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DOES TORT REFORM MATTER IN ENVIRONMENTAL  
OUTCOMES? AN EMPIRICAL INVESTIGATION

by Ross Marchand



The opinions expressed in this Graduate Policy Essay are the author's and do not represent official positions of the Mercatus Center or George Mason University.

**Abstract**

Since the early 1980s, states have enacted various tort reforms aimed at curtailing runaway litigation. In particular, states restricted caps on various damages awarded through the tort system and limited applicability of joint and several liability. Legal scholars have suggested that reigning in the tort system may increase harm by decreasing the consequences of wrongdoing by potential tortfeasors. A countervailing effect would arise, however, if eliminating joint and several liability encourages wealthy defendants to lower their payable damages by naming judgment-proof parties as co-defendants. To determine which effect prevails, I exploit state and year variation in tort liability rules to see if tort reform lowers the level of hazardous chemical emissions released by firms. Reform of joint and several liability is found to significantly reduce emissions, while punitive damage caps are found to increase emissions.

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## List of Acronyms

**ADA-** Americans for Democratic Action

**AFL-CIO-** American Federation of Labor and Congress of Industrial Organizations

**CERCLA-** Comprehensive Environmental Response, Compensation, and Liability Act

**EPA-** Environmental Protection Agency

**ERNS-** Emergency Response Notification System

**HRS-** Hazard Ranking System

**JSL-** Joint and Several Liability

**NAICS-** North American Industry Classification System

**NPL-** National Priorities List

**PRP-** Potentially Responsible Party

**SIC-** Standard Industry Classification

**TRI-** Toxic Release Inventory

## Introduction

In his widely cited primer on private property appearing in *The Concise Encyclopedia on Economics*, prominent economist Armen Alchian identifies a robust system of private property rights as “one of the most fundamental requirements of a capitalist economic system...” He notes, however, that the “definition, allocation, and protection” process of this right constitutes, “one of the most complex and difficult sets of issues that any society has to resolve.” While Alchian’s point can be made about a plethora of private property claims ranging from intellectual property to fishing rights, disputes are perhaps the most difficult to resolve in the realm of environmental law.

In the era preceding federal efforts to control particulates, property owners often took factory owners to court, in an attempt to gain the right to enjoy their land without nuisance (Meiners and Yandle, 1998). When attempting to abate their neighbors’ emissions, property owners would frequently allege a private nuisance tort, defined by the *Restatement (Second) of Torts* as “a nontrespassory invasion of another’s interest in the private use and enjoyment of land” (American Law Institute 1965). Plaintiffs have additionally relied on “trespass” tort suits if the party in question invaded the “plaintiff’s exclusive right of possession by engaging in an abnormally dangerous activity or intentionally or negligently entering the land of another” (Best and Collins 1982, 109). The tort allegation of choice has depended on the evidence available and the jurisdiction where the alleged wrong occurred; certain jurisdictions may accept a lower standard of evidence for trespass tort allegations.

Regardless of the specific type of wrong alleged by the plaintiff, though, property owners have repeatedly absorbed large litigation costs to keep their land undisturbed by

noxious fumes over the past four hundred years. Typically, successful plaintiffs have been awarded payments, known as *damages*, from the defendants to compensate for the wrongdoing of the defendants. Orders from the court to cease industrial activity associated with the tort, known as *injunctions*, have also been issued if the judge deems this strong remedy to be sufficiently necessary. This paper will examine attempts to curtail this litigation-based system of pollution abatement, and examine the impact of these reforms on incentives to pollute.

In Section I, I describe the machinery of the tort system, and discuss how these “tools” diminished in importance with the advent of federal environmental protection efforts and state-level tort reforms. These reforms have targeted liability apportionment and award sizes, respectively through the alteration of joint and several liability and imposition of damage caps. Whether various tort reforms incentivize wrongdoing by lessening the threat of litigation has been explored in empirical analyses and law journal articles. This literature, which mainly examines the effect of tort reforms on the behavior of medical practitioners, is analyzed in **Section II**. There is a gap in the literature as to how tort reform impacts pollution, with the exception of contaminated land cases overseen by the EPA’s Superfund program. I review how the choice of tort rules in this federal litigation program influences pollution management decisions at the firm level in **Section III**. I examine state-level tort reforms and pollution data in **Section IV**, and use a fixed-effects model to determine the impact of tort reform on pollution abatement. I find that reform of joint and several liability is associated with a large, statistically significant reduction in firm releases of hazardous waste, as discussed in **Section V**. **Section VI** includes conclusions and recommendations.

## **I. An Overview of the Tort System**

The operation of tort law largely depends on the liability structure set up by different states. In areas of the law not preempted by federal statute, states have the power to dictate how blame is shared and allocated in the payment of damages, as well as the maximum amount of allowable damages that a court can order a party to pay. Under the joint and several liability doctrine, defendants found to have even a small share of the blame for a misdeed can be found to be wholly responsible. Even a proximate polluter can be found monetarily responsible for the entire amount of damage spurred by the pollution; the rule “minimizes accountability because there is no direct relationship between actual responsibility and potential liability” (Heartland Institute, 1994: 5). Joint and several liability has functioned as the prevailing rule since the emergence of the tort system in 17th century England, and continues to be the default rule in many pollution tort cases (Meiners and Yandle 1998). An increasing number of US states, however, have implemented proportionate liability reform in the past thirty years. Under the proportional liability doctrine, liable damage is capped at the proportional share of blame that is allotted in the courtroom.<sup>1</sup> A large number of states have also moved to limit the various types of damages an unsuccessful defendant can be ordered to pay. Punitive damage caps have been a particularly popular legislative reform item for states over the past thirty years. Punitive damages are used to deter tortfeasors’ bad behavior, if other damages

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<sup>1</sup> The most recent, comprehensive survey of states by type of apportionment law was conducted by attorneys-at-law Matthiesen, Wickert, and Lehrer (2016). The survey, current as of July of 2016, shows 8 states with pure joint and several liability, 14 states with proportional liability, and 28 states with modified joint and several liability. For the purpose of my analysis, however, modified joint and several liability operates the same as proportional liability in nearly all cases. Typical modified systems include joint and several liability when defendants were acting in concert, and/or limit joint and several liability to medical malpractice claims.

awarded (compensatory damages) at the trial are deemed insufficient to incentivize a change in conduct.

Punitive damages are particularly important in the context of environmental law. Here, the importance of deterrence is especially large; many polluting firms would be fine paying a small amount of damages in perpetuity if they could continue emitting hazardous waste. In *Boomer v. Atlantic Cement Co.* (1970), New York property owners alleged that a neighboring concrete plant's smoke emissions and vibrations constituted a nuisance. The New York Court of Appeals, however, denied the property owners' request for a permanent injunction and decided against punitive damages to deter the offending activities of the concrete plant. Instead, they reasoned that if the firm paid "permanent damages to [the] injured property owners," there might be an incentive down the line for the firm to develop sufficient abatement technology. In rejecting harsher measures, the Court noted that tort law has limited applicability in solving underlying environmental issues. In the Court's opinion, pollution abatement "is a direct responsibility for government and should not thus be undertaken as an incident to solving a dispute between property owners and a single cement plant..." (Ibid.).

The New York Court of Appeal's dismissal of the tort system's ability to protect property owners against polluting firms was symptomatic of growing federal intervention into environmental matters. Just eight years prior, Congress had passed the Clean Air Act,<sup>2</sup> which established federal authority to set emissions standards for "fixed sources" of potential contamination (ie., factories, underground storage tanks) and use inspections to monitor compliance with said standards. Successive amendments to the Clean Air Act

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<sup>2</sup> Public Law 88-206, U.S. Statutes at Large 77 (1963), 392.



would set state-level emission standards, establish special rules for areas deemed to have particularly poor air quality, and create programs designed to target specific pollutants such as sulfur dioxide. The Clean Water Act,<sup>3</sup> signed into law in 1972 by Congress, creates a parallel regulatory program in the design and maintenance of water quality standards. These new regulatory powers were entrusted to the Environmental Protection Agency (EPA), formed in 1970. While these programs sought to preemptively end hazardous emissions before civilians and property owners could be adversely affected, one EPA program incorporates the tort system mechanism of litigation. The Comprehensive Environmental Restoration of Contaminated Land Act of 1980 (CERCLA),<sup>4</sup> better known as *Superfund*, enabled the EPA to sue land owners suspected of contaminating their properties with hazardous substances that could harm future property owners or neighbors. As I will discuss in the next section, the EPA's imposition of strict, joint and several liability in the Superfund program led to multiple problems in fulfilling Superfund's contamination abatement goals.

Concurrently with the rise of federal statutes, a large uptick in litigation forced states to rethink unlimited damages and joint and several liability. A growing share of economic output being devoted to addressing litigation costs arising from tort suits meant that business-owners, doctors, and real estate developers had to fear pollution, medical malpractice, and asbestos suits respectively. State legislatures, weary of successive waves of litigation, passed successive rounds of tort reform to defray key features of the system. In recounting the history of reforms, legal scholar Joseph Sanders (2006: 510) attributes the initial wave of tort reform in the mid-1980s to a "hard insurance market," though he

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<sup>3</sup> Public Law 92-500, U.S. Statutes at Large 86 (1972), 816.

<sup>4</sup> Public Law 96-510, U.S. Statutes at Large 94 (1980), 2767.

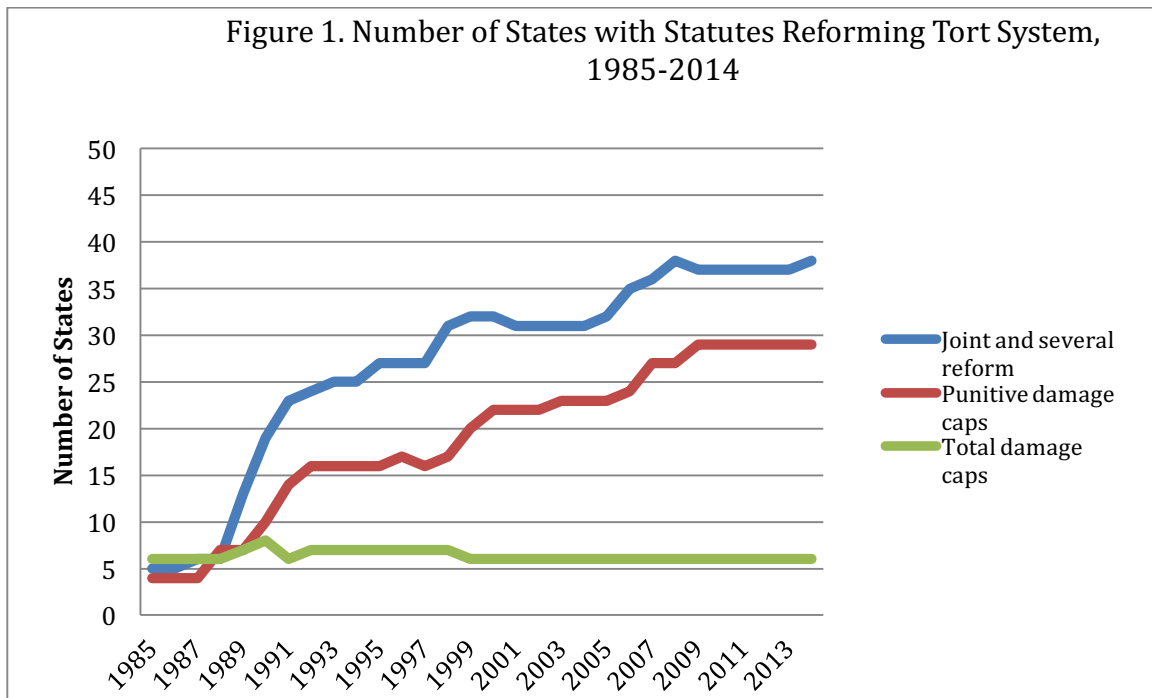
concedes, “the relationship between the tort system and hard insurance markets has been hotly contested over the years.” In an unpredictable litigation environment characterized by large potential damages, liability insurers fear they can be rendered unprofitable by a group of policyholders suddenly facing damages and subsequently filing insurance claims. To compensate for this large, perceived risk, insurers sharply increased their premiums in the 1970s and 1980s and reduced offerings. Legal scholar J. Stanley Edwards (2015: 444) recounts how “rising liability premiums” experienced by manufacturers starting in the 1970s and the cancellation and refusal by insurers “to reissue policies held by high-risk policyholders” in the 1980s increased the momentum for reform. States with Republican legislatures led the reform effort, while Democratic states largely resisted efforts to curtail the tort system. Efforts to regulate litigation fell along partisan lines, with Republicans acting to defray a major cost threatening the solvency of corporations and insurance companies, and Democrats resisting attempts to threaten the legal profession.<sup>5</sup> In the early to mid-2000s, renewed attention to the proliferation of litigation, coupled with a string of Republican electoral victories led to another wave of tort reform. Figure 1 tracks the implementation of punitive damage caps and joint and several liability reforms since the early 1980s. By 2012, 37 states had significantly modified or abolished joint and several liability, while 29 states had implemented punitive damage caps. Only six states have enacted a cap on *total* damages, owing to the large concentration of the costs of such a move on the legal profession.<sup>6</sup>

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<sup>5</sup> See, for example, Leonhardt 2009.

<sup>6</sup> As legal scholar Todd Zywicki (2008: 1) notes, “The riches transferred through the tort system draws talented youth into law schools to become tort lawyers (both plaintiff and defense), thereby drawing them away from more highly-valued social uses.” Drying up damage awards through the imposition of total damage caps completely disrupts these opportunities in the legal market, leading to widespread opposition to these reforms from industry participants.

**Figure 1.** Number of States with Statutes Reforming Tort System, 1985-2014



Source: R. Avraham, “Database of State Tort Law Reforms (5th),” (2014).

## II. A Review of the Literature

Have these reforms increased incentives for tortfeasors to commit acts of wrongdoing?

Classic intuition and economic theory suggests so. Decreasing the expected cost of engaging in a tortious action is likely to encourage tortious behavior, all else equal.

Prominent law and economics scholar George L. Priest (1991: 31) explained the initial popularity of the unrestrained tort system as “the acceptance by judges of a set of ideas—some economic in nature—implying that the more extensive [product and service] liability would simultaneously reduce the accident rate and help the poor.” Although there is little

literature directly addressing the effect of proportional liability reforms and punitive damage caps on environmental outcomes, there are multiple studies addressing related issues. Al Ringleb and Steven Wiggins (1990) examine if an increase in liability laws in the late 1960s allowing workers to easily sue employers for hazardous chemical exposures led to greater increases in the number of small firms specializing in hazardous production processes. Firms in the manufacturing industry often have high-exposure activities which can be separated from low-exposure activities that carry little risk of litigation. The authors hypothesize that, when the cost of exposing all firm assets to litigation exceeds the cost required for reorganization, firms splinter into “hazardous” production firms and “safe” production firms in order to safeguard assets from litigation exposure. Ringleb and Wiggins test this by examining how state reforms that relaxed the evidentiary burden for plaintiffs seeking workers compensation impacted the entry rate of small firms in “hazardous industries.” Using 1950s-1970s firm data and liability dummies covering the same period, they conclude that small business entry is encouraged by pro-plaintiff liability reform; the laws “have led to roughly a 20 percent increase in the number of small (“hazardous”) corporations in the US economy” (Ringleb and Wiggins, 1990: 589). The authors use their regression results to affirm their hypothesis, though they concede that other reforms that went along with worker compensation liability reforms may have an impact on small firm entry rates as well. They note that “judicial experiments” in joint and several liability at the time “reduced barriers to worker recovery” (Ringleb and Wiggins, 1990: 582). If expansion of joint and several liability has an effect on small firm entry rates, than there are omitted liability variables that are skewing the results. Ringleb and Wiggins limit their analysis to small firm entry; they do

not attempt to identify the impact of liability rules on outcomes (ie. worker exposure to carcinogens).

In contrast, Currie and MacLeod (2008: 795-830) focus on the link between liability reforms and harm abatement. The researchers compile data on various tort reforms undertaken in the 1989 to 2001 period, and test whether these reforms increase complications related to birth and delivery. While caesarian sections (C-sections) can increase safety relative to natural births if the risk of natural birth is high, the procedure is likely riskier for the average delivery than natural birth. Thus, for the doctors, incentives aligning choice of procedure with patient safety would decrease C-section rates for non-high-risk pregnancies. If doctors do not expect to be penalized for complications related to C-sections, they are more likely on the margin to increase unnecessary use of the procedure. As journalist Melanie Plenda (*The Atlantic*, 2014) points out, doctors often cite C-sections as more convenient than regular births, and federal reimbursement rates are considerably higher. Currie and MacLeod find that, consistent with intuition, enacting punitive damage caps “increase[s] procedure use, and hence cost” (2008: 826). Joint and several liability (JSL) reform, however, “reduces C-sections, and complications of labor and delivery” (Ibid.). The authors theorize that since “JSL reform causes physicians to take more care due to an alignment between liability and harm, fewer inappropriate C-sections are being performed when joint and several liability is modified or abolished” (Ibid.).

In examining how tort reform impacts ER death rates for accidental injury hospital admissions, Carvell, MacLeod, and Currie (2012: 51-77) obtain a similar result. The researchers examine joint and several liability reform, punitive damage caps, and

collateral source rule reform, but find that only joint and several liability reforms have any impact on death rates. In contradiction of the standard narrative, Carvell et al. conclude that eliminations of joint and several liability increase “the level of care taken, so that the incidence of important categories of fatal accidents is reduced” (2012, 74). None of the other reform variables had a statistically significant impact on death rates.

In attempting to explain why joint and several liability reform exclusively appears to increase the level of care taken by physicians, the researchers theorize that adapting proportionate liability reform encourages hospitals to name physicians as co-defendants in medical malpractice suits. Carvell et al. argue that the initial choice of the plaintiff of whom to sue differs under joint and several and proportionate liability. The former encourages lawsuits targeting financially deeper pockets, as they will have a greater likelihood of being able to pay damages. The latter encourages plaintiffs to sue firms with a greater degree of culpability regardless of size. Under joint and several liability, the initial, wealthy defendant (the “deep pocket”) has little incentive to name smaller, judgment proof (ie. financially insolvent) parties as co-defendants. Even if the court finds that these smaller parties are responsible for a share of the blame, the inability of these insolvent players to pay for their damages share will still result in the wealthy defendant footing the entire bill. Under proportionate liability, however, wealthy defendants can reduce their damages bill even if these responsible, smaller co-defendants are unable to pay their share of damages. Wealthy defendants have an incentive to find and name other responsible parties under proportionate liability, but not under joint and several systems. Due to plaintiffs’ decisions over who to sue and the defendants’ subsequent actions, judgment-proof parties (ie. physicians) are less likely to be brought to

court under a joint and several system. This is likely to result in a lower standard of care, and in the case of Carvell et al.'s research, higher death rates in the ER.

Carvell et al.'s judgment-proof theory offers a potential explanation for their research finding, but may not be supported by the data presented. When faced with an uncertain liability environment, physicians often resort to "defensive medicine" in which unnecessary procedures are ordered to avoid litigation. Despite reducing the risk of lawsuits, however, these procedures may in fact result in worse outcomes. The gulf between this perception and the actual riskiness of the practice, which the authors focus on, leads to an uncertain interpretation of the results. Doctors may perform less C-sections, for example, if they perceive *less* of a litigation threat rather than more, as suggested by the authors.

If the authors' judgement proof theory is correct, we would expect to see the result hold in situations outside of the medical sector. If judgment proof parties are not deterred from tortious activities under joint and several liability, we should expect to see manufacturing and mining firms investing little resources into pollution abatement. In these sectors there is no real analogue to "defensive medicine;" risk of litigation is more closely tied to harmful outcomes. Proportionate liability reform should then incentivize pollution abatement by these firms.

### **III. Superfund: A Case Study in Liability Structure**

While there is little research on the link between tort reform and environmental outcomes, much has been written on the incentive effects of the Superfund program. As mentioned previously, Superfund legislation was passed in the early 1980s to deal with land contaminated by toxic waste. If a site is abandoned and suspected to be

contaminated, the EPA conducts a toxicity analysis to examine if the site is above the “acceptable” threshold of safety. This Hazard Ranking System (HRS) test ranges from 0 (least toxic) to 100 (most toxic), and if a site meets or exceeds a score of 28.5, the case is put on the National Priorities List (NPL). At this stage, the EPA attempts to seek out potentially responsible parties (PRP), who can be former or current owners of the site, or alternatively a party culpable in the storage or dumping of hazardous material on site premises.

In litigating these parties, the EPA uses joint and several liability. Often, one party will be given notification that sufficient evidence has been compiled against them, and it has been determined that they are responsible for at least some share of the site’s contamination. It is then up to the accused firms to either go into court with the expectation of full liability if found guilty, or seek out other responsible parties and legally seek contribution for any possible pollution damages. A firm put on the PRP list can hire an investigator to compile evidence implicating other pollution parties, and use the evidence in court to force a more equitable sharing of the liability stemming from the contamination. The entire process of PRPs getting other PRPs to accept their portion of liability results in a tangled web of litigation, disputes and stalling. Hedeman et al. (1991: 10420) describes the messiness of the situation: “In identifying PRPs, EPA incurs substantial upfront costs. In turn, these PRPs spend more money on lawyers and consultants to find other PRPs. The universe of PRPs then spends huge sums on lawyers and consultants to negotiate who should pay what, a process that results in numerous studies and data searches as companies try to document their own and others’ contributions to the waste.” If a party is small enough to be judgment-proof, however,



naming that party as a fellow PRP will fail to reduce the liability of the initial, often larger PRP.

Moreover, even if an initially-named, large firm is able to successfully name other defendants that are not currently judgment-proof, the firm with deep pockets still has every reason to worry about being straddled with an outsized portion of the contamination liability. Smaller PRPs can detach themselves from the liability through the bankruptcy process. Thus, in situations where PRPs consist of only a few large, publicly traded firms alongside smaller parties, the large firms will often bear the full liability. Harper et al. (1996: 114) refers to this as the “deep pockets” approach to assessing liability, and empirically tests whether high-asset, publicly listed PRPs stand to lose the most from joint and several liability. The authors seek to identify Superfund situations that result in large, abnormal returns to market capitalization, and find that, “For sites where only a few publicly owned (i.e., deep pocket) firms are named along with relatively more privately owned firms, returns to the publicly owned firms are lower, for a given expected remediation cost” (Ibid.: 114). Harper et al.’s finding suggests that smaller, judgment proof parties are not bearing the brunt of Superfund’s joint and several liability regime. Irrespective of the deep-pocketed firms’ share of the blame, they are likely to face the entire damages bill even if they incur the substantial upfront cost associated with naming co-defendants.

In order to discourage arrangements resulting in “unfair” distributions of liability and decrease the transaction costs associated with PRP negotiations, the EPA has encouraged PRPs to organize into intra-PRP bureaucracies as a forum for the firms to collectively negotiate with the EPA. Yet, as legal scholar Jerome Organ points out, firms

“holding out” from joining these collective settlement vehicles have little incentive to join the settling firms. The firms cooperating with the EPA will have to endure a “disproportionate responsibility for orphan share liability as well as the transaction costs of pursuing recovery from recalcitrant PRPs,” resulting in little incentive to cooperate (Organ 1994: 1063-1064).

Since the 1980s and early 1990s, however, a series of court decisions have modified the joint and several liability structure of Superfund into a system that more closely resembles proportionate liability. In *United States v. Alcan Aluminum Co.* (1992), manufacturing firm Alcan sought to reverse the EPA’s decision to name it as a PRP for its alleged role in the contamination of a waste site in Oswego County, New York. Although the EPA used Alcan’s contribution of heavy metals and polychlorinated biphenyls as a justification for inclusion into a Superfund suit, Alcan countered that the level of contamination created by their waste was miniscule and in terms of toxicity was “really just like homogenized milk” (Ibid.). By using evidence about the toxicity of their industrial byproduct, Alcan aimed to absolve itself of any liability related to the Oswego contamination.

This strategy proved unsuccessful, even upon appeal; the Second Circuit Court of Appeals found Alcan to be a PRP (*United States v. Alcan Aluminum Co.*, 1992b). In a departure from the joint and several liability framework, the court found that a defendant could successfully “present evidence relevant to establishing divisibility of harm” by delineating “relative toxicity, migratory potential, and synergistic capacities of the hazardous substances at the site” (Ibid.). This finding was echoed in a similar court case, *United States v. Alcan Aluminum* (“Alcan-PAS”) (1993), pertaining to the same

company's activities at a different location. As in the case a year prior, the court found Alcan to be a PRP for contamination at a waste site, but held that the corporation could force the government into apportioning liability through "intensely factual" arguments about the magnitude of their contribution to the waste.

The successive Alcan cases led to findings of the *theoretical* possibility of apportionment, but it would take the case of *Burlington Northern and Santa Fe Railway Co. et al. v. United States et al.* (2009) to trigger apportionment amongst responsible parties. In the lead-up to the case, agricultural chemical distributor Brown & Bryant (B&B) spilled pesticides while relabeling the products and preparing them for shipments. The EPA, in seeking to recover remediation costs from the resulting ecological damage, named B&B to be primarily responsible for the contamination. Upon that corporation's bankruptcy, however, the EPA named Burlington Northern and Santa Fe Railway Co. as PRPs. Both railroad companies had owned part of the distribution facility where the contamination took place, and were thus held joint and severally responsible for the contamination. The railroad companies argued that joint and several liability was not appropriate in this case, since a large portion of the remediation cost stemmed from contamination that did not occur on the railroads' portion of the land.

The district court and Supreme Court ultimately concurred with the defendants, and allotted 9% liability to the railroad companies. The majority opinion found that "CERCLA did not mandate 'joint and several' liability in every case," and emphasized that there was a "reasonable basis" for apportionment based on the evidence presented (Ibid.). Judicial rulings in favor of apportionment had the potential to permanently disrupt the EPA's preferred Superfund strategy of going after deep-pocketed firms regardless of

those firms' share of responsibility for contamination. Shortly after the *Burlington* case, legal scholar Michael Foy (2011: 29) remarked how the decision "has the overall effect of ameliorating the harsh results inherent in joint and several CERCLA liability" that results in "unfair targeting of defendants with deep pockets." Duquesne legal academic Aaron Gershonowitz (2012: 83-124) argued similarly about the significance of the precedent set by *Burlington*; he argued that in the aftermath of the decision, "joint and several liability in CERCLA actions will become the exception and not the rule."

Despite the assertions of these scholars, Superfund cases in the wake of *Burlington* have generally not resulted in apportionment. Environmental and legal scholar Ryan Brady (2014) examines seven CERCLA-related lower court cases that occurred between the *Burlington* case and mid-2015, and finds that apportionment requests by defendants were not granted in any of them. In *Pakootas v. Teck Cominco Metals, LTD* (2012), a case involving river contamination, the defendant firm cited an analysis of the riverbed and documented its volumetric contribution to the waste in order to argue that they should only pay a fraction of damages. This, however, was not sufficient for the court to allow for apportionment; the court faulted the firm for not analyzing how different chemicals comingled with one another to produce the environmental harm. In this case, along with the others presented by Brady, the high standard for apportionment used by the courts represents a continuation with the pre-*Burlington* status quo.

Although the joint and several liability structure of CERCLA has largely persisted since the early 1980s, state-led Superfund programs have changed considerably over time. These mini-CERCLAs, which represent state-level attempts to compel responsible parties to clean up contaminated areas, have proliferated since the mid-1980s. According

to annual Environmental Law Institute (ELI) (1989; 2002) reports on the structure of these programs, states with joint and several CERCLA rules increased from 14 in 1989 to 36 in 2001. Alberini and Austin (2001: 92-115) exploit this state-level shift in liability structure to examine how changes in liability structure affect environmental outcomes. Using a slightly older dataset (1987-1995) than that presented by ELI, the scholars use accidental spills of contaminants recorded by the EPA using the Emergency Response Notification System (ERNS).

While Alberini and Austin (2001: 100) do not include joint and several liability as a dummy variable, they do include a dummy variable for strict liability. In examining the variation of state Superfund programs, however, strict liability is almost always adopted with joint and several liability; because of this, the authors argue that the different liability rules, “can be collapsed to a simple binary model describing just the presence or absence of strict liability.”

Running a state fixed-effects model, they find that the strict liability states (often with joint and several liability) have “greater spill severity and frequency...associated with smaller production units (our proxy for firms with fewer assets)” (Ibid.: 110). This relationship was not found in negligence liability states, suggesting that a feature of *either* strict liability or joint and several liability was causing the small firms to increase environmental contamination. The authors theorize that, when strict liability legislation is signed into law, large firms react to the increased risk of accident-based litigation by spinning off into smaller, judgement-proof firms. This explanation is consistent with the results, but neglects any consideration of joint and several liability rules. It is also possible that joint and several liability gives small firms less incentive to avoid

environmental contamination due to the decreased probability of those firms being named as a defendant in the event of litigation.

To determine which explanation is correct, the state-fixed effects model used by Alberini and Austin should be expanded beyond Superfund cases to general environmental torts filed by individuals and groups. Although state Superfund rules dictate a strict/negligence standard *and* a joint and several/proportional standard, general state liability rules only prescribe the latter. If a generic environmental lawsuit by a property owner is successfully brought against a manufacturing firm, the apportionment rule will be determined by state law, but the strict/negligence standard will be decided by the individual court. Thus, by examining variation in liability rules that govern the broader state tort systems and using a longer time period, the results can differentiate between strict liability rules and joint and several rules by excluding the former.

I hypothesize that, all else equal, modifications and eliminations of joint and several liability will deter hazardous emissions from mining and manufacturing firms. In contrast, punitive damage caps will conform to standard economic theory and increase these hazardous emissions.

#### **IV. Data and Empirical Strategy**

In analyzing the impact of tort reform on environmental contamination, I make use of state-level variation in reforms and hazardous emissions to construct a state and year fixed effects model. In this construction, however, the selection of the dependent variable is fraught with difficulty. If I mine the EPA's data for pollution levels by year, area, and type of pollutant, no single pollutant stands out as the obvious candidate for analysis. Pollutants that have triggered nuisance suits vary widely by place and time. Since the

ideal dependent variable will be relevant to a broad cross-section of common law cases *and* federal enforcement actions, settling on any particular pollutant threatens to weaken the internal validity of the analysis.

The EPA’s Toxic Release Inventory (TRI) offers a cross-sectional look at emissions of environmental contaminants deemed to be harmful to human health. The EPA continually revises its list of chemicals deemed to cause “cancer or other chronic human health effects,” “significant adverse acute human health effects,” and/or “significant adverse environmental effects” (EPA 2015). At the time of writing, there are 594 chemicals on the list. If a facility has ten or more full time employees, manufactures and/or uses a TRI chemical, and operates in a TRI-reportable industry,<sup>7</sup> it must submit a TRI report for each relevant chemical with emissions exceeding the allowable “safe” threshold. Releases are measured in pounds, and are provided at the state level starting from 1991.

To see how these TRI emissions change with respect to different reforms, I use joint and several liability modifications/eliminations as an independent treatment variable. I code the introduction of punitive damage caps as another independent variable. The imposition of a total damage cap would also be a worthwhile tort reform to explore, but all total damage caps since 1991 have related exclusively to medical liability. Thus, I limit our examination to joint and several liability reform and punitive damage caps.

Tort reform data for 49 states in Avraham’s *Database of State Tort Law Reforms* (5<sup>th</sup>) is analyzed for the 1991 to 2012 period via the statistical software package R.<sup>8</sup> Data from Louisiana is omitted, due to Louisiana’s unique status as a civil law state as opposed

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<sup>7</sup> TRI covers: mining, utilities, manufacturing, various wholesaling, publishing, and hazardous waste.

<sup>8</sup> <https://www.r-project.org/>

to a common law state. Aforementioned tort remedies such as nuisance and trespass suits do not exist; lawsuits are only launched as a result of a breach in legislative statute.

I variously lag the joint and several liability reform and punitive damage cap dummies by 2 and 3 years. This allows for the relevant players in the game to fully realize the changes in legal structure following tort reform, and to incorporate this knowledge into their decision-making. As a causality check, I also include lead variables for these tort reforms. I check whether, all else equal, tort reforms 2 and 3 years *in the future* are associated with decreased hazardous emissions.

In the fixed-effects model, I also include controls, such as state-level measures of wealth, economic activity, and state government ideology. To measure wealth, per-capita personal income figures by state and year were obtained from the Bureau of Economic Analysis (BEA). Additionally, poverty rate data by state and year was obtained from the U.S. Census Bureau. I also controlled for the presence of manufacturing in certain states, as a state's dependence on manufacturing can exert a large influence on the dependent variables even absent the treatment variable. To arrive at this variable, I used BEA data on state-level employment data by industry classification code; the North American Industry Classification System (NAICS) was used for data from 1997 through 2012, while Standard Industry Classification (SIC) was used for pre-1997 data. Both classification systems, however, contain job totals under the "manufacturing" classification, as well as a more general job count under the "private non-farm employment" classification. Dividing the former by the latter provides us with a crude, albeit useful, way of comparing manufacturing intensity across the states and across time.



Finally, a state government ideology control variable is adapted from Berry et al. (2010). The authors propose that interest group ratings of state legislators provide a more useful way of examining state government leanings than a simple distribution of Republicans vs. Democrats. They thus take interest group scores from Americans for Democratic Action (ADA) as well as from the American Federation of Labor and Congress of Industrial Organizations (AFL-CIO) and the Committee on Political Education (COPE) to construct closely related ideological scores for state legislators in each given year. The scores are then averaged, providing a score for each state by year. For both the ADA and COPE measures, there is a 0-100 continuum, where a score of “100” would indicate full agreement with the position of the interest groups. Since these interest-groups would be classified as heavily “progressive” in the U.S. sense of the word, states that lean to the left will tend to receive high scores for both of these variables, while states to the right will receive scores approaching zero. The regressions used in this analysis (“Regression (1)”) are run using the ADA measure, but substituting out the ADA measure for the COPE measure made negligible difference in any of the regression results. Whereas the dependent variable is the logarithm of releases (divided by the number of facilities for that state and year), the tort reform dummy variables and interaction are both lagged and lead by 2 and 3 years, and state and year effects are controlled for. The formalized equation is as follows:

$$\begin{aligned}
 \ln(TR)_{st} = & \beta_0 + \beta_1 JSLR_{st-X} + \beta_2 PDCAP_{st-X} + \beta_3 Perincome_{it} + \beta_4 Povrate_{it} \\
 & + \beta_5 Manuemploy_{it} + \beta_6 Stateideology_{it} + \beta_7 YEAR_t + \beta_8 STATE_i \\
 & + \beta_9 STATE_i * YEAR_t + \beta_{10} X_{st} + \varepsilon_{st}
 \end{aligned}$$

Although this state fixed-effects model can show an industry-wide response to the independent variables, there is no way to determine if firms are reacting differently based on the size of the firm. Although the EPA does not give any proxy for firm size in the TRI, the U.S. Census Bureau's Statistics of U.S. Businesses reports firm entry, exit, and employment growth figures by firm size, industry, and state. If a proportional liability system entails an increase in marginal cost for small firms in pollution-intensive industries but not large firms, changes in small firm entry, exit, and growth into larger firms may result.

Regression (2) uses a state-fixed effect model to determine how changes in liability rules change the behavior of firms listed under the North American Industry Classification System (NAICS) (1997-2012) "manufacturing" categories and Standard Industrial Classification (SIC) "manufacturing" categories (1992-1996). As in Regression (1), there are controls for state ideological scores, poverty rate, per-capita income, and manufacturing intensity. The regression equation is as follows:

$$\begin{aligned} \ln(\text{Entry})_{st} = & \beta_0 + \beta_1 \text{JSLR}_{st-x} + \beta_2 \text{PDCAP}_{st-x} + \beta_3 \text{Perincome}_{it} + \beta_4 \text{Povrate}_{it} \\ & + \beta_5 \text{Manuemploy}_{it} + \beta_6 \text{Stateideology}_{it} + \beta_7 \text{YEAR}_t + \beta_8 \text{STATE}_i \\ & + \beta_9 \text{STATE}_i * \text{YEAR}_t + \beta_{10} X_{st} + \varepsilon_{st} \end{aligned}$$

This regression is similar to the aforementioned model by Ringleb and Wiggins (1990), in that the relationship between liability structure and small firm entry is examined. I supplant their analysis, however, by also examining the response of large manufacturing firms. If the authors' proposed mechanism of large firms strategically folding into smaller firms is correct, we should expect to see proportional liability associated with greater small firm exit and greater large firm entry. If, however, Carvell

et al.'s "judgment-proof" theory is correct, the marginal cost of operating as a small firm in a hazardous industry will increase under proportional liability with theoretically ambiguous results for large firms. "Deep pocket" firms may be found responsible for a high percentage of the liability regardless of contribution to the harm, meaning that the marginal cost of a large firm operating in a hazardous industry may increase, decrease, or stay the same depending on the firm's activities.

## V. Results and Discussion

**Table 1.** Results of Regression (1)

Ln (Releases Per Facility)				
	X= -3	X= -2	X =2	X = 3
<b>Joint and Several Reform, Enacted X Years Ago</b>	.068 (.082)	0.063 (.078)	-0.143 (.074)	-0.163* (.073)
<b>Punitive Damages Cap, Enacted X Years Ago</b>	.090 (.078)	0.164 (.075)	0.421*** (.071)	0.479*** (.070)
<b>Constant</b>	12.21*** (.389)	12.14*** (.386)	12.62*** (.404)	12.67*** (.401)
<b>Observations</b>	1029	1029	1029	1029
<b>R<sup>2</sup></b>	.024	.024	.033	.033
<b>Control Variables?</b>	YES	YES	YES	YES
<b>Fixed Effects?</b>	YES	YES	YES	YES

Notes: \*p < .05; \*\*p < .01; \*\*\*p < .001

The results outlined in Table 1 suggest that both joint and several liability reform and punitive damage caps are associated with large, statistically significant percentage changes in TRI releases per facility. The signs, however, are opposite from one another; joint and several reform appears to deter pollution while punitive damage caps incentivize tortious activities. These variables and the interaction terms have statistically

insignificant coefficients when they are lead variables, suggesting that reforms precede the decline in releases per facility. Lags and leads of one year were also regressed on the logarithm of releases per facility, but both turned out to be insignificant. If the model is correctly specified, the insignificance at X=1 coupled with the significance at X=2 and X=3 may mean that the relevant players (ie. potential defendants) take time to learn the new “rules of the game” after the enactment of tort reform, and adapt accordingly around the X=2 mark.

Additionally, the control variables move in largely predictable ways. The per capita income and state government ideology variables have negative, statistically significant signs (<0.1% level), suggesting that high-income states and left-of-center states tend to reduce their emissions at a faster rate, all else equal. The variable tracking the share of employment devoted to manufacturing appears strongly positive, although this is not entirely intuitive since the dependent variable is measuring releases *per facility*. It is probable, however, that a de-industrialization of a state economy frees up scarce state inspection resources to monitor a diminished base of manufacturing firms, increasing incentives for these firms to keep emissions under control. Also, in the event of pollution suits launched by private individuals and state governments, a smaller base of manufacturing firms means that less resources need to be devoted to tracking down the culprit and identifying co-defendants. Further research, however, is needed to examine these possibilities.

These initial results are consistent with Carvell et al.’s (2012) speculation that joint and several liability reform deters negligence and wrongdoing by increasing the number of firms likely to be litigated if tortious acts are committed. They also suggest

that punitive damage caps behave in a way consistent with basic economic theory; decreasing the potential costs of wrongdoing will tend to increase wrongdoing.

The results are limited by the absence of a variable to control for state-level environmental agency inspection and fining capacity. State government ideology is a crude indicator, though Shimshack and Gray (2011) note that “red” states tend to have significantly less environmental monitoring and sanctioning than blue states. Additionally, the data is at the state-level and is thus highly aggregated. Firm-level evidence would be preferable, which I am currently in the process of gathering for further and continued research. Once firm-level evidence is gathered for future research, I can pair firm-level emissions data with revenue data, and see if firms likely to be judgment proof are the most likely to reduce emissions in the aftermath of tort reform. In the absence of this data, I take the logarithm of small manufacturing firm entry and exit incidence and regress it on the same tort reform dummy variables as before, with the same controls of state government ideology, per capita income, manufacturing employment as a percentage of all employment. To determine if small manufacturing firm trends were unique, large manufacturing firm entry and exit incidence were also used as dependent variables.

**Table 2.** Results of Regression (2)

Ln (Small Firm Entry)				
	X= -3	X= -2	X =2	X = 3
<b>Joint and Several Reform, Enacted X Years Ago</b>	-.014 (.022)	-.017 (.021)	-.036 (.020)	-.046* (.020)
<b>Punitive Damages Cap, Enacted X Years Ago</b>	-.027 (.021)	.022 (.020)	0.025 (.019)	.017 (.019)

<b>Constant</b>	5.39*** (.162)	5.39*** (.161)	5.36*** (.159)	5.38*** (.158)
<b>Observations</b>	958	958	958	958
<b>R<sup>2</sup></b>	.135	.136	.151	.152
<b>Control Variables?</b>	YES	YES	YES	YES
<b>Fixed Effects?</b>	YES	YES	YES	YES

Notes: \* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$

Regression (2) shows a statistically significant, negative relationship between proportionate liability reform and small firm entry. This relationship attains statistical significance beginning three years after reforms are passed into law; the lead variables are insignificant. Ringleb and Wiggins' (1990) "firm spin-off" theory is tested by regressing large firm entry and exit on liability rule changes, but no significant relationship is found. These results are consistent with Carvell et al.'s (2012) judgment-proof theory of harm abatement; the incentive effects seem clustered around small manufacturing firms. In contrast to Regression (1), the coefficient on the punitive damage cap dummy is not statistically significant for the years following reform. These conflicting results suggest that punitive damage caps may reduce pollution on the intensive margin, whereas proportionate liability reform has an extensive marginal impact. This provides additional support to Carvell et al.'s interpretation, since judgment proof firms are only concerned about the costs of being brought to trial and not damage payments. In this model, damage caps would not affect small firm entry decisions on the margin. In contrast, Ringleb and Wiggins' model suggests that damage caps would decrease the desirability for large firms to spin off into smaller firms.

## **VI. Conclusion**

Proportionate liability reforms are strongly associated with a decrease in chemical emissions deemed hazardous by the EPA's Toxic Release Inventory. In contrast, punitive damage caps predict large increases in industrial emissions. In addition, there is a negative, statistically significant relationship between proportionate liability and small manufacturing firm entry. This result does not hold for large manufacturing firms. It is premature to identify the mechanism by which joint and several reforms work, but my results are consistent with Carvell, Currie, and MacLeod's (2012) theory about the role of litigation incentives faced by judgment-proof firms

Moving the legal system away from JSL seems to result in less pollution by making small firms bear the legal repercussions of their tortious activities. Additionally, punitive damage caps seem to encourage tortious behavior by reducing maximum allowable awards regardless of the egregiousness of the tortious behavior. These results identify significant secondary consequences from changes in legal apportionment structure, and suggest that policymakers should take these consequences into account when considering tort reform legislation.

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