups: Limited liability, asset partitioning, and risk compartmentalization. *Strategic Management Journal*, *44*, 2888–2921.

Berry, H., Kaul, A., & Lee, N. (2021). Follow the smoke: The pollution haven effect on global sourcing. *Strategic Management Journal*, *42*(13), 2420–2450.

Bethel, J. E., & Liebeskind, J. P. (1998). Diversification and the legal organization of the firm. *Organization Science*, *9*(1), 49–67.

Boies, J., & Prechel, H. (2002). Capital dependence, business political behavior, and change to the multilayered subsidiary form. *Social Problems*, *49*(3), 301–326.

Boomhower, J. (2019). Drilling like There's No tomorrow: Bankruptcy, insurance, and environmental risk. *American Economic Review*, *109*(2), 391–426.

Brunnermeier, S. B., & Levinson, A. (2004). Examining the evidence on environmental regulations and industry location. *The Journal of Environment & Development*, *13*(1), 6–41.

Chandler, A. D. (1977). *The visible hand: The managerial revolution in American business*. Harvard University Press.

Choi, T. Y., & Krause, D. R. (2006). The supply base and its complexity: Implications for transaction costs, risks, responsiveness, and innovation. *Journal of Operations Management*, *24*(5), 637–652.

Copeland, B. R., & Taylor, M. S. (2004). Trade, growth, and the environment. *Journal of Economic Literature*, *42*(1), 7–71.

Darnall, N., Henriques, I., & Sadorsky, P. (2010). Adopting proactive environmental strategy: The influence of stakeholders and firm size. *Journal of Management Studies*, *47*(6), 1072–1094.

Davis, G. F., Diekmann, K. A., & Tinsley, C. H. (1994). The decline and fall of the conglomerate firm in the 1980s: The deinstitutionalization of an organizational form. *American Sociological Review*, *59*(4), 547.

Dieleman, M., & Boddewyn, J. J. (2012). Using organization structure to buffer political ties in emerging markets: A case study. *Organization Studies*, *33*(1), 71–95.

Doshi, A. R., Dowell, G. W. S., & Toffel, M. W. (2013). How firms respond to mandatory information disclosure. *Strategic Management Journal*, *34*(10), 1209–1231.

Dunbar, R. L. M., & Wasilewski, N. (1985). Regulating external threats in the cigarette industry. *Administrative Science Quarterly*, *30*(4), 540–559.

Edelman, L. B., & Suchman, M. C. (1997). The legal environments of organizations. *Annual Review of Sociology*, *23*, 479–515.

Ederington, J., Levinson, A., & Minier, J. (2005). Footloose and pollution-free. *The Review of Economics and Statistics*, *87*(1), 92–99.

Erens, B. B., Friedman, S. J., & Mayerfeld, K. M. (2008). Bankrupt subsidiaries: The challenges to the parent of legal separation. *Emory Bankruptcy Developments Journal*, *25*, 65.

Fennell, M. L., & Alexander, J. A. (1987). Organizational boundary spanning in institutionalized environments. *Academy of Management Journal*, *30*(3), 456–476.

Freudenburg, W. R. (2005). Privileged access, privileged accounts: Toward a socially structured theory of resources and discourses. *Social Forces*, *84*(1), 89–114.

Grant, D., Jones, A. W., & Trautner, M. N. (2004). Do facilities with distant headquarters pollute more? How civic engagement conditions the environmental performance of absentee managed plants. *Social Forces*, *83*(1), 189–214.

Grant, D., Trautner, M. N., Downey, L., & Thiebaud, L. (2010). Bringing the polluters back in: Environmental inequality and the organization of chemical production. *American Sociological Review*, *75*(4), 479–504.

Gray, W. B., & Shadbegian, R. J. (2007). The environmental performance of polluting plants: A spatial analysis. *Journal of Regional Science*, *47*(1), 63–84.

Hall, B., & Kerr, M. L. (1991). *1991–1992 green index: A state-by-state guide to the nation's environmental health*. Island Press.

Hartmann, J., & Moeller, S. (2014). Chain liability in multitier supply chains? Responsibility attributions for unsustainable supplier behavior. *Journal of Operations Management*, *32*(5), 281–294.

Hoetker, G. (2007). The use of logit and probit models in strategic management research: Critical issues. *Strategic Management Journal*, *28*(4), 331–343.

Kandel, E., Kosenko, K., Morck, R., & Yafeh, Y. (2019). The great pyramids of America: A revised history of U.S. business groups, corporate ownership, and regulation, 1926–1950. *Strategic Management Journal*, *40*(5), 781–808.

Kassinis, G., & Vafeas, N. (2006). Stakeholder pressures and environmental performance. *Academy of Management Journal*, *49*(1), 145–159.

Kim, Y. H., & Davis, G. F. (2016). Challenges for global supply chain sustainability: Evidence from conflict minerals reports. *Academy of Management Journal*, *59*(6), 1896–1916.
King, A. A., & Shaver, J. M. (2001). Are aliens green? Assessing foreign establishments' environmental conduct in the United States. *Strategic Management Journal*, *22*(11), 1069–1085.
Konisky, D. M., & Woods, N. D. (2012). Measuring state environmental policy. *Review of Policy Research*, *29*(4), 544–569.
Li, X., & Zhou, Y. M. (2017). Offshoring pollution while offshoring production? *Strategic Management Journal*, *38*(11), 2310–2329.
Lynn, M. L. (2005). Organizational buffering: Managing boundaries and cores. *Organization Studies*, *26*(1), 37–61.
Matheson, J. (2009). The modern law of corporate groups: An empirical study of piercing the corporate veil in the parent-subsidiary context. *North Carolina Law Review*, *87*, 1091–1156.
Mayer, K. J. (2006). Spillovers and governance: An analysis of knowledge and reputational spillovers in information technology. *Academy of Management Journal*, *49*(1), 69–84.
Meznar, M., & Nigh, D. (1995). Buffer or bridge? Environmental and organizational determinants of public affairs activities in American firms. *Academy of Management Journal*, *38*(4), 975–996.
Mohai, P., Pellow, D., & Roberts, T. (2009). Environmental justice. *Annual Review of Environment and Resources*, *34*(1), 405–430.
Oliver, C. (1991). Strategic responses to institutional processes. *The Academy of Management Review*, *16*(1), 145–179.
Plater, Z., Abrams, R. H., Graham, R. L., Heinzerling, L., & Wirth, D. A. (2010). *Environmental law and policy: Nature, law, and society* (4th ed.). New York, NY.
Prechel, H. (2000). *Big business and the state: Historical transitions and corporate transformation, 1880s-1990s*. State University of New York Press.
Prechel, H. (2015). Organizational political economy and environmental pollution. *Sociology Compass*, *9*(9), 828–840.
Prechel, H., & Boies, J. (1998). Capital dependence, financial risk, and change from the multidivisional to the multilayered subsidiary form. *Sociological Forum*, *13*(2), 321–362.
Prechel, H., & Morris, T. (2010). The effects of organizational and political embeddedness on financial malfeasance in the largest U.S. corporations dependence, incentives, and opportunities. *American Sociological Review*, *75*(3), 331–354.
Prechel, H., & Touche, G. (2014). The effects of organizational characteristics and state environmental policies on sulfur-dioxide pollution in U.S. electrical energy corporations. *Social Science Quarterly*, *95*(1), 76–96.
Prechel, H., & Zheng, L. (2012). Corporate characteristics, political embeddedness and environmental pollution by large U.S. corporations. *Social Forces*, *90*(3), 947–970.
Ringleb, A. H., & Wiggins, S. N. (1990). Liability and large-scale, long-term hazards. *Journal of Political Economy*, *98*(3), 574–595.
Roe, M. J. (1986). Corporate strategic reaction to mass tort. *Virginia Law Review*, *72*(1), 1–59.
Schlissel, D., Peterson, P., & Biewald, B. (2002). *Financial insecurity: The increasing use of limited liability companies and multi-tiered holding companies to own nuclear power plants*. Synapse Energy Economics.
Scott, W. R. (1995). *Institutions and organizations*. SAGE Publications.
Shavell, S. (1986). The judgment proof problem. *International Review of Law and Economics*, *6*(1), 45–58.
Skilton, P. F., & Robinson, J. L. (2009). Traceability and normal accident theory: How does supply network complexity influence the traceability of adverse events? *Journal of Supply Chain Management*, *45*(3), 40–53.
Travis, A. (2019). The organization of neglect: Limited liability companies and housing disinvestment. *American Sociological Review*, *84*(1), 142–170.
Witting, C. A. (2018). *Liability of corporate groups and networks. International corporate law and financial market regulation*. Cambridge University Press.

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