Bankruptcy Claim Dischargeability and Public Externalities: Evidence from a Natural Experiment *

Michael Ohlrogge †, ‡

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Abstract

In 2009, the Seventh Circuit ruled in *U.S. v. Apex Oil* that certain types of injunctions requiring firms to clean up previously released toxic chemicals were not dischargeable in bankruptcy. This was widely perceived to represent a split with Sixth Circuit precedent, although Supreme Court cert was denied. Numerous legal commentators wrote of the significance of this decision in strengthening incentives for firms, and their creditors, to reduce the likelihood of costly environmental damage that would no longer be dischargeable in the event of bankruptcy. I show using difference in differences and triple difference methodologies that companies whose operations are confined to the Seventh Circuit (and thus likely to file for bankruptcy there) responded by reducing the volume of toxic chemicals they release on-site by approximately 15%. In place of these releases, firms substituted off-site treatment by specialized facilities generally considered to be safer for the environment. I also show evidence of a tightening of credit to impacted firms, helping shed light on the mechanism of influence via pressure from creditors. These results point to important ways in which bankruptcy law and other legal rules that impact recovery for firms' creditors can work to shape the positive or negative externalities those firms generate.

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†Stanford University, Department of Management Science & Engineering: Ph.D. Candidate

‡Stanford Law School: Academic Fellow, Olin Program for Law & Economics; JD Alumnus

1 Introduction

Under US bankruptcy law, a Chapter 11 reorganization is designed to give a struggling company a "fresh start." Generally speaking, any pre-bankruptcy obligations that are not fully satisfied in the bankruptcy are "discharged" and cannot be pursued against the reorganized company. Congress has, however, carved out certain exceptions. In 2009, in *U.S. v. Apex Oil Co.*, the US Court of Appeals for the Seventh Circuit issued a ruling that restricted the ability of corporations to discharge obligations to clean up toxic chemical contamination that they caused prior to filing for bankruptcy.

For Apex Oil, this meant being liable for an estimated $150 million in cleanup obligations which Apex argued it was immune to on account of its prior bankruptcy and reorganization. This amount was by no means an outlier. Cleanup costs for the type of contamination faced by Apex Oil regularly run into the hundreds of millions or billions of dollars,[1] and newly contaminated sites were identified in the Seventh Circuit at a rate of more than one per year in the period leading up to the *Apex* decision.[2] Apex appealed the Seventh Circuit's ruling to the Supreme Court. It cited, amongst other factors, a ruling by the Sixth Circuit that had reached the opposite conclusion when interpreting comparable statutory language.[3] Apex Oil argued that the Supreme Court should act to resolve this circuit split. The High Court, however, declined review, letting the Seventh Circuit's decision stand.

What happens when a ruling such as *Apex* changes which parties will bear the burden of environmental cleanup if the polluting firm declares bankruptcy? Could such a ruling also impact the likelihood that such cleanup will be needed in the first place? To investigate this, I examine data from the federal Toxics Release Inventory (TRI). This gives detailed information on the amounts of toxic chemicals that are handled by industrial facilities throughout the United States and how those chemicals are disposed of. From amongst these facilities and their parent companies, I identify a set of firms that operate ex-

[1] The National Priorities List (NPL) maintained by the EPA tracks sites with major toxic cleanup requirements subject to the Superfund program. These sites have cleanup requirements comparable to the site in question in *Apex*. Dixon et al. (1993) estimated average private party cleanup costs of $63 million per site in 2009 dollars or $74 million per site in 2018 dollars. And, these figures do not cover the costs of government contributions to cleanup at these sites, which occur when private parties are unable to pay for needed cleanup.

[2] For instance, in the ten years leading up to the *Apex* decision, twelve new sites were added to the NPL in the Seventh Circuit alone. And, not all sites with serious contamination as in *Apex* are added to the NPL. For a listing of these sites, see https://www.epa.gov/superfund/superfund-data-and-reports.

[3] Section 3 gives a fuller account of the legal context of the case, including decisions by the Second and Third Circuits that were more similar to the holding in *Apex*.

clusively or primarily within the Seventh Circuit. I document that bankruptcies by firms such as these have a high likelihood of being in the Seventh Circuit, thus making them subject to the *Apex* ruling. I next show that efforts to escape the ruling by filing in other circuits will generally be ineffectual.[4]

Using difference in differences and triple differences statistical tests, I find that firms responded to *Apex* by reducing the amounts of toxic wastes they dispose of on-site by approximately 15-25% and by increasing the amounts they send off-site to specialized treatment facilities by approximately 30%.[5] Environmental experts with whom I consulted uniformly agreed that such a shift serves to meaningfully reduce the risk that firms cause catastrophic contamination of the type dealt with in *Apex*.[6]

The decrease in on-site disposal and the increase in off-site treatment occur at precisely the same time following the *Apex* decision. Both effects are highly statistically significant, and are robust across the difference in differences and triple difference tests. I focus investigation on the chemicals identified by federal regulations as being governed by the Resource Conservation and Recovery Act (RCRA), the environmental statute interpreted by *Apex*. In placebo tests, I look for an impact from *Apex* amongst chemicals not governed by RCRA, and see no meaningful change. In similar tests, I investigate facilities designated as "Conditionally Exempt Small Quantity Generators" under RCRA. These facilities handle relatively small amounts of toxic chemicals, and are exempt from most RCRA requirements. I likewise see no impact from *Apex* on these facilities.

To better understand the mechanisms by which *Apex* may have affected firms, I merge the data from TRI with public company information in Compustat. I find some evidence that lenders tightened credit to firms impacted by *Apex* in the wake of the ruling, with total credit extended declining by

[4]Section 3 presents details on this. Of particular note is that the Second and Third Circuits, which contain the national bankruptcy "hubs" of New York and Delaware, already had precedents similar to that established by *Apex*. A firm could seek to file for bankruptcy in the Sixth Circuit, which had a precedent contrary to *Apex*. Doing so would entail substantial costs, including likely needing to retain additional counsel local to the Sixth Circuit. To build a stronger case for being able to file in the Sixth Circuit, a firm might furthermore seek to move its incorporation there, something that would need to be done relatively far in advance of filing for bankruptcy and something that would impose further costs of operating under a relatively obscure, foreign corporate law. Even then, there is no guarantee the ploy would succeed, as the Bankruptcy Code would allow environmental regulators to seek to move the bankruptcy proceedings back to a more local venue if doing so would advance the "interests of justice," which a court might well find to be the case if a firm's choice of bankruptcy venue represented a blatant attempt to evade the *Apex* precedent. In short then, Section 3 demonstrates that attempts to avoid the *Apex* ruling would be expensive and uncertain, and in many cases, therefore, likely less cost effective than simply taking steps to reduce the risks of toxic contamination in the first place. Some firms may still pursue this option, but in that event, it would simply attenuate the impacts I measure for the *Apex* decision.

[5]The discrepancy of the magnitude of these percentage changes in explained in part by the fact that prior to the ruling, facilities' total on-site disposal amounts were greater than their total amounts of off-site treatment, hence when the same volume of chemicals is shifted from one method to another, the percentage change is different.

[6]These experts also agreed that this shift in handling of wastes is generally superior from a public interest perspective, given the greater safety standards of firms that specialize in treating and disposing of toxic wastes. In Appendix A.5 I provide additional statistics pointing to the greater safety of specialized treatment and disposal facilities.

approximately 8%. This finding is consistent with the fact that the inability to discharge pollution cleanup obligations will frequently lower recovery for creditors in bankruptcy. Because only a subset of firms in the TRI data are also public companies, however, these findings are less statistically precise and less conclusive than the main results on changes in waste disposal procedures.

If firms shifted how they dispose of toxic wastes following *Apex*, it suggests that their new practices must be to some extent more expensive than their prior ones. But, was the cost difference small or large? The fact that (presumably profitable) firms exist that specialize in treating wastes produced by other companies suggests that in at least many instances the extra costs to outsource treatment and disposal are relatively small.

To gain more insight into this question, I look at total industrial output and profitability of firms impacted by *Apex*. I find no evidence of a sizable or significant drop in output or profitability. An absence of evidence does not equal evidence of an absence. While the results of my tests do not rule out a small reduction in output or productivity, they can bound the magnitude of a possible decline. I show, for instance, that a decline in output of greater than 5% can be rejected at roughly a 90% confidence level.

Taken together, these findings suggest that the *Apex* decision induced changes that were relatively low-cost, but that also had some meaningful impact on reducing pollution harms. A precise cost-benefit analysis, however, is beyond the scope of this paper.

For firms to have plausibly changed their behavior due to *Apex*, the decision must have been significant and surprising. In its web review of the decision, the American College of Environmental Lawyers wrote that the case, "will likely reverberate around the country for years to come" (Rosenthal, 2010). C. Douglas Goins, associate general counsel for environmental affairs at Lockheed Martin, wrote that the case "will have a major impact on debtors, creditors and the government" (Goins and Bean, 2010). *Apex* was the titular or primary focus of numerous articles in law reviews and practice journals,[7] and was the subject of more than two dozen client alerts by law firms.[8]

[7] To cite a few: Gardner and Pusha III (2014); Rdzanek (2010); Haider et al. (2010); Fil (2009); Viteskic (2010)

[8] These included major national firms such as Perkins Coie (Hird, 2010) and Weil (Bledsoe, 2010), as well as a great number of smaller firms, many in the Seventh Circuit, that specialize in counseling and representing firms handling the types of toxic chemicals that were at the center of the *Apex* ruling. A full set of copies of these alerts is available upon request.

To get a fuller sense of the extent to which *Apex* was surprising and significant, I interviewed half a dozen attorneys who advise clients in the Seventh Circuit whose activities are regulated under RCRA. Section 3.4 gives a fuller account of these interviews, but one is particularly informative for understanding the impact of the *Apex* ruling. In the *Apex* case, there were actually five separate firms whom environmental regulators sought to hold jointly liable for cleanup of pollution contamination near the town of Hartford, Illinois. Four of these firms voluntarily agreed to a consent order to clean up the pollution, but the fifth, Apex Oil Co., refused, citing its prior bankruptcy and discharge.

One of the attorneys I interviewed represented a firm who voluntarily agreed to participate in the cleanup. By this person's account, the Illinois Environmental Protection agency declined to pursue further action against Apex Oil Co., believing that this would be futile due to Apex's prior bankruptcy. In the face of this, counsel for the four companies that had entered into the cleanup agreement worked together to develop a legal strategy by which Apex could be required to participate in the cleanup. They then worked to convince the federal Environmental Protection Agency that pursuing such a strategy could have a viable chance of success. At least based on this account, the fact that neither the state nor the federal authorities considered it an easy or obvious matter that Apex Oil Co. could be held responsible for cleaning up its pre-bankruptcy contamination points strongly to the fact that *Apex* decision was a surprising and significant legal development.[9]

The findings in this investigation have several implications for policy. Although the Supreme Court declined to review the *Apex* decision in 2010, close to a decade has now passed and the composition of the Court has changed meaningfully. Thus, the High Court could choose to resolve the circuit split that it has thus far not addressed. This study shows the potentially significant impact from either extending the *Apex* holding beyond the Seventh Circuit or from reversing the holding where it currently governs.

This study also informs congressional action. Environmental issues are a consistently and perhaps increasingly important part of political deliberation in the United States. On the one hand, concerns are rising in some sectors about global warming and, for instance, weather related catastrophes linked to it.[10] On the other hand, a strong political current runs in the opposite direction with, for instance,

[9]Note: I am currently working on getting in contact with other individuals who were directly involved in the *Apex* case. I hope and expect to update the discussion here as I am able to speak with more such people.

[10]And, these weather catastrophes can intersect directly with issues of toxic chemical contamination. See, for instance, recent accounts in

calls to abolish the US Environmental Protection Agency arising in the 2016 presidential election.[11] Congress could thus take up major environmental reforms, shifting policy in one direction or another.

If Congress does so, this investigation shows that the precise wording of any reforms could be consequential in ways that are far from obvious. An interesting facet of *Apex* is that it turned on how a particular wording in the RCRA statute interacted with text from the Bankruptcy Code, yet it is all but certain that the RCRA provision was not written with a mind to such interaction.[12] This study shows that unintended legislative details can have large impacts for outcomes of interest to policymakers.[13]

The findings in this study have potentially broader policy implications as well for how corporations are governed and how they do (or do not) externalize harms to the public. While it is on some level intuitive that firms might respond to the *Apex* decision in the ways documented here, it is by no means certain that they would. *Apex* impacted how obligations are handled in bankruptcy. As a first order matter, therefore, a firm's shareholders will already frequently have lost their investments, and the firm's top managers may well have lost their jobs. Instead, it is only a firm's creditors who are most directly impacted by this ruling. The fact that firm behavior as a whole changed suggests that changes in bankruptcy law, and potentially legal changes more generally that impact creditors, have the potential to be useful tools for constraining negative externalities.[14]

The remainder of this paper proceeds as follows. Section 2 considers prior literature. Section 3 analyzes the legal background of *Apex*. Section 4 presents the data analyzed here and Section 5 presents the main analyses. Section 6 discusses validation, robustness, and extension analyses, and Section 7 concludes. The Appendix offers additional details on legal analysis, data, and robustness analyses.

which Hurricane Florence caused flood waters to breach a coal ash pond and spill toxic contamination into surrounding areas in September of 2018: https://www.nytimes.com/interactive/2018/09/13/climate/hurricane-florence-environmental-hazards.html.

[11] See, e.g. https://www.washingtonexaminer.com/trump-says-hed-eliminate-department-of-environment-protection.

[12] In particular, as described in further depth in Appendix C.2, the key issue for *Apex* was whether the provisions of RCRA that enabled the EPA to demand cleanup also enabled the EPA to accept monetary compensation to cover the costs of that cleanup in lieu of the responsible party cleaning up the contamination directly. Paradoxically, the fact that the EPA's powers were more limited in statute, barring it from pursuing a monetary judgment, was the only reason that the *Apex* case reached the decision that it did and not a precisely opposite result.

[13] Nearly identical considerations also apply to how state environmental legislation interacts with the US Bankruptcy Code, meaning that these considerations can be relevant even when individual states take legislation action to revise their environmental codes.

[14] The potential importance of policy that impacts firm creditors as a tool to improve firm externalities is emphasized by two other factors as well. First, there is already an extensive literature that points to the importance of firm creditors in corporate governance more generally (see, e.g., Triantis and Daniels, 1995; Baird and Rasmussen, 2005). Secondly, many US corporations are rapidly becoming even more heavily financed by debt, likely raising even further the prominence of creditors in US corporate governance.

2 Prior Literature

To my knowledge, this is the first empirical study to seek to isolate a causal impact on firm behavior of a change in bankruptcy law governing claim dischargeability or priority. There is, however, a rich literature that relates more broadly to the themes of this investigation.

One important and closely related study is Akey and Appel (2017) which uses TRI data and methods similar to this study to investigate how a change in limited liability protection impacted the toxic chemical release behaviors of firms. Ringleb and Wiggins (1990) also investigate the potential implications of limited liability protection for harm-externalizing behaviors of firms, and studies such as Feinstein (1989), Rose (1990), Dionne et al. (1997), Earnhart and Segerson (2012), Goetz (2018), Gao et al. (2018), and Chang et al. (2018) consider extensions of this analysis by investigating how financial risks and strains on firms relate to their public externalities. Theoretical grounding for the analyses of bankruptcy and limited liability law in influencing pre-bankruptcy firm behavior is developed by work such as Jensen and Meckling (1976); Black and Scholes (1973); Posner (1976); LoPucki (1996); Bebchuk and Fried (1995) and Hansmann and Kraakman (1991). Papers that look more generally at how legal rules such as liability standards impact firms' toxic chemical contamination and harm externalizing behaviors include Alberini and Austin (1999); Alberini and Frost (2007); Boyer and Porrini (2011) and Chang and Sigman (2014).

3 Legal Background

3.1 Liability under RCRA and Related Environmental Statutes

The Resource Conservation and Recovery Act (RCRA) is the environmental statute at the heart of the *Apex* case. The statute governs how hazardous chemical wastes can be handled, stored, transported, and disposed of. Here, I discuss aspects of RCRA most pertinent to understanding the *Apex* ruling.

RCRA contains extremely broad and powerful enforcement provisions. As a result, liability for toxic contamination cleanup under RCRA, which the *Apex* case made more difficult to discharge in

bankruptcy, can accrue to companies in many situations; it can be extremely difficult to avoid via other legal mechanisms, and it can be extremely costly to comply with. In *Apex*, the EPA brought suit under RCRA §7003, the "imminent hazard" provision which states:

> Notwithstanding any other provision of this chapter, upon receipt of evidence that the past or present handling, storage, treatment, transportation or disposal of any solid waste or hazardous waste may present an imminent and substantial endangerment to health or the environment, the Administrator may bring suit on behalf of the United States . . . against any person . . . who has contributed or who is contributing to such handling, storage, treatment, transportation or disposal . . . to order such person to take such . . . action as may be necessary. . .
> 42 U.S.C.A. §6973

In other words, any time the EPA determines that past or present hazardous waste pollution *may* have created an imminent and substantial endangerment of health or the environment, the Administrator can bring suit to require essentially any party it finds contributed to the hazard to take whatever actions the EPA deems necessary in order to address the hazard. The liability under this provision is strict.[15] As one practice manual describes it:

> The breadth of those potentially liable under §7003 is demonstrated by the fact that even if the persons or activities causing the potential endangerment are not subject to any other provision of RCRA or other environmental law, they can be liable under the imminent hazard provision. ... [Furthermore] compliance with a regulation or permit under RCRA is not a shield to a §7003 action to address a potential endangerment. (Broun and O'Reilly, 2018, §5.30, internal quotations omitted)

In particular, then, legal provisions that would normally exempt a firm from RCRA regulatory requirements,[16] do not have a direct bearing on whether a firm can be required to comply with EPA orders to clean up catastrophic contamination of the type dealt with in *Apex*.[17]

If a company does find itself targeted with an enforcement action under RCRA §7003 the results can be extremely expensive. The cleanup at issue in *Apex* was estimated to cost $150 million. Discussions with practitioners confirm this is by no means an outlier, either. $50 to $100 million is often the lower bound for costs to clean up a polluted site, and costs can reach well into the hundreds of millions or even billions of dollars if the contamination is extensive or in a highly populated area.[18]

The strong enforcement powers under RCRA should not, however, be interpreted to imply that environmental cleanup liability is in any way an "act of God," randomly striking companies with hundreds

[15] *Apex* District Court judgment, 2008 WL 2945402.

[16] For example: releasing RCRA-regulated chemicals into waterways, which can in some instances trigger a switch to regulation under the Clean Water Act, rather than RCRA.

[17] Another related point is that although the *Apex* decision itself dealt specifically with §7003 of RCRA, other environmental laws, such as the Clean Water Act, have enforcement provisions very similar to those in RCRA §7003. See, e.g. Gross and Anderson (2010), an early analysis of the *Apex* decision that discusses its relevance for the Clean Water Act as well.

[18] See the introduction to this paper and footnotes 1 and 2 for more specific statistics on the costs and frequency of catastrophic chemical contamination events.

of millions of dollars in cleanup obligations irregardless of how firms comport their operations. Instead, there is broad agreement that firms can and do take concrete steps to limit their liability.

One effective way to reduce risks of catastrophic contamination liability is for a firm to reduce the extent to which it disposes of toxic chemicals on site (in on-site landfills, in releases to on-site waterways, and so forth) and to instead hire a specialized company to take possession of its toxic wastes for proper treatment and disposal. The lawyers and other experts I spoke with who advise firms on RCRA compliance consistently agreed that doing this was a meaningful way that firms could reduce their likelihood of significant liability under RCRA.

Environmental experts that I spoke with also consider the move from on-site disposal to off-site treatment of wastes to generally be superior from a public interest perspective. Specialized facilities tend to have economies of scale that facilitate better treatment and containment of toxic chemicals. Appendix A.5 gives further statistics that support this conclusion. Another option firms have is to increase the care with which they operate their facilities to reduce the likelihood of leaks and similar failures that can lead to large pollution contamination. This article investigates the care that firms take along both of these dimensions, and the ways that this was impacted by the *Apex* decision.

3.2 Chapter 11 Bankruptcy and Dischargeability of Claims

Chapter 11 of the Bankruptcy Code provides mechanisms for a corporation that is struggling financially to restructure its obligations and to hopefully re-emerge as a profitable and productive part of the economy. In a Chapter 11 reorganization, parties to whom the corporation has monetary or other obligations must file claims with the bankruptcy court by a given deadline.

Bankruptcy law governs how much each of these parties will receive on their claims, with some parties generally receiving less than the total value they would have expected had the corporation not become financially distressed. In theory, and generally in practice as well, all claimants are entitled to receive at least as much in a reorganization as they would have gotten had the corporation been liquidated. A Chapter 11 bankruptcy thus seeks to make all parties at least as well off as they would

have been in a liquidation, and at least some parties better off, thereby generating a social surplus.[19]

After a Chapter 11 reorganization, generally speaking, claims against a corporation stemming from activity prior to its bankruptcy filing are discharged. Thus, even if a party received only a small fraction of the amount owed to it, it will have no right to seek additional payment. Parties that failed to submit claims at all will have no right to any recovery.

There are, however, exceptions to this general framework. In particular, not all pre-bankruptcy obligations of the corporation can be discharged in a Chapter 11 reorganization. For instance, corporations prior to bankruptcy have obligations to obey federal and state laws. These obligations cannot be "discharged" en masse through bankruptcy. If state laws require that delivery vehicles be registered with the department of motor vehicles, a corporation reorganized from bankruptcy cannot claim that its obligations to obey these laws have been "discharged" in bankruptcy, even if the vehicles were acquired prior to its bankruptcy. Similarly, if a court orders a company, pre-bankruptcy, to cease illegally dumping toxic chemicals into a nearby river, the company cannot argue, post-bankruptcy, that its obligation to comply with the court order was discharged.

More difficult situations arise, however, where there is ambiguity over whether the target of an injunction pertains to a reorganized corporation's post-bankruptcy activity or its pre-bankruptcy activity. For instance, what if chemicals enter a river not through being directly and illegally dumped, but via leaking underground tanks owned by a corporation, with the leaks likely having started pre-bankruptcy? Can the reorganized company be compelled to repair the tanks? Even more difficult, what if the tanks have already leaked such as to contaminate the surrounding soil, such that repairing the tanks would actually not sufficiently reduce the harm being caused to the waterway? Would perhaps the injunction to fix the tanks be maintained through bankruptcy, but the injunction to clean the surrounding soil be discharged? Courts have grappled with these issues for more than three decades now.

[19] The surplus comes from the fact that in many situations, a corporation is "worth more alive than dead."

3.3 Apex and the Circuit Split

In 1985, the US Supreme Court addressed some questions about the scope of environmental enforcement actions vis-a-vis companies in or post-bankruptcy when deciding the case *Ohio v. Kovacs*.[20] In this case, the state of Ohio had already seized a property that had been polluted prior to the responsible party's bankruptcy filing. As was authorized under its environmental laws, Ohio then sought monetary compensation from the polluter to cover expenditures the state made to clean up the site. The Supreme Court ruled that because money was the only thing the state sought, it was akin to other obligations like debts and tort liability and thus dischargeable in bankruptcy.[21]

After Kovacs, however, it remained to be seen how courts would deal with situations in which regulators made demands other than for monetary compensation in response to past pollution. An early case to tackle this was *U.S. v. Whizco, Inc.*[22] There, the Sixth Circuit held that even if an order for environmental cleanup did not seek money and in fact could not even demand money (under the statute authorizing the order), if a party did not themselves have the equipment and personnel required to comply with the order, and thus would as a practical matter need to pay money to a third party in order to comply with the order, then the order also qualified as a dischargeable claim in bankruptcy. *Whizco* remains good law in the Sixth Circuit and has not been significantly distinguished since it was decided.

Following *Whizco*, however, courts in the Second and Third Circuits interpreted *Kovacs* differently. In *In re Chateaugay Corp.*[23] and *In re Torwico Elecs., Inc.*[24] these Circuits both held that where a regulator seeks an injunction under authority that does not permit it to accept payment in lieu of compliance with the injunction, obligations under that injunction are not dischargeable in bankruptcy.[25]

Prior to *Apex* then, there was a 2-1 circuit split. In many ways, *Apex* can be seen as siding with the Second and Third circuits on the issue of claim dischargeability. The case arguably went further than these previous holdings (particularly compared to *Chateaugay*). As discussed in greater detail in Appendix C.2, not only did *Apex* no longer own the site that was the primary focus of the environmental

[20] 469 U.S. 274.
[21] The Appendix goes in to more detail on the specific issues of statutory interpretation at play.
[22] 841 F.2d 147, (6th Cir. 1988)
[23] 944 F.2d 997 (2d Cir. 1991)
[24] 8 F.3d 146 (3d Cir. 1993)
[25] Appendix C.2 gives additional legal details on the nuances of these cases.

contamination, it no longer was in the business of refining at all. This made the Apex Corporation, at least according to its arguments, particularly unable to directly comply with the injunction and thus only capable of doing so by compensating a third party to clean the waste, potentially making its situation more analogous to that of *Kovacs* and *Whizco*. The Seventh Circuit, however, rejected these distinctions, holding that it makes no difference whether a corporation pays money to its own employees to perform a cleanup or instead pays the employees of another entity.

3.4 Reactions to Apex

In order for *Apex* to have plausibly impacted the behavior of firms, it must be both surprising and significant. *Apex* would clearly be a surprising decision if, for instance, legal practitioners had been comprehensively surveyed prior to the decision and unanimously agreed that it would be unthinkable that the Seventh Circuit could reach a decision such as it did in *Apex*. Yet, less absolute movements of legal opinion can in many instances still have a meaningful impact.[26]

This is particularly true given that *Apex* dealt with cleanup obligations that frequently number in the hundreds of millions of dollars or more. Thus, even a relatively modest change in the probability of these being discharged can have very large monetary impacts on a range of impacted parties. Although it is impossible to quantify precisely how surprising or significant the *Apex* decision was, particularly given challenges such as hindsight bias (Kahneman, 2011), there are numerous pieces of evidence that point to the decision being both significant and surprising.

The introduction to this paper already cites a number of these pieces of evidence. It provides quotes from the American College of Environmental Lawyers and from the general council for environmental affairs for Lockheed Martin, references the large number of legal publications and law firm client alerts that focused on *Apex*, and gives an account from an attorney involved in the original case suggesting that state and federal environmental regulators were initially skeptical that *Apex* could be held liable as it ultimately was. This section, therefore, focuses on one more additional piece of evidence regarding the significance of the *Apex* decision not touched on in the introduction.

[26]Indeed, it is very rare that there will be uniform or near uniform agreement on what the state of the law is, and for that agreement to be completely reversed by a court ruling.

In addition to speaking with an attorney involved in the original *Apex* case, I also spoke with half a dozen attorneys and other experts who advise firms in the Seventh Circuit who handle toxic chemicals of the type governed by RCRA. The majority of these whom I spoke with considered *Apex* to be a significant development, though perspectives did differ in meaningful ways.

Two practitioners I spoke with brought up, unprompted by me, that clients will at times express to them a belief that they can escape significant environmental cleanup obligations by declaring bankruptcy and reorganizing, and that *Apex* is an important case in advising against this approach. One practitioner stated that he didn't think that many of his clients would pay direct attention to the ruling, but that it was significant in influencing the willingness of lenders to extend new loans. Only one practitioner thought the ruling had little impact at all. This person noted that managers tend to be more focused on short-term cost savings rather than long-term liability (like the ruling impacted).[27] Several other practitioners, however, said that their clients are keenly aware of trying to minimize their potential for RCRA liability, and that small firms may be particularly impacted because for them, the corporation's chair or CEO may also double as the firm's primary environmental compliance officer.

I identified people to consult for these interviews primarily by performing internet searches for "RCRA Attorney" plus the states in the Seventh Circuit (e.g. Illinois). I also was given a lead to one expert by an environmental law scholar I had interviewed to assist me with understanding more general background information for this investigation. As such, the results from these interviews should not be interpreted as rigorously collected, statistically representative social science data. Nevertheless, they help to better contextualize an understanding of the *Apex* case and the plausibility that it could lead to the effects I document in the statistical tests in this investigation.

3.4.1 Timing of Apex's Impact

A consideration in formulating statistical tests is when to mark the *Apex* decision as having occurred. The District Court decision for *Apex* came in 2008, the Circuit court decision in 2009, and the denial of cert by the Supreme Court came in 2010. In fact, although the district court decision was reached in

[27] Two other attorneys whom I connected with briefly also responded that they personally saw little impact from *Apex* but they noted that this was because the set of clients they advised were not the types of companies handling the types and amounts of waste such to be expected to be very influenced by the ruling.

2008, the case commenced in 2005, and in 2006, the District Court granted motions that were favorable to the EPA's efforts to deny dischargeability of Apex's environmental cleanup obligations.[28]

For my empirical specifications, I consider 2009, the date of the Seventh Circuit's decision, to be the start point of when to begin looking for an impact of *Apex*. This is a natural marker, given that this is when the precedent became binding for the whole of the Seventh Circuit.[29] When interviewing attorneys for this project, one question I asked was when they became aware of the case and its outcome. Apart from the attorney directly involved in the proceedings, no one I spoke with was aware of it prior to 2008 when the District Court issued its final decision.[30] Some attorneys were aware of the decision in 2008, whereas more became aware at the time of the Seventh Circuit's decision in 2009.[31]

In general for my analyses, I estimate separate effects of *Apex* for each year. Thus, readers can view these and make their own determinations regarding a reasonable start time to look for its effects. Generally speaking, as evidenced in Figure 1, for instance, my tests show a small effect for the case in 2009, but often one that cannot be fully distinguished from statistical noise. This effect then grows consistently and considerably over the next several years. Given an increasing awareness of the case over time, this pattern would be precisely what one would expect to see.

3.5 The Impact of Claim Dischargeability on Pre-Bankruptcy Firm Operations

The introduction to this paper and Section 3.4 provide testaments from a variety of sources as to the importance of the *Apex* decision. But, what precisely are the mechanisms by which the decision could impact pre-bankruptcy operations of firms? Shareholders will generally lose most or all of their investment if a firm files for bankruptcy. Thus, as a first-order matter, their incentives and decision-making will likely be less impacted by a court ruling that influences how claims are handled in a bankruptcy.

Creditors are one type of stakeholder who will be directly impacted by the *Apex* decision. Suppose

[28] *U.S. v. Apex Oil Co., Inc.*, 438 F.Supp.2d 948 (2006).

[29] Nevertheless, some of the client alerts on the case and news coverage of it came in 2008 in response to the District Court's decision, suggesting that some saw the District Court's decision as potentially having a broader impact than just the specific court in which it was decided.

[30] Indeed, although the District Court had granted rulings favorable to the EPA in 2006, it was only upon a full resolution of the issues in the case that it became clear what, if any, practical impact those rulings would have.

[31] Some of the press attention and other writings on the case came in 2010 with the Supreme Court's denial of Cert, and so undoubtedly this was when some practitioners and likely managers in affected industries became aware of it as well. No one I personally spoke with, however, said they became aware of the case at this point.

a firm in bankruptcy cannot discharge obligations to clean up pre-bankruptcy pollution contamination. One possibility is that the firm could liquidate rather than reorganize. This may enable creditors to get satisfaction on their claims as higher priority than clean-up obligations.[32] If a firm would have reorganized in the absence of the *Apex* decision, but instead chooses to liquidate, then by definition of choosing a second-best-alternative, this will destroy value and result in lower recovery for creditors.

If a firm's creditors were to chose this route of liquidation, however, regulators would have an incentive to accept a commitment to clean up contamination that partially satisfies a company's whole obligations.[33] In exchange, regulators would commit to bring no further actions based on pre-bankruptcy contamination. By doing so, regulators and creditors would split the surplus value generated by reorganizing the firm rather than liquidating it. But, whether such an agreement between creditors and regulators is reached or not, the result would still be lower recovery for creditors than they would have received in the absence of the *Apex* ruling. Thus, creditors will have an incentive to pressure firms to reduce their risks of catastrophic toxic contamination.

Managers of firms also stand to be impacted by *Apex*. Although top management is sometimes replaced in a reorganization, managers still have a reasonable hope to remain with the reorganized firm. To the extent that the *Apex* decision makes it less likely for a firm to reorganize rather than liquidate, and also to the extent that the decision might leave the reorganized firm with greater obligations and less profitability,[34] managers will also have a direct incentive to reduce the likelihood of significant toxic cleanup obligations. Indeed, from anecdotal evidence, several of the practitioners whom I interviewed said that managers have raised with them the possibility of using bankruptcy as an escape for significant cleanup obligations. Thus, in practice, at least a certain set of managers do operate with the assumption that they will be able to retain a role in a reorganized company.

[32] Certain environmental statutes like CERCLA, however, may limit the extent to which this will be efficacious for creditors.

[33] Indeed, this precise issue was discussed in a set of amicus briefs to the Supreme Court that accompanied the Cert petition filed by Apex following the Circuit Court ruling. See in particular the amicus brief by G. Eric Brunstad, and the joint amicus brief by Atlantic Richfield Corporation, Shell Oil Products, the Premcor Refining Group and Sinclair Oil Corporation. These amicus briefs are available at http://www.scotusblog.com/case-files/cases/apex-oil-company-inc-v-united-states/.

[34] In theory, an effective reorganization ought to be able to achieve a given level of stability and profitability for a reorganized firm regardless of its obligations going in to the bankruptcy. Actual practice, however, may deviate from this ideal.

3.6 Bankruptcy Choice of Venue

Under US bankruptcy law, corporations have some choice in where to file for bankruptcy. The mechanics of this inform which corporations are likely to be most affected by the *Apex* decision. In this section I give an overview of the pertinent issues, saving a more detailed discussion for Appendix C.1.

In looking for impacts from *Apex*, I focus on firms that operate exclusively or primarily within the Seventh Circuit. Appendix C.1 documents that firms such as these have a high likelihood in general of filing for bankruptcy within their home circuit.[35] Furthermore, Appendix C.1 demonstrates that it would be difficult for firms to avoid the *Apex* ruling by filing outside of the Seventh Circuit.

The Second and Third Circuits, home to New York and Delaware, are the primary places a firm would file for bankruptcy other than where its primary operations are. These circuits, however, already had precedents analogous to *Apex*. Thus, a firm could not avoid the impact of *Apex* simply by filing in one of these common jurisdictions. As discussed in Section 3.3, the Sixth Circuit does have a precedent contrary to *Apex*. In theory, a firm could attempt to avoid the *Apex* decision by filing, or planning to file, for bankruptcy in the Sixth Circuit. In practice, however, Appendix C.1 discusses reasons why this would be a costly choice and one that would not even guarantee evasion of the *Apex* precedent.

Appendix C.1 argues therefore that in most instances it will be more cost-effective for firms to take modest but meaningful steps to limit the risks of catastrophic pollution contamination. It is nevertheless possible that some firms may determine that it is more practicable to seek to circumvent the *Apex* decision by planning to attempt to file for bankruptcy in the Sixth Circuit. To the extent this is true, it would simply mean that the effects I measure for *Apex* under-estimate the impact that could be expected if a similar rule were adopted nationally, either through judicial or legislative action.

3.7 Additional Legal Considerations

Appendix C presents additional legal background and analyses to further inform the interpretation of the *Apex* case and its impact. In particular, Appendix C.3 discusses asset sales under §363 of the

[35] As discussed in Appendix C.1, there is also some potential that a set of firms that operate primarily in the Seventh Circuit may have had a high likelihood of filing for bankruptcy in the Second or Third circuits prior to the ruling. These firms then would be expected to be less impacted by the ruling. But, this would simply serve to attenuate the effects of the *Apex* decision that I measure.

bankruptcy code and why they would not be an effective escape from the holding of the *Apex* decision. Appendix C.4 considers practical differences between how creditor recovery would play out under the *Apex* precedent versus a contrary precedent. Finally, Appendix C.5 considers how the influence of *Apex* may vary for firms based on how close, financially, they are to declaring bankruptcy.

4 Data

4.1 Toxics Release Inventory (TRI) Data

4.1.1 Data Construction

The core analyses in this study use data from the national Toxics Release Inventory (TRI).[36] Facilities that fall within specific industries (such as manufacturing, waste management, mining, etc.), have ten or more full time employees, and that handle amounts of toxic chemicals above specified thresholds[37] must submit detailed annual reports on the amount of each covered chemical used at the facility and how that chemical was processed or disposed of.[38]

TRI data is available in a year-by-facility-by-chemical format. For each such combination, there are roughly 40 separate elements giving information on how much of each chemical was disposed of in various fashions.[39] For this study, I focus on a time period starting in 2004, five years prior to the Seventh Circuit's *Apex* decision, and extending through 2014, five years following the *Apex* decision.

Not all chemicals reported in the TRI database are covered by RCRA. Similarly, some facilities that make reports to the TRI database are not directly regulated under any provisions of RCRA. I restrict my sample to chemicals and facilities directly regulated under RCRA.[40] Some RCRA-regulated facilities are

[36]Congress created the TRI in 1986 with the Emergency Planning and Community Right-to-Know Act (100 Stat. 1728), part of the Superfund Amendments and Reauthorization Act of 1986. Congress expanded the scope of TRI reporting with the Pollution Prevention Act of 1990. (104 Stat. 1388). The Act is now codified in 42 U.S.C.A. Chapter 116, with implementing regulations in 40 C.F.R. §372.

[37]For many RCRA regulated chemicals, these thresholds are very low. For instance, 0.1 grams for dioxin compounds, 100 pounds for lead compounds, 40 C.F.R. §372.28. The general reporting requirements for chemicals not specifically designated in 40 C.F.R. §372.28 is 25,000 pounds, 40 C.F.R. §372.25. These thresholds are for total amounts of the chemical *processed*, meaning that the amounts of the chemicals released are generally much smaller (see Table 1 in particular, noting on average on-site releases are about 6% as large as total waste processed), thus still making this a relatively sensitive metric. In unreported tests, I examine the distributions of values for the key response variables across different chemicals and see no evidence of censoring - that is, histograms appear largely smooth with no obvious cutoffs or clustering of values.

[38]Specific reporting requirements are given in 40 C.F.R. §372.5, and §372.22-28.

[39]Many of these elements are subsets of others, so this does not imply 40 unique disposal channels.

[40]Appendix A.1 gives details on how I make these identifications.

designated as CESQG facilities, or Conditionally Exempt Small Quantity Generators.[41] These handle only small quantities of toxic chemicals and are deemed to pose significantly lower risk to health and the environment. On account of this, CESQGs are governed by less stringent regulation under RCRA. Because of their low risks, there is much less reason to anticipate that CESQGs would change behavior due to the *Apex* decision, so I exclude them from my main analyses.[42]

To ensure that I analyze a balanced panel and that parameter estimates do not reflect changing composition of which facilities are in the data in a given year, I restrict the TRI data to facilities that have observations for the full eleven years of the sample period. As a practical matter, this eliminates fewer than 10% of the observations from the data and has no material impact on the key coefficient estimates. Finally, since my objective is to study the extent to which facilities release toxic chemicals on-site, I eliminate any facilities that have zero on-site chemical releases during the study period. Again as a practical matter, doing this makes little difference in coefficient estimates[43] but eliminating these gives a more accurate depiction of the effective sample size that determines those estimates. After making these restrictions, I am left with roughly 360,000 year-by-facility-by-chemical observations, covering 3,900 separate facilities owned by 1,546 separate companies.

4.1.2 Outcomes of Interest

There are two primary outcomes that I investigate in the TRI data: on-site releases and off-site treatment. On-site releases cover the total amount amount of each chemical that is released on-site at a facility. These include, for instance, injections into underground reservoirs, disposal in landfills, impoundments on surface-level pools, and discharges into streams or waterways. As informed by discussions with practitioners and environmental law experts, I study these releases as amongst the most likely to contribute to substantial toxic cleanup obligations.[44] There is nothing inherently illegal about such on-site releases of toxic chemicals, provided a facility obtains proper permits and processes the chemicals in the mandated ways prior to release. Yet, efforts to treat and dispose of chemicals properly

[41] For an overview of these designations, see https://www.epa.gov/sites/production/files/2015-01/documents/cesqg.pdf

[42] Appendix B.3 does present a series of "placebo" tests, including ones that look specifically at these CESQG facilities and test for whether the *Apex* ruling had any perceptible effect on them. As would be expected, these tests show no evidence of an impact from *Apex*.

[43] For these facilities, the fixed facility-level fixed effects completely determine all observation values.

[44] In particular, although discharges to streams or waterways may at times not stay on-site (though the specifics vary), they do pose a real risk of contaminating groundwater which in turn can lead to some of the most expensive cleanup operations.

can fail for many reasons, and when they do, companies can be held strictly liable for cleanup.

Because my focus is on those chemical releases with the greatest potential to contribute to significant environmental cleanup obligations, I exclude from my metric of on-site releases those releases made into the air (e.g. through combustion of a toxic chemical). While these may be harmful to human health and the environment, and may occasion substantial penalties if such releases violate permitting and treatment requirements, the potential liability that comes from these air releases is much more likely to be presently assessed, in other words, impacting a company before its bankruptcy. Such air releases are not, by contrast, likely to occasion an environmental agency issuing an injunction to "clean up" its air releases from the period prior to its reorganization in bankruptcy.

Apart from these two key outcomes in the TRI data, I consider two additional items in supplemental analyses. First, I examine the total quantity of each chemical waste produced by each facility in each year. I analyze this to investigate whether the *Apex* decision impacted the overall quantity of chemical operations of affected companies or whether it merely changed how companies dispose of the wastes that they produce. Lastly, as a placebo test, I analyze the total amount of each waste released into the air from facilities. Table 1 gives summary statistics[45] for the TRI data on these various outcomes.[46]

In Appendix A.1 I give additional technical details on construction of the TRI data I analyze, and in Appendix A.2 I address issues relating to the accuracy of the data.

4.1.3 Local vs. National Firms

As discussed in Section 3.6 I focus on firms that operate exclusively or primarily within the Seventh Circuit. The TRI data identifies each facility's ultimate parent company. This makes it possible to identify companies that only have TRI facilities within the Seventh (or another) Circuit.[47] I term these "local" firms, which I contrast with "national" firms that have facilities across multiple circuits.[48]

It is of course possible that a firm I identify as "local" might have facilities outside of the Seventh

[45] See Appendix A.1.1 for a small technical note on the units by which weights of chemicals are measured and reported in this table.

[46] In Table 1 the amounts of chemicals released on-site, sent off-site for treatment, and released into the air, do not add up to the "total waste" given in that table. As mentioned, there are over 40 separate elements in the TRI data for each chemical covering the different ways that chemical can be processed or disposed of. For instance, chemicals be re-used in industrial processes and thus be counted towards "total waste" but not show up in any of specific disposal methods depicted in the table.

[47] I make these determinations before eliminating any of the facilities for the reasons discussed above.

[48] Each circuit thus has its own set of local firms.

Circuit that do not appear in the TRI data. But, for the industries that TRI covers - mining, manufacturing, and so forth - there is a good chance that most firms will have most or all of their facilities covered by the TRI data, or at least most of their significant facilities. Also, the the "local" vs. "national" designation is simply a way to identify firms with a relatively high likelihood of filing for bankruptcy in the Seventh Circuit. Thus, even if there were a firm that I identify as "local" but in fact has, say, 25% of its operations outside of the Seventh Circuit, that firm would still share much of the propensity of other truly "local" firms to file for bankruptcy in the Seventh Circuit. Finally, to the extent that I classify a firm as "local" where a fuller analysis would have identified it as "national," this should simply attenuate the statistical estimates I derive, since I would be mixing a less impacted firm in with the truly local firms.

As part of my robustness analyses, I also consider variations that allow for a more flexible definition of "local" firms. In particular, for each firm, I calculate the total amount of chemical wastes the firm produces over my sample period over all facilities and all different chemicals. I then calculate the percentage of that total is accounted for by facilities in each judicial circuit. I designate firms as "local" if, for instance, 70% or 95% of all their chemical wastes are handled in a single circuit.

The summary statistics in Table 1 break out firms separately based on whether they are "local" or "national." Notable in the table is the fact that, for instance, when considering the firm-wide total wastes produced, "local" firms are less than half the size of "national" ones. Given that smaller firms are considerably more likely to file for bankruptcy locally (as discussed in Appendix C.1 in more detail), this further suggests that the local firms I identify will be those primarily impacted by *Apex*.

4.2 Compustat

The TRI data does not in and of itself contain any financial information on the firms and facilities it tracks. I thus gather financial information from Compustat which provides data on public companies in the US via their SEC filings. As with the TRI data, I construct a balanced panel by limiting my investigations to firms for which there are a full set of observations throughout my sample period, giving a sample of 2,802 firms.[49]

[49] I also exclude from Compustat firms with NAICS code '525' which corresponds to "funds, trusts, and other financial vehicles." These are companies without any real operations of their own and thus are most appropriately excluded from these analyses.

I proceed to match these names by hand to the 1,564 firms in the TRI data. In the event that a firm in TRI is a subsidiary of a firm in Compustat, I consider this a match as well. This process yields 335 total firms in both data sets. Of these matches, only eight correspond with the "local" firms in TRI whose operations are exclusively within the Seventh Circuit. Fortunately, when I expand my scope of "local" to include corporations for whom the majority of their TRI operations are in the Seventh Circuit, I am able to identify forty-six "local" Seventh Circuit companies in Compustat. Table 2 gives summary statistics on the full Compustat panel and on the subsets of it that qualify for my differing definitions of "local" Seventh Circuit companies.

In my baseline specifications, I Winsorize data in Compustat at the 2.5% and 97.5% levels, as is common practice in dealing with such data. I also consider variations with no Winsorizing. In most cases there is no practical difference in results. In one place there is a small change in the significance of one estimate (from $p = 0.029 < 0.05$ to $p = 0.053 < 0.1$), and this is noted in Section 5 below.

5 Analysis

5.1 Firm Responses to Apex Decision

5.1.1 Baseline Methodology

This section presents formal statistical analyses to investigate whether the *Apex* ruling caused specific firms in the Seventh Circuit to take steps to reduce risks of catastrophic chemical contamination. I focus on two outcomes: the quantity of on-site releases of a given toxic chemical and the amount of the chemical sent off-site for treatment. For all of my analyses with TRI data, my response variable is the natural logarithm of one plus the amount reported in the TRI data for a given year.[50] This means that effects I estimate *Apex* are interpreted as percentage increases from a baseline level for each metric.

I consider two complementary statistical forms for my analyses: difference in differences and triple difference methodologies. For the difference in differences approach, I restrict my sample just to "local" firms in each judicial circuit, and examine whether local firms in the Seventh Circuit significantly

[50] Appendix B.9 considers different functional forms of the key response variables.

changed their behavior compared to local firms in other circuits in the wake of the *Apex* decision in ways that cannot be explained by the other regression controls I include.

For the triple differences formulation, my sample size includes all firms, both local and national. Here, roughly speaking, I am considering the difference in toxic release behavior between local and national firms in the Seventh Circuit and the same difference in the other circuits. I then look for whether the difference between local and national firms in the Seventh Circuit changed more than that same difference did in other circuits in the wake of the *Apex* decision.

Each of these methodologies has advantages and disadvantages. Using both in concert can help to capture the benefits of each while giving robustness against shortcomings. A challenge of the difference in differences method is that if, for instance, something changed in the regulatory environment of the Seventh Circuit around the time of the *Apex* decision (for instance, perhaps for reasons unrelated to the court case, regulators began inspecting RCRA facilities more stringently in the Seventh Circuit but not in other circuits), the impact of this change could be mistaken for the impact of the *Apex* decision. In Section 6 I explicitly consider several possibilities for such regulatory or economic changes and present results suggesting that there is no evidence for them. These tests help to address concerns with the difference in differences methodology. But, there is always the possibility that the tests failed to investigate a relevant change or were not sensitive enough to detect a change they did investigate.

The triple differences methodology helps to address these concerns. As long as whatever unobserved change in regulatory or economic conditions impacted "local" and "national" firms in the Seventh Circuit similarly, then this change will be controlled for by the statistical methodology. But, it is also possible that local vs. national firms differ fundamentally in how they are inspected by regulators or impacted by economic conditions. In this case, the triple differences may solve some problems (of controlling for factors that similarly affect local and national firms) at the expense of creating new problems (of failing to fully control for factors that differently affect these firms).

Supplemental tests can help to address these new concerns the triple difference methodology occasions. One way is to look explicitly for evidence of factors that differentially affected local vs. national firms in the Seventh Circuit near the time of the *Apex* decision. Another is by varying the definitions

of "local" vs. "national" firms (as discussed in Section 4.1.3). But, none of these tests can prove with 100% certainty the absence of an unobserved, compounding factor.

By using both differences in differences and triple differences techniques, it is possible to create a suite of statistical tests that in aggregate is robust to a broader array of factors that could confound the analyses I conduct. Frequently, because the triple differences uses a larger sample (all firms, rather than just local) and a richer set of controls, it is able to deliver more precise estimates. Thus, I slightly favor these methodologies, but generally present both.

Formally, I define the difference in differences methodology I use as:

$$\log(1+\text{Amount}_{ict}) = (\text{Apex}_t \times \text{Seventh Circuit}_i)'\beta + (\text{Facility}_i \times \text{Chem}_c)'\Gamma_1 + (\text{Chem}_c \times \text{Year}_t)'\Gamma_2 + \varepsilon \quad (1)$$

Here, i indexes facilities, c indexes chemicals, and t indexes time, measured in years. Amount_{ict} here represents either the amount of on-site releases or off-site treatment for a given chemical-facility-year. Seventh Circuit_i is an indicator for whether a given facility is within the Seventh Circuit. $(\text{Facility}_i \times \text{Chem}_c)$ represents facility x chemical fixed effects[51] and $(\text{Chem}_c \times \text{Year}_t)$ represents chemical by year fixed effects.[52] β is the coefficient of interest, measuring the impact of the *Apex* ruling under the difference in differences statistical assumptions. Γ_i variables represent coefficients on fixed effects. I double cluster standard errors at the state and company levels.[53]

In some formulations Apex_t represents an indicator for whether the year is ≥ 2009, the year of the Seventh Circuit's *Apex* decision. This thus results in estimating a single average effect of the *Apex* decision for all years in which the decision was in effect. In other formulations, Apex_t represents a categorical variable for the year of observation, thus enabling a separate impact of *Apex* to be measured for each year in my sample. I set the base level of this categorical variable to be the year 2008, immediately prior to the *Apex* decision. Thus the coefficients for the interaction between the *Apex* variable

[51] In other words, this specification is considering deviations from a baseline amount of on-site releases or off-site treatment for each chemical handled by each facility.

[52] Thus, if there were changes in the national economy that affected, for instance, the supply and demand for a particular chemical, and these changes affected firms similarly across different circuits, then those would be controlled for by these effects.

[53] The "treatment" which these specifications seek to study the effects of is the decision by the Seventh Circuit, which impacted the states of Illinois, Wisconsin and Indiana. Because therefore whether a facility received the given "treatment" is determined by which state it resides in, I use states as the geographic component of my error clustering. This matches recommendations in Cameron and Miller (2015) as well as the practice followed by leading recent empirical studies in law and economics with similar research designs to this one, such as Honigsberg et al. (2017). I have observations from all fifty states plus DC and Puerto Rico in my data.

and years other than 2008 represent the difference between those years and the base level.

For the triple differences methodology, I employ the following functional form:

$$\log(1+\text{Amount}_{ict}) = (\text{Apex}_t \times \text{Single Circuit}_i \times \text{Seventh Circuit}_i)'\beta + (\text{Facility}_i \times \text{Chem}_c)'\Gamma_1 + (\text{Chem}_c \times \text{Year}_t)'\Gamma_2 + (\text{State}_i \times \text{Year}_t)'\Gamma_3 + (\text{Single Circuit}_i \times \text{Year}_t)'\Gamma_4 + \varepsilon \quad (2)$$

In this framework, I now interact the Apex_t variable with an indicator both for whether a given facility is within the Seventh Circuit and for whether a given facility is owned by a company that operates only within the Seventh Circuit (Single Circuit_i). I also allow for state-by-year fixed effects, thus controlling for any time varying factors (such as changes in regulation, enforcement, or local economies) that would affect both local and national firms within a given state similarly. I also add fixed effects that interact the designation of "single-circuit" and the year.[54]

5.1.2 Baseline Results

I now consider the results of fitting Equations 1 and 2 to the TRI data. Table 3 summarizes the results for models that use a single indicator for the *Apex* ruling being in force, whereas Figure 1 presents the models that estimate a unique value for each year. When considering on-site releases, the difference in differences and triple differences models in Table 3 show reductions of amongst local firms in the Seventh Circuit following *Apex* of 14.4% and 23.3%, respectively. For off-site treatment, the results show increases of 31.4% and 29.4%, respectively. [55]

The plots in Figure 1 also support these conclusions. For each of the two variables (on-site releases and off-site treatment) and each of the methodologies (difference in differences and triple differences), the plots show yearly estimates for the pre-*Apex* period that center near zero with little evidence of an

[54]These add controls for the possibility that there may have been national-level economic or regulatory factors that may have impacted local firms differently than national ones at the time of the *Apex* decision.

[55]In both the formulations, the magnitude of the percentage increase for off-site treatment is 1.5 or two times that as the magnitude of the percentage decrease for on-site releases. As Table 1 demonstrates, the base level for the amounts of toxic wastes released on-site is much higher than the base level for the amounts of such wastes sent off-site for treatment. Thus, if a given amount of waste moves from on-site disposal to off-site treatment, it will result in a smaller proportional change for on-site releases and a larger proportional change for off-site treatment. Also, some wastes that cease being disposed of on-site show up under the effects for "off-site disposal," another variable in the TRI data not analyzed in depth in this study as effects on it are generally comparable to off-site treatment. Details are available upon request.

"effect" from *Apex* beginning before the decision. Following *Apex*, by contrast, the plots show consistent downward and upward movements for the on-site release and off-site treatment variables respectively.

To complement the plots in Figure 1, I also construct a set of "raw data" difference in differences plots. For the first of these, I consider just observations from "local" firms, and compare the behavior of these single circuit firms that are in the Seventh Circuit vs. those in other circuits. For both on-site releases and off-site treatment, I compute the average amount by which the releases of each type of firm vary, in percentage terms, from the baseline level of 2008. I then plot these average yearly differences separately for those firms in the Seventh Circuit vs. those in the rest of the country. This is thus a close analogue to the regression analyses going on in the statistical formulation of the difference in differences analyses. Figure 2 presents the results of this. As in the formal statistical analyses, Figure 2 shows comparable behavior for firms in the Seventh vs. other circuits prior to the *Apex* decision but then a sharp divergence in both on-site releases and off-site treatment following the decision.

For the second "raw data" difference in differences plot, I perform the same operation but now look just at observations from within the Seventh Circuit and compare the behavior of facilities that are owned by "local" firms vs. those that are owned by national firms. This thus reflects the additional set of differences that is being compared in my triple difference regression specifications. Figure 3 presents the results. Prior to *Apex* the behavior of local and national firms within the Seventh Circuit is largely comparable. After *Apex* their behavior diverges in the anticipated directions.

Taken together, the results in Table 3 and Figures 1 to 3 present evidence that firms responded to *Apex* by reducing toxic wastes they release on-site and substituting off-site treatment. As discussed in Section 3.1, this is precisely the kind of response that would be expected of firms seeking to limit their exposure to catastrophic toxic chemical liability of the type *Apex* made more difficult to discharge.

5.1.3 Impact of Apex on Total Waste and Air Releases

I now consider two additional outcomes: total waste and stack air releases. Total waste gives insights into total industrial activities at facilities. If production levels drop significantly, total waste would be expected to as well. Because this category includes, for instance, amounts of chemicals that are recycled,

re-used, or burned for energy, simply shifting how a facility handles its wastes will have relatively little impact on its reported figures for total waste.[56]

If the *Apex* ruling did indeed induce a change in firm behavior, as the analyses above suggest, then that must have imposed some costs on firms. But, the results above give no indication of how large those extra costs were. Looking for evidence of the impact of *Apex* on total waste can give some insight, since if costs were large, affected firms may have responded by reducing their net production levels.[57]

The results from Table 3 estimate a coefficient of 0.057 for the *Apex* variable when the outcome is total waste, one third to one sixth the magnitude of coefficients estimates for on-site releases and off-site treatment above. With a standard error of 0.11 this result is not even close to statistically significant. Rather than giving evidence that *Apex increased* total waste, this is best interpreted as a null result.

Nevertheless, based on this coefficient estimate and standard error, it is possible to construct a hypothesis test to assess the likelihood that the true impact of the *Apex* decision did include a sizable reduction in total waste and thus, presumably, in total production as well. Based on the findings in Table 3, one can reject at an 85% confidence level the hypothesis that *Apex* caused a reduction of 5.9% or more in total waste, and at a 90% confidence level a reduction of 8.6% or more in total waste. The relevant coefficient and standard error for total waste from the difference in differences analysis are 0.084 and 0.095, respectively.[58] These indicate that one can reject, at an 85% confidence level, the hypothesis that *Apex* caused a reduction of 1.4% or more in total waste, and one can reject at the 90% confidence level the hypothesis that *Apex* caused a reduction of 3.7% or more in total waste.

These findings thus show no positive evidence that responses to *Apex* were sufficiently expensive to substantially alter firms' cost structures and thus total output. Given that it seems likely that *Apex* did impost some costs, the analyses above suggest that those costs can be bounded to relatively low levels.

I now consider the impact of *Apex* on stack air releases. There are two reasons that investigating these may be informative. First, they serve as a type of placebo test. If there were other relevant

[56] It is of course possible that if a facility re-engineers its production techniques, it could use less of a toxic chemical while maintaining a given level of production, meaning that total waste is not a perfect measure of total industrial activity.

[57] This is by no means a certain outcome, and the analysis here does not purport to be a full general equilibrium analysis of the impact of increasing production costs on a segment of firms within a market, but under many reasonable modeling assumptions this would be the anticipated outcome.

[58] For brevity these are omitted from Table 3.

regulatory or economic conditions that changed around the time of the *Apex* ruling, it is plausible that they would impact stack air releases as well. By contrast, there is much less reason to believe stack air releases would be affected by *Apex* directly, since they do not lead to accumulation of waste in the ground or water systems. Thus, if my tests detect an "impact" of *Apex* on air releases, it at least raises concerns that the tests may be reflecting some factor other than the court decision.

Nevertheless, there is a channel by which *Apex* could indirectly impact air releases. This would be if costs of reducing liability risk following *Apex* were great enough to curtail total firm production.

Given this background, Table 3 shows essentially zero impact of *Apex* on air releases, with a coefficient estimate of 0.025 and no statistical significance to speak of. Nevertheless, as with the coefficient for total waste, the standard error is relatively high (0.088). The fact that this "placebo" test shows no effect from the *Apex* decision where none is expected is at least consistent with the hypothesis that the earlier tests of *Apex* are indeed picking up the impact of the court case and not some extraneous contemporary factor. And, the small, insignificant change in on-site air releases also supports the notion that the net costs of the *Apex* decision were relatively small. But, in both cases, the relatively large standard errors limit the inferences that can be based on this particular result.

One final piece of insight from analyses of total waste and air releases can be gleaned by considering parallel trends analyses for them - that is, by looking at the estimates for effects of *Apex* for each separate year, depicted in Figure 4. Although there is a fair amount of noise, the plots show much the same effects both pre- and post-*Apex*. In other words, this demonstrates an added dimensions along with firms in the "treatment" group were comparable to those in the "control" group during the pre-*Apex* period.[59]

5.2 Credit & Financial Impacts of Apex

To shed more light on the nature and mechanisms of *Apex*'s impact, I now analyze financial data from Compustat. As discussed in Section 4.2, Compustat data is available only for a subset of firms in the TRI database. In fact, as the third column of Table 2 indicates, Compustat has data on only eight of the firms that I identify as operating exclusively within the Seventh Circuit. A sample size this small

[59] In unreported tests, I also construct "raw data" difference and differences plots for the air releases and total waste variables. As with the regression analyses, these show comparable behavior in the treatment and control groups both before and after the *Apex* decision.

precludes meaningful analysis.[60] Thus, for my analyses using Compustat data, I rely on my expanded definitions of "local" firms that require only a fraction (either 70% or 95%) of their operations reported in the TRI data to be within a single circuit. By these definitions I identify, 46 firms and 18 firms, respectively, as both "local" to the Seventh Circuit and as having Compustat data available.[61]

There are two primary outcomes that I look at in the Compustat data for an impact from *Apex*. First, I look at the natural logarithm of firms' total liabilities to examine whether credit tightened in response to potentially lower recovery in the event of a firms' bankruptcy.[62] Secondly, I look at firms' profits to better understand the costs of changes firms made in response to *Apex*. Firms of different sizes have very different magnitudes of profits, so using total profits would not be suitable here. And, since profits can be negative, taking the natural logarithm, as I do with liabilities, is also not possible. To achieve a metric of profitability that is comparable across firms, therefore, I take the net profits[63] for each firm in each year and then divide this by the total assets the firm had as of year 2008, the year prior to the *Apex* decision. In this way, I calculate a version of firms' return on assets, but one which will only respond to changes in firms' total profits and not, for instance, be influenced by rising / falling asset values.[64]

Given these outcomes, I formulate triple difference specifications of the form:

$$y_{it} = (\text{Apex}_t \times \text{Single Circuit}_i \times \text{Seventh Circuit}_i)'\beta + \text{Company}_i + (\text{State}_i \times \text{Year}_t)'\Gamma_1 + (\text{NAICS 4}_i \times \text{Year}_t)'\Gamma_2 + (\text{Single Circuit}_i \times \text{Year}_t)'\Gamma_3\varepsilon \quad (3)$$

Here i indexes firms and t indexes years. y_{it} represents either of the two outcomes for liabilities and profits discussed above. The key interaction of interest here is the same as in Equation 2: ($\text{Apex}_t \times \text{Single Circuit}_i \times \text{Seventh Circuit}_i$). This measures the unique change in outcomes for firms whose operations (based on the TRI data) are primarily within the Seventh Circuit. Also as with Equation 2,

[60] In unreported tests I try my baseline analyses on this sample, and unsurprisingly find no evidence of a statistically significant effect of *Apex*.

[61] See again Table 2 for details on these firms.

[62] For my measure of total liabilities, I use Compustat variable 'lt.' For total assets, I use variable 'at.'

[63] Compustat variable 'ib.'

[64] As I discuss further below, I find evidence that firms' liabilities reduced somewhat following *Apex*, suggesting a potential tightening of credit. Firm assets declined, but by a smaller amount, suggesting some partial substitution of funding. But, since firm assets are declining, if I simply measure return on assets on a year-by-year basis, then reductions in firm profits get confounded by corresponding reductions in firm assets, potentially making it look like firm "profitability" decreased less or even increased, when in fact this is being driven simply by reduced value of total assets.

this formulation contains state-by-year fixed effects.[65] Company_i represents a simple company fixed effect in this formulation. Finally, ($\text{NAICS } 4_i \times \text{Year}_t$) represents the interaction between firms' NAICS4 industry classification and the yearly fixed effects. This enables each of the different three-digit NAICS industries to have a unique yearly time trend and thus helps to control for the greater diversity of firms in the Compustat data.

Figure 5 now plots the yearly coefficient estimates of the *Apex* effect calculated by fitting Equation 3 to the Compustat data using both the 70% and 95% thresholds for "local" firms. First, the plots show little evidence of systematic trends or differences between the "treatment" and "control" groups during the pre-*Apex* period. Second, the plots in general show a decrease in total liabilities of the affected firms starting immediately after the *Apex* decision and increasing for several years following it. If I replace the post-*Apex* indicators in Equation 3 with a single indicator to average the post-*Apex* effect, it yields a coefficient indicating a reduction in total liabilities of 9.1% (p-value 0.029**) for the 70% "local" threshold and a reduction in total liabilities of 13.2% (p-value 0.031**) for the 95% "local" threshold.[66]

To contextualize the magnitude of these declines, in Table 2 I consider the "local" firms under these varying definitions, and calculate for each firm separately the year-to-year standard deviation in its log total liabilities. These figures thus represent how much, in percentage terms, firm total liabilities tend to vary from year to year. The average of these intra-firm standard deviations across the local firms in the Seventh Circuit is approximately 0.25. Thus, the declines in total liabilities of 9.1% and 13.2% measured over the different definitions of local firms suggest that *Apex* may have led to a decline in total liabilities equal to roughly one half of the amount of normal year-to-year variation amongst these firms - in other words, a relatively modest tightening of credit.

When I examine the log of total firm assets under these specifications, I get reductions in assets of 5.5% and 6.0% for the 70% and 95% "local" firm thresholds respectively. These are both roughly half the size of the declines in total liabilities and neither is statistically significant. That assets appear to reduce less than liabilities suggests that firms may be partially substituting for reduced credit via other funding methods, but the statistical imprecision of these estimates makes it difficult to conclude this

[65] Here, a firm's state is based on its corporate headquarters as listed in the Compustat data.

[66] For versions of these analyses without Winsorizing, the p-values are 0.053* and 0.049**, respectively, and the coefficients are a modest amount smaller, showing reductions of 7.7% and 11.7% respectively.

for certain.

Finally, Figure 5 presents results on firm's returns on assets. For both the 95% and 70% local thresholds, the plot shows a small dip in profits following the *Apex* decision. But, the magnitude of this dip is comparable to dips that existed pre-*Apex* as well, making it much less clear that the dip can be meaningfully attributed to the *Apex* ruling. And, in any case, the dip completely disappears within a few years, whereas all of the other measured impacts of *Apex*, over the credit outcomes from Compustat and the pollution outcomes from the TRI data, are far more persistent. When I use a single coefficient to capture the post-*Apex* effects for return on assets, the coefficient is almost exactly 0 for the 95% and 70% local thresholds and has no statistical significance. Overall then, there is little evidence that *Apex* substantially impacted firm profitability, a result consistent with analyses of total waste in the TRI data. But, as with the total waste analyses, because the standard errors are relatively large, it is not possible to conclusively rule out a meaningful impact on firm profitability.

6 Validation, Robustness and Extension Analyses

In Appendix B I consider a number of tests to better gauge the validity and robustness of the primary findings of this investigation. This section summarizes those results.

First, I conduct additional tests to look for evidence of specific events other than the *Apex* ruling that may have impacted a similar set of firms in a similar way. Appendix B.1 looks for evidence in changes in RCRA enforcements near the time of the *Apex* ruling and Appendix B.2 investigates whether new specialized waste treatment and disposal facilities may have opened in or near the Seventh Circuit, thus potentially making these facilities a cheaper or more attractive option than they previously were.

Tests such as these are helpful in ruling out specific changes that could cloud the analysis. It is difficult though to test for every possible change that could occur near the time of the *Apex* decision. A more general response is to conduct additional placebo tests looking for an "effect" from *Apex* in places where no effect should be observed. The hope is that if there were some other non-*Apex* factor that occurred at a similar time to *Apex*, it might impact the targets of these placebo tests as well.

If such an effect for a "placebo" were found, it could point to a new factor that must be explicitly

controlled for in the baseline analyses in order to ensure validity. By contrast, if no effect is found, it builds support that the main tests in this paper are indeed capturing the impact of *Apex*. Appendix B.3 considers two such placebo tests. It looks for an impact of *Apex* on chemicals not regulated under RCRA, and then looks for an effect from *Apex* on Conditionally Exempt Small Quantity Generator (CESQG) facilities which are only lightly affected by RCRA and have low risks of causing catastrophic contamination. In both cases, no impact from the *Apex* ruling is found, as would be expected.

The second type of tests that I consider in Appendix B are ones that employ plausible variations on the forms of the statistical analyses that I use in Section 5. Appendix B.4 investigates the TRI analyses from Section 5.1.2 but uses the alternative definitions of "local" firms that require only a majority, rather than all, of a company's TRI activity to be within a single circuit. It finds results that are consistent with those in the main analyses, though at times with a lower degree of statistical significance.

Appendix B.5 then considers variations that omit circuits outside of the Seventh Circuit from the data. These seek to investigate the possibly that perhaps the Seventh Circuit did not change after the *Apex* decision but that instead, it was actually changes in some other circuit, perhaps a large one such as the Ninth, that made the Seventh Circuit look different compared to the country as a whole. These tests find no meaningful changes in results when any single circuit is omitted from the analysis.

Another possibility that Appendix B.5 considers is that the *Apex* decision, and perhaps the Supreme Court's decision not to review it, may have sparked speculation that other circuits would also adopt the *Apex* precedent. If this were the case, then including circuits that did not yet have a precedent addressing the issues considered in *Apex* in the data might attenuate the measured impact of the *Apex* decision. Conversely then, restricting the sample to only the Seventh Circuit plus the Second, Third, and Sixth Circuits (which already had precedents on the issue *Apex* addressed) might amplify the results.

Appendix B.5 indicates that restricting the sample size in this way results in some instances in modest increases in magnitude, but the changes are small, not statistically significant, and not fully consistent. This does not mean that there was no response in terms of circuits outside the Seventh anticipating that their appellate courts would adopt precedents similar to *Apex*; simply that if there was such a response, the tests in Appendix B.5 were not sensitive enough to pick it up.[67]

[67]This result is similar, for instance, to that in Honigsberg et al. (2017), which looked at a Second Circuit ruling impacting usury laws

Next, Appendix B.6 examines whether firms impacted by the *Apex* decision became less likely to be cited for violations of RCRA regulations. If so, it could provide evidence of another dimension along which firms sought to reduce their liability risks. The mechanism here would not be so much an effort to avoid fines for RCRA violations - these tend to be small and in any case their impact on companies was not meaningfully changed by *Apex*. Instead, a more plausible explanation would be that firms sought to improve the overall safety of their operations in an effort to reduce the chances of spills that could lead to catastrophic contamination. A side effect of this could be reduced citations for RCRA violations.

Appendix B.6 presents a small amount of suggestive evidence in favor of such an effect. But, a challenge is that one of the best markers of serious violations of RCRA regulations, the incidence and amount of fines, is also extremely rare, with only a tiny number of facilities receiving such fines in the Seventh Circuit at any point in the study period. Thus, the safest interpretation of these results is that they present nothing contrary to the findings under the primary analyses in this investigation.

Appendix B.7 addresses the conceptual concern that perhaps the *Apex* decision was significant not on account of its change to bankruptcy law but instead because it represented a signal that the Seventh Circuit was getting tougher on environmental enforcement more generally. Appendix B.7 discusses how the placebo tests and triple difference specifications in this study help to rule out that possibility. Appendix B.8 gives more interpretation of the magnitude of impacts of *Apex* measured in this analysis and discusses whether effects of this size are plausible.

Finally, Appendix B.9 presents analysis results when using different functional forms for the key outcome variables. In the baseline specifications, outcomes are measured in $\log(1 + \text{Amount})$ for the amount of chemicals released or treated off-site. In the alternative specifications, I consider outcomes that are binary indicators for whether any of a chemical was released on-site or treated off-site. I also consider an outcome that represents the ratio of off-site releases to the sum of on-site and off-site releases. These alternative formulations yield results that confirm the conclusions of the main analysis and with a generally high degree of statistical significance.

and presents generally similar results regardless of whether the sample omits jurisdictions that might plausibly have anticipated their circuit courts adopting precedents similar to that in the Second Circuit.

7 Conclusion

When a corporation enters bankruptcy proceedings, very frequently there are more obligations to other entities than it can fully satisfy. Legal rules, such as those governing the dischargeability and priority of claims in bankruptcy, and those governing limited liability protections for firm owners, govern which obligations will be met and in what amounts, given limited resources. Scholars in law and economics have for some time been interested in how these rules governing distribution of resources after a firm fails might impact the behavior of firms before they fail, particularly when it comes to activities that externalize harms to other parties.

When the Seventh Circuit Court of Appeals issued its decision in *U.S. v. Apex Oil Co.* in 2009, it created a valuable natural experiment in which one set of firms saw a change in rules governing which obligations could be discharged in bankruptcy, whereas another set of firms saw no such change. A priori - it was not certain that a change in law such as this would impact firm behavior. *Apex* most directly impacted firm creditors and only indirectly affected firm managers and shareholders. Yet, the results from this investigation suggest firms subject to the precedent from *Apex* took meaningful new precautions to reduce risks of causing catastrophic toxic chemical contamination.

As public and academic interest in externalities created by corporations increases, and as corporations come increasingly to rely on debt, the findings in this paper point to the potential value in looking at bankruptcy law and law more generally that influences recovery for firm creditors as tools to improve net social efficiency. At the same time, the *Apex* decision impacted the dischargeability of a very specific type of obligation relevant to a very specific set of firms. Thus, there is much need for further research to better understand if, where, and how the findings here generalize to other pertinent contexts.

References

Akey, Pat, and Ian Appel, 2017, The limits of limited liability: Evidence from industrial pollution, *Working Paper* .

Alberini, Anna, and David H Austin, 1999, Strict liability as a deterrent in toxic waste management: empirical evidence from accident and spill data, *Journal of Environmental Economics and Management* 38, 20–48.

Alberini, Anna, and Shelby Frost, 2007, Forcing firms to think about the future: Economic incentives and the fate of hazardous waste, *Environmental and Resource Economics* 36, 451–474.

Baird, Douglas G, and Robert K Rasmussen, 2005, Private debt and the missing lever of corporate governance, *U. Pa. L. Rev.* 154, 1209.

Bebchuk, Lucian Arye, and Jesse M Fried, 1995, The uneasy case for the priority of secured claims in bankruptcy, *Yale Law Journal* 105, 857.

Black, Fischer, and Myron Scholes, 1973, The pricing of options and corporate liabilities, *The journal of political economy* 637–654.

Bledsoe, David, 2010, Supreme Court Lets Stand Seventh Circuit Ruling on Discharging RCRA Cleanup Orders in Bankruptcy, *Perkins Coie News & Insights,* https://www.perkinscoie.com/en/news-insights/supreme-court-lets-stand-seventh-circuit-ruling-on-discharging.html.

Boyer, Marcel, and Donatella Porrini, 2011, The impact of court errors on liability sharing and safety regulation for environmental/industrial accidents, *International review of law and economics* 31, 21–29.

Broun, Caroline, and James O'Reilly, 2018, *RCRA and Superfund: A Practice Guide, 3d* (Thomson Reuters).

Cahoon, Bradley, 2006, Extreme makeovers: Risk reduction strategies for redeveloping mine-scarred & other industrial lands, *Rocky Mountain Mineral Law Institute* 52.

Cameron, A Colin, and Douglas L Miller, 2015, A practitioner's guide to cluster-robust inference, *Journal of Human Resources* 50, 317–372.

Chang, Howard F, and Hilary Sigman, 2014, An empirical analysis of cost recovery in superfund cases: Implications for brownfields and joint and several liability, *Journal of Empirical Legal Studies* 11, 477–504.

Chang, Xin Simba, Kangkang Fu, Tao Li, Lewis Tam, and George Wong, 2018, Corporate environmental liabilities and capital structure, *Working Paper* .

Cole, Marcus, 2002, Delaware is not a state: Are we witnessing jurisdictional competition in bankruptcy, *Vand. L. Rev.* 55, 1845.

De Marchi, Scott, and James T Hamilton, 2006, Assessing the accuracy of self-reported data: an evaluation of the toxics release inventory, *Journal of Risk and uncertainty* 32, 57–76.

Dionne, Georges, Robert Gagne, Francois Gagnon, and Charles Vanasse, 1997, Debt, moral hazard and airline safety an empirical evidence, *Journal of Econometrics* 79, 379–402.

Dixon, Lloyd S, Deborah Skoller Drezner, and James K Hammitt, 1993, *Private-sector cleanup expenditures and transaction costs at 18 Superfund sites*, volume 204 (Rand Corporation).

Earnhart, Dietrich, and Kathleen Segerson, 2012, The influence of financial status on the effectiveness of environmental enforcement, *Journal of Public Economics* 96, 670–684.

Eisenberg, Theodore, and Lynn M LoPucki, 1998, Shopping for judges: an empirical analysis of venue choice in large chapter 11 reorganizations, *Cornell L. Rev.* 84, 967.

Ellias, Jared A, 2018, What drives bankruptcy forum shopping? evidence from market data, *The Journal of Legal Studies* 47, 119–149.

Feinstein, Jonathan S, 1989, The safety regulation of us nuclear power plants: Violations, inspections, and abnormal occurrences, *Journal of Political Economy* 97, 115–154.

Fil, Richard, 2009, Resource Conservation and Recovery Act vs. Chapter 11: When Is a "Discharge" Not Discharged?, *American Bankruptcy Institute Journal* 28, 26.

Gao, Pengjie, Tae Kim, and Qiping Xu, 2018, Financial constraints and corporate environmental policies, *Working Paper* .

Gardner, R William, and Rubin Pusha III, 2014, The west virginia chemical spill and environmental liabilities in a post-apex world, *American Bankruptcy Institute Journal* 33, 38.

Goetz, Martin R., 2018, The technology of creditor protection, *Working Paper, Goethe University* .

Goins, C. Douglas, and Thomas Bean, 2010, Rethinking Environmental Cleanup Strategies When One Potentially Responsible Party Is In Bankruptcy, *Perkins Coie News & Insights,* https://www.perkinscoie.com/en/news-insights/supreme-court-lets-stand-seventh-circuit-ruling-on-discharging.html.

Gross, Joel M, and Christopher Anderson, 2010, Classic Chapter 11 reorganizations versus section 363 sales and the effects on environmental cleanup obligations: The choice after Apex Oil Co. and General Motors, *Norton-Journal of Bankruptcy Law and Practice* 1, 51.

Haider, Shan, Ji Hun Kim, and Nicholas M. McGrath, 2010, After Apex, Debtors Must Clean Up After Themselves, *American Bankruptcy Institute Journal* 29, 48.

Hansmann, Henry, and Reinier Kraakman, 1991, Toward unlimited shareholder liability for corporate torts, *Yale Law Journal* 1879–1934.

Hird, David, 2010, Supreme Court's Denial of Certiorari in Apex Oil Leaves Standing Seventh Circuit Ruling that Environmental Cleanup Injunctions are Not Dischargeable in Bankruptcy, *Weil Bankruptcy Blog,* https://business-finance-restructuring.weil.com/environmental/supreme-courts-denial-of-certiorari-in-apex-oil-leaves-standing-seventh-circuit-ruling-that-environmental-cleanup-injunctions-are-not-dischargeable-in-bankruptcy/.

Honigsberg, Colleen, Robert J Jackson Jr, and Richard Squire, 2017, How does legal enforceability affect consumer lending? evidence from a natural experiment, *The Journal of Law and Economics* 60, 673–712.

Jennings, Brian, and Julie Wilson-McNerney, 2016, Section 363 is no magic bullet for environmental liability, *Law 360* .

Jensen, Michael C, and William H Meckling, 1976, Theory of the firm: Managerial behavior, agency costs and ownership structure, *Journal of financial economics* 3, 305–360.

Kahneman, Daniel, 2011, *Thinking, fast and slow* (Macmillan).

LoPucki, Lynn M, 1996, The death of liability, *Yale Law Journal* 106, 1.

Norton, William L. Jr., and William L. III Norton, 2018, *Norton Bankruptcy Law & Practice, 3d* (Thomson Reuters).

Posner, Richard A, 1976, The rights of creditors of affiliated corporations, *The University of Chicago Law Review* 43, 499–526.

Rdzanek, Diana E, 2010, Discharge of RCRA Injunctive Claims in Bankruptcy: The Seventh Circuit's Decision in United States v. Apex Oil Co., Inc., *Seventh Circuit Review* 6, 163.

Ringleb, Al H, and Steven N Wiggins, 1990, Liability and large-scale, long-term hazards, *Journal of Political Economy* 98, 574–595.

Rose, Nancy L, 1990, Profitability and product quality: economic determinants of airline safety performance, *Journal of Political Economy* 98, 944–964.

Rosenthal, Brian, 2010, When a discharge isn't, *American College of Environmental Lawyers,* http://www.acoel.org/post/2010/03/08/When-a-Discharge-Isnt-.aspx.

Shumway, Tyler, 2001, Forecasting bankruptcy more accurately: A simple hazard model, *The journal of business* 74, 101–124.

Triantis, George G, and Ronald J Daniels, 1995, The role of debt in interactive corporate governance, *Calif. L. Rev.* 83, 1073.

Viteskic, Ena, 2010, Is bankruptcy an excuse for neglect?, *The Kentucky Journal of Equine, Agriculture, & Natural Resources Law,* http://www.kjeanrl.com/full-blog/2010/11/is-bankruptcy-excuse-for-neglect.html.

Weissman, William R, and J Michael Sowinski Jr, 2015, Revitalizing the brownfields revitalization and environmental restoration act: Harmonizing the liability defense language to achieve brownfield restoration, *Virginia Environmental Law Journal* 257–355.

Zahran, Sammy, Terrence Iverson, Stephan Weiler, and Anthony Underwood, 2014, Evidence that the accuracy of self-reported lead emissions data improved: A puzzle and discussion, *Journal of Risk and Uncertainty* 49, 235–257.

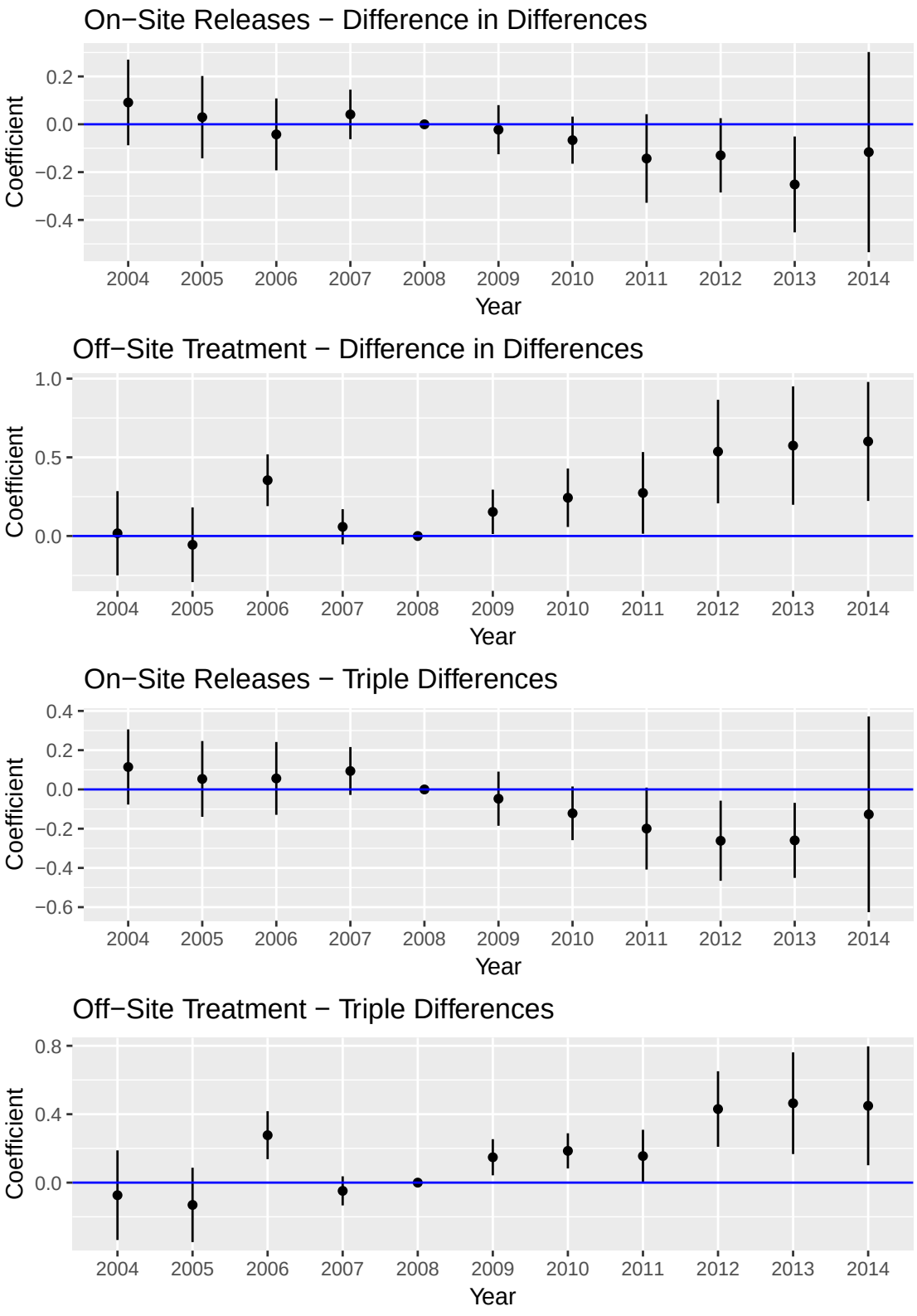

Figure 1. TRI Baseline Analyses - Parallel Trend Plots - Local Firms Only. These plots depict the annual coefficients estimates from equations 1 and 2. For each, the base level for the categorical year variable is set to 2008, the year before the *Apex* decision. Thus, this coefficient is represented as zero by definition on all of these plots. All other coefficients represent an effect of *Apex* estimated for each given year, relative to the base year of 2008. Vertical lines in the plots depict 95% confidence intervals for the coefficients. All model aspects of fixed effects, error clustering, and sample size are the same as for the results depicted in Table 3.

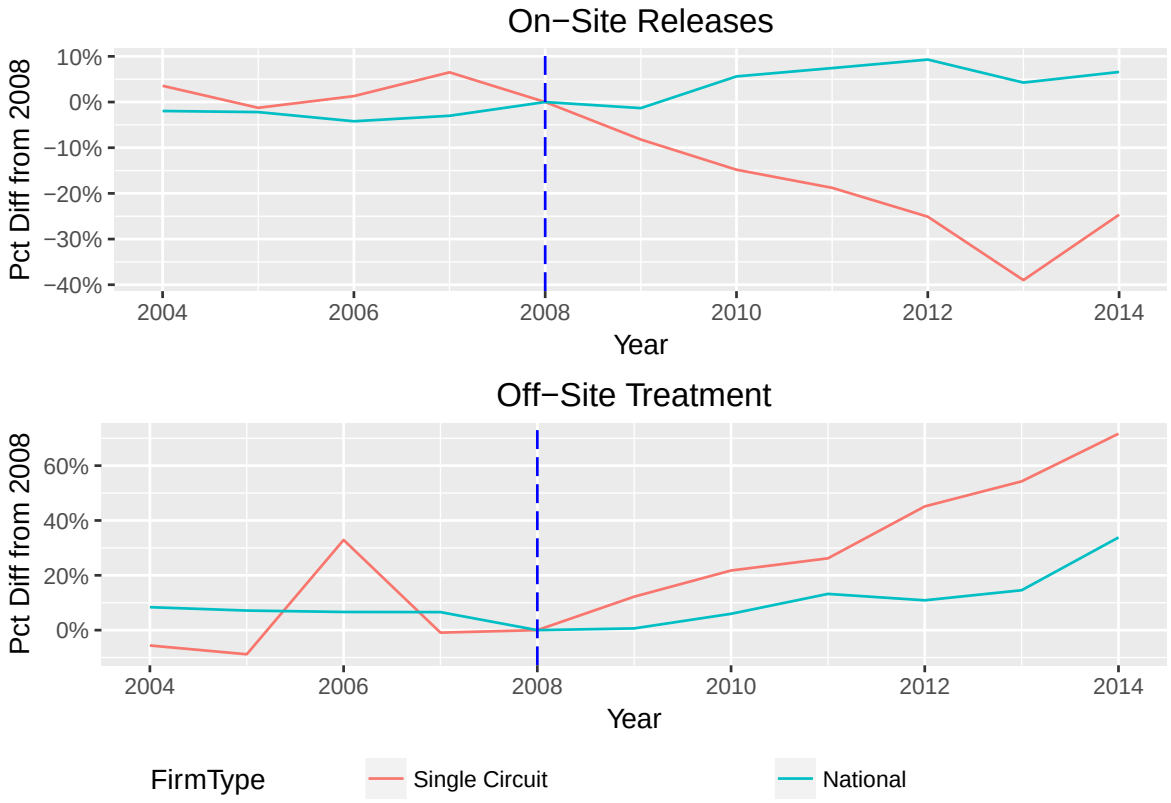

Figure 2. "Raw Data" Difference in Differences Plot - "Local" Firms Only. This plot considers just the set of "local" firms that operate only in a single circuit: the same set of data used for the difference in differences statistical analyses. Rather than presenting regression coefficients, however, the data underlying this plot simply calculates, for each facility-by-chemical-by-year observation, the percentage by which the value of that observation differs from the facility-by-chemical observation from 2008, the baseline year prior to the *Apex* decision. Thus, if on-site releases are 100 pounds in 2008, and 90 pounds in 2009, then this will record "-10%." Finally, I take the mean "percentage difference from 2008" across all chemicals and facilities across all "single circuit" firms in the Seventh Circuit, and across all "single circuit" firms outside of the Seventh Circuit, and plot those yearly mean percentage differences in this chart.

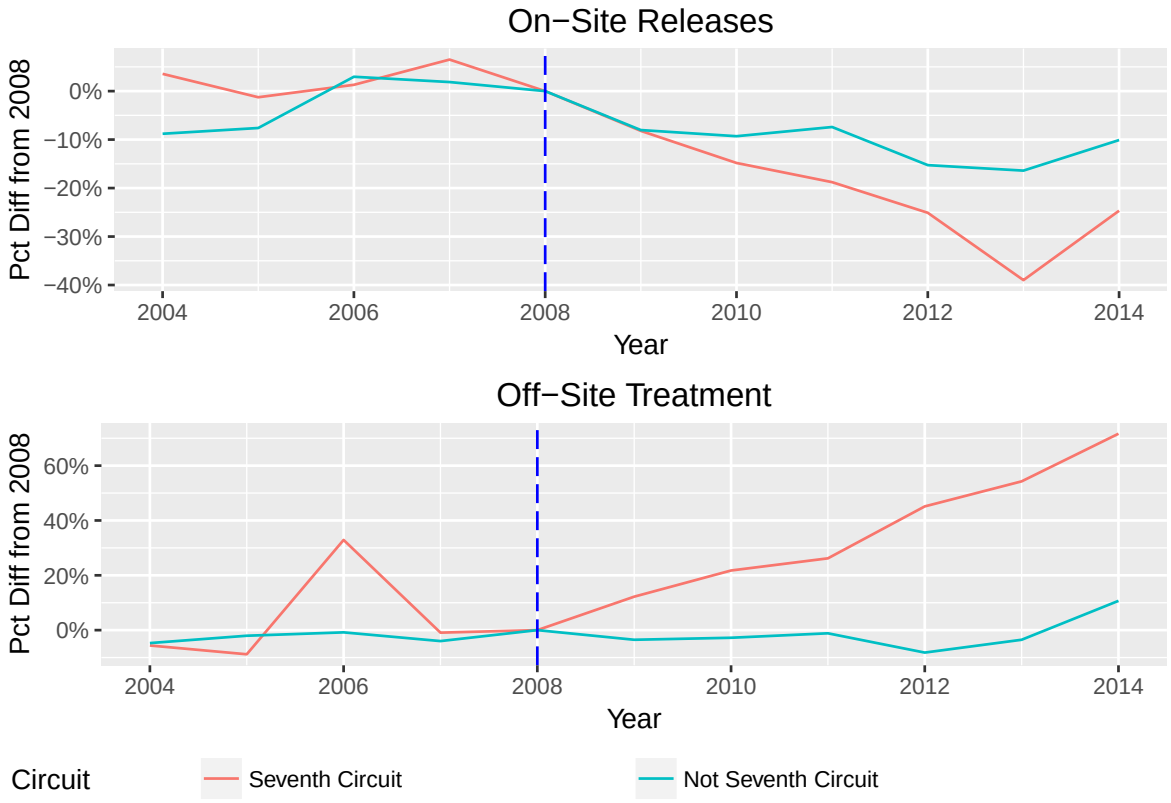

Figure 3. "Raw Data" Difference in Differences Plot - Seventh Circuit Facilities Only. This plot considers just the set of facilities located within the Seventh Circuit. It compares the behavior of those facilities that are owned by "local" firms that operate only within the Seventh Circuit with the behavior of facilities that are in the Seventh Circuit but that are owned by "national" companies whose operations span multiple circuits. Thus, this would represent the underlying data that would be used, for instance, to run a difference in differences statistical analysis, but looking only at facilities within the Seventh Circuit. As with Figure 2, however, rather than presenting regression coefficients, this instead simply plots the "raw data" representing the average change in chemical disposal levels across "local" and across "national" firms operating within the Seventh Circuit. As such, this can be seen as reflecting the additional set of differences that is being compared in the triple difference regression specifications.

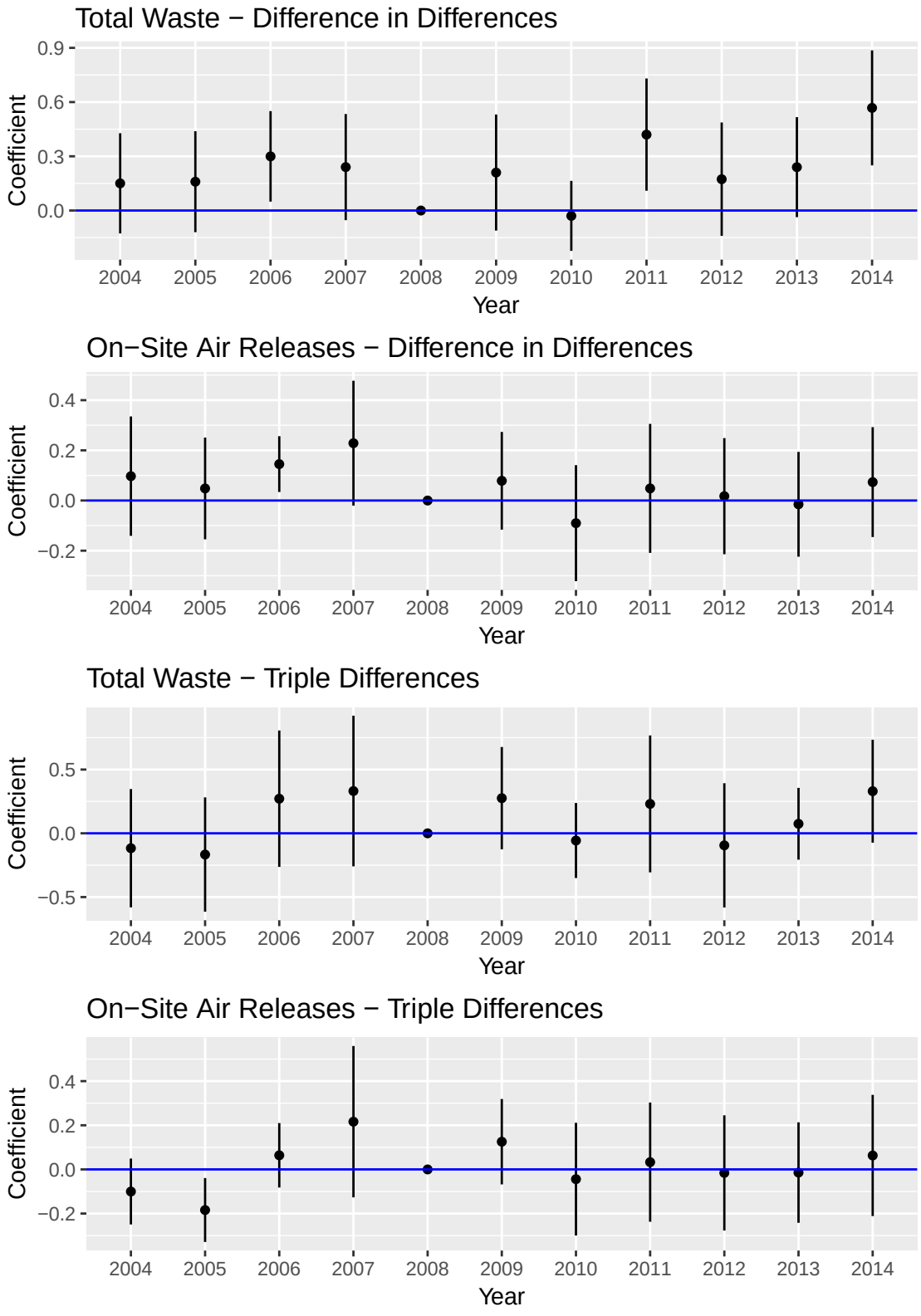

Figure 4. TRI "Total Waste" and "Air Releases" - Parallel Trend Plots. This figure depicts parallel trend plots of the precise same nature and specifications as those in Figure 1 but simply uses total waste and air releases as the response variables.

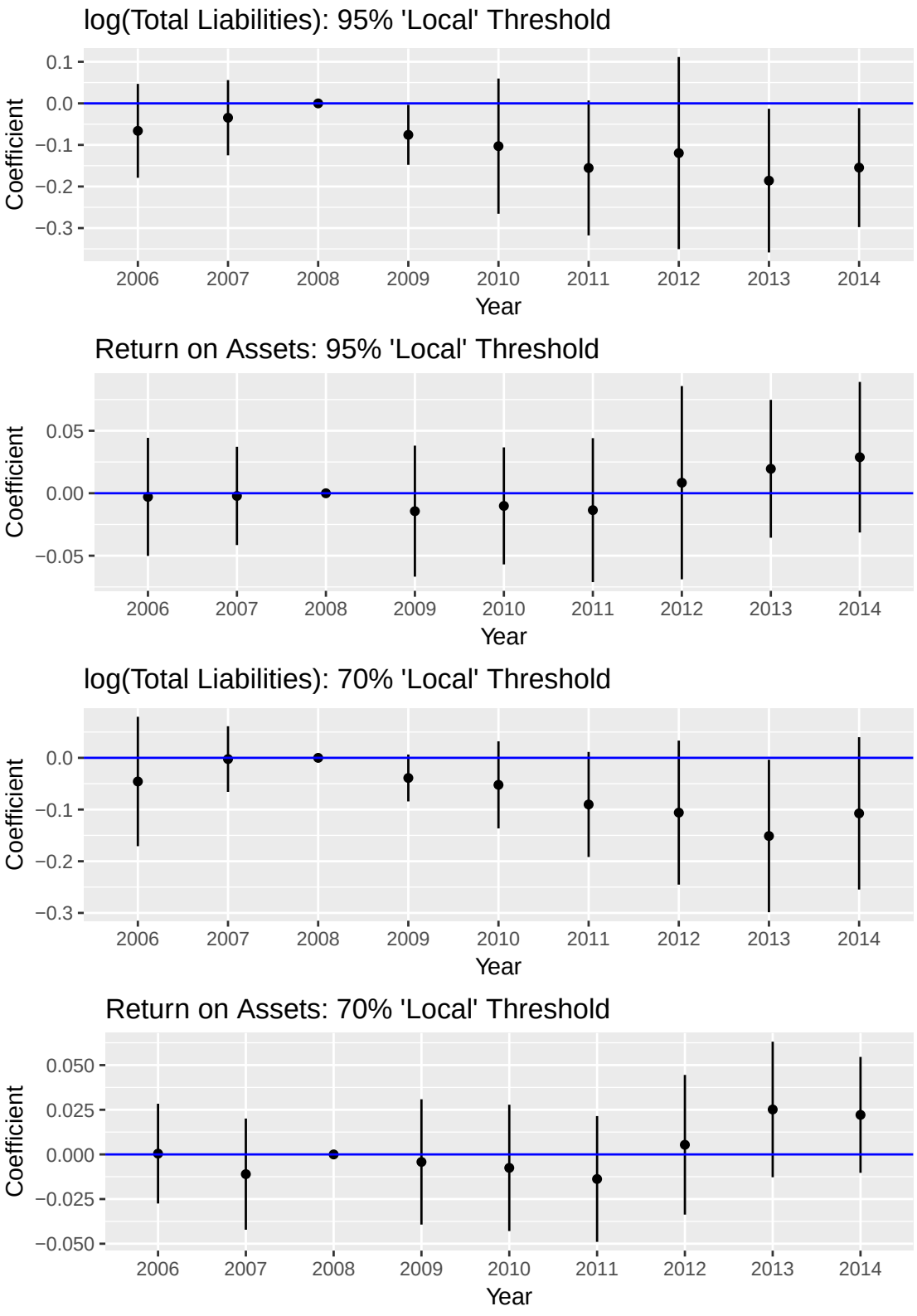

Figure 5. Compustat Parallel Trends Plots. These plots depict the results from the triple difference analysis for the Compustat data defined by Equation 3. As with comparable TRI plots in Figure 1, these set the base level for the categorical year variable to 2008, the year before the *Apex* decision. Other coefficient estimates thus represent deviations from this as a baseline, and vertical bars represent 95% confidence intervals on the estimates, with robust errors clustered at the state level. Results from versions of these analyses that use just a single post-*Apex* indicator variable are discussed in Section 5.2.

Table 1
TRI Summary Statistics. Units for all statistics on wastes are in millions of pounds and represent sums taken over the eleven-year sample period from 2004 to 2014. Counts for total observations are at the facility-by-chemical-by-year level.

	All Circuits			Seventh Circuit	
Firm Type	All Firms	National	Local	National	Local
All Firms: Total Waste	87,347	77,163	10,183	7,567	921
Firm Avg. Total Waste	55.8	82.4	16.2	36.4	16.7
Facility Avg. Total Waste	23.1	23.9	15.2	22.4	15.1
Facility Avg. On-Site Releases	3.5	3.2	3.9	2	2.5
Facility Avg. Off-Site Treatment	0.4	0.4	0.4	0.3	0.4
Facility Avg. Stack Air Releases	0.3	0.4	0.2	0.3	0.2
Observations	360,197	302,033	58,164	33,457	5,521
Unique Facilities	3,788	3,230	670	338	61
Unique Companies	1,564	936	628	208	55

Table 2
Compustat Summary Statistics. Values for total assets and liabilities are given in millions of dollars. The respective standard deviations are calculated as follows. For each of assets and liabilities, I take the natural logarithm and then compute the intra-firm yearly standard deviation of this figure over the sample period. The reported standard deviations for log total assets and log total liabilities then represent the mean of these intra-firm standard deviations. The standard deviation for return on assets follow the same mean, intra-firm calculation, but with no logarithm applied. Return on Assets is calculated by dividing total firm profits by assets in 2008. In this way, it seeks to create a consistent measure of net profitability that is on a scale comparable across firms.

	All Firms	**7th Cir TRI Local**	**7th Cir TRI Local - 95%**	**7th Cir TRI Local - 70%**
Number of Firms	2,802	8	18	46
Number of Observations	25,218	72	162	414
Avg. Total Assets	6,888	3,632	16,078	11,710
SD log(Total Assets)	0.27	0.21	0.21	0.21
Avg. Total Liabilities	4,445	2,516	10,238	7,451
SD log(Total Liabilities)	0.32	0.21	0.25	0.24
Avg. Return on Assets	0.028	0.042	0.064	0.061
SD Return on Assets	0.051	0.051	0.04	0.042

Table 3
TRI - Baseline Results. This table presents the results of fitting equations 1 and 2 to the TRI data. For each regression specification, the response variable is equal to the natural logarithm of one plus the value found in the TRI data. Coefficients are thus interpreted as percent changes in an outcome attributable to the *Apex* ruling. For the difference in differences formulation, the sample consists only of "local" firms (as defined in Section 4.1.3) in each judicial circuit. For the triple difference formulations, the sample consists of both "local" and "national" firms in each judicial circuit. Robust standard errors are double clustered at the state and company level.

	(Difference in Differences)		(Triple Differences)			
	(On-Site Release)	(Off-Site Treatment)	(On-Site Release)	(Off-Site Treatment)	(Total Waste)	(On-Site Air)
Apex x Seventh Circuit	-0.144 *	0.314 **				
	(0.0816)	(0.1365)				
Apex x Seventh Circuit x Single Circuit			-0.233 **	0.294 ***	0.057	0.025
			(0.0909)	(0.0956)	(0.111)	(0.0887)
Observations	57684	57684	355176	355176	355176	355176
Adjusted R^2	0.816	0.636	0.828	0.669	0.779	0.826
Facility x Chem FE	yes	yes	yes	yes	yes	yes
Chem x Year FE	yes	yes	yes	yes	yes	yes
State x Year FE	no	no	yes	yes	yes	yes
Local Firm x Year FE	no	no	yes	yes	yes	yes

Cluster robust standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Appendix A Data Details

A.1 TRI Data Details

This subsection discusses several additional details in constructing the TRI data not covered in Section 4.1. First, in creating my measure of on-site releases, I start with TRI data element ON_SITE_RELEASE_TOTAL and subtract from this the two TRI data elements STACK_AIR and FUGITIVE_AIR. My measure for off-site treatment of waste is simply the TRI data element OFF_SITE_TREATED_TOTAL and my metric for total waste is simply the TRI data element PROD_WASTE.

In identifying which facilities are regulated by RCRA (so as to restrict my analyses to those), I follow the procedure for matching between TRI and RCRA datasets described in Appendix A.4 below. The RCRA data in turn contains designations of CESQG facilities, which I also use in my data selection.

In identifying which chemicals are regulated by RCRA, I begin with the EPA's website for its "Substance Registry Services."[68] I enter "RCRA" in the search terms under the "Browse by chemical / substance lists" and download the pertinent Excel files that correspond to the different subsections of RCRA that list specific chemicals covered by the statute. These Excel files (which I most recently accessed on July 6, 2018) in turn contain the CAS (Chemical Abstract Service) compound ID for the RCRA regulated chemicals. I then match these to the CAS IDs for chemicals in the TRI database. In most cases, the TRI data gives a precise chemical ID to be used in this match. In some instances, the TRI designation is more general - stating, for instance, "Arsenic Compounds" or "Cadmium Compounds." In these cases, if the underlying element or chemical in the compound is regulated under RCRA, I also include it in my analyses.

In reporting on TRI data, if a given facility has zero releases of a particular chemical via a particular method (e.g. on-site release) for a given year, in some cases the facility will report a '0' for that year and in other cases it will simply omit that chemical and release method for its reporting. Accordingly, I create a fully balanced chemical-by-facility-by-year-by-release method panel by filling in '0' for instances in which (a) a given facility has no record of a given chemical for a given year, (b) the facility does have record of that chemical for other years, and (c) the facility has reported records of other chemicals for a given year.

A.1.1 Units in TRI Data

A final data detail regarding the TRI data is the units of weight in which chemicals are measured. In my regression analyses, I treat each chemical separately, take its logarithm, and use facility by chemical fixed effects. Thus, the units chemicals are measured in are irrelevant to the statistical estimates obtained in my analyses. For the summary statistics in Table 1, however, I do aggregate totals across different chemicals to give a rough sense of aggregate amounts. This clearly is a simplification: different chemicals have different toxicities and so a given amount of one chemical is not directly comparable to the same amount of another chemical.

Also, for almost all the chemicals in TRI, the reported units are in pounds. But, there are a few chemicals that tend to be used in very small amounts but which have very high toxicities, and the amounts of these chemicals are reported in grams, not pounds. When reporting aggregate statistics, I could divide the amounts of these chemicals by 453 to convert pounds to grams. Yet, doing so would in many ways be less informative rather than more, since it would fail to capture the special toxicity of these chemicals whose weights are reported in grams. Thus, in a technical sense, the amounts reported in Table 1 should best be understood as representing "total units" rather than "total pounds." Again though, I stress this issue is only pertinent to the reporting of summary statistics and has no bearing at all on any regression results.

A.2 TRI Data Reliability

US law provides for strict penalties for both firms and individual employees of those firms caught violating TRI reporting requirements, which includes fabricating or mis-representing reported data.[69] Firms subject to TRI reporting receive periodic audits and inspections to assess their data accuracy.

As an initial matter then, it is reasonable to expect some relatively high level of accuracy of the data. Nevertheless, a more careful consideration of the matter is in order. Some early research examined statistical patterns

[68] https://ofmpub.epa.gov/sor_internet/registry/substreg/LandingPage.do

[69] 42 U.S.C.A. §11045(c).

in TRI data reporting and concluded that it was likely that some facilities were submitting inaccurate information, primarily for certain types of chemical releases into the air. For these air releases, naturally, it is far harder for EPA inspectors to identify mis-reporting and pin it to a certain facility (De Marchi and Hamilton, 2006). Yet, even looking at these difficult-to-verify air releases, later research using similar techniques identified large improvements in the accuracy of TRI reporting, particularly since 2001 (Zahran et al., 2014). This same research notes that releases such as off-site treatment (one of the key outcomes examined in this study) are far easier to accurately monitor and inspect, and as such have maintained a higher level of accuracy even when air-release reporting raised more statistical suspicions. These statistical investigations thus bode relatively well for the accuracy of the TRI data used here: data accuracy has improved significantly over time, and the major sources inaccuracy were for difficult-to-verify air emissions that are not a central component of this study.

Yet, what is perhaps the most persuasive evidence in support of the accuracy of the TRI data used in this study comes from a careful examinations of the incentives of firms to accurately or inaccurately report their data and how those relate to the *Apex* decision. In some situations, if there were some kind of intensification of regulatory enforcement or increase in penalties, it might be anticipated that firms could respond by fabricating their reporting data. Firms might perhaps falsely depict that they had reduced their on-site releases of toxic chemicals. This might be particularly true if the new regime set strict new limits on total on-site releases, and firms found these new limits difficult or costly to honestly comply with. For a strategy like this to be effective, the new regime would presumably also need to not increase the likelihood or penalties of detection, or at least not sufficiently to overcome the benefits of fabricating data.

Yet, a scenario such as this is completely at odds with the legal reality of the *Apex* decision. First, the *Apex* decision did nothing to change any kinds of limits on amounts of chemicals released. Thus, there would seem to be little direct pressure from the decision for companies to start fabricating more information on the TRI reports that they make. Furthermore, if a firm did violate any permits or regulations governing the amounts of chemicals it released on site, those would be subject to regulatory fines. Such fines would impact a company immediately, rather than the kinds of longer-term considerations of dischargeability in the event of bankruptcy that *Apex* affected. The *Apex* decision in fact decidedly had no impact on the dischargeability of fines already assessed, and in any event, the magnitude of these fines tends to be quite minor.[70] In short, the type of catastrophic contamination relevant to the *Apex* decision is of a completely nature than any penalties firms might seek to avoid by fabricating their TRI reporting information.

Thus, when considering the reporting for on-site releases, there are very strong reasons to believe that the *Apex* decision would not in any way alter the incentives of firms to accurately report their data.[71] For the other key outcome in this study, off-site treatment, the reasoning in support of data accuracy is even stronger. First, there is less of an incentive to artificially inflate this number in general - firms do not get any kind of regulatory "credit" for increasing the amounts of wastes they send off-site for treatment.

Perhaps equally importantly, fabricating this information is far more difficult. RCRA regulations require very detailed reporting of which wastes are sent to which treatment facilities and by which methods. Treatment facilities in turn must maintain their own detailed records of the wastes they receive, their amounts and origins. Thus, as is relatively clear from this situation, and as has been noted in prior research (Zahran et al., 2014), for a firm to fabricate off-site treatment reporting it would need to collude with one or more other companies, who, in this case, would somehow need to have an incentive to risk serious penalties to falsely claim they are treating and disposing of *more* toxic chemicals than they actually are. It seems almost impossible to imagine a scenario in which the *Apex* ruling would have increased the incentive for such multi-firm, collaborative fraud. Accordingly, even if one accounts the results reported here for on-site releases slightly less certain due to questions of data accuracy, the results for changes in off-site treatment should remain reliable in this regard.

A.3 RCRA Inspections and Enforcements Data

As discussed in Section 4.1 I already restrict the sample for my main analyses to the set of facilities reporting in TRI that are also subject to regulation under RCRA. This in turn makes it a relatively straightforward matter to

[70] For instance, as noted in Table B.4, total fines over all facilities nationally during the entire eleven-year study period are $55 million, roughly one third the amount of cleanup obligations due in the single instance of the contamination at issue in the *Apex* case.

[71] Additionally, for the findings in this investigation to be valid, it is not necessary that the TRI data be completely accurate in every respect. Instead, it is merely necessary that the *Apex* ruling did not systematically induce the local, Seventh Circuit firms that it impacted to start fabricating *more* than they previously did.

merge data on RCRA inspections and enforcements in to the data sets I use for my primary analyses.

I start by identifying the TRI facility ID associated with each facility ID in the RCRA database, with details on this process given in Appendix A.4. I then access the EPA's RCRA database from the "Downloads" section of the EPA's ECHO (Environmental Compliance History Online) program.[72]

For information on inspections of facilities to assess RCRA compliance, I access the file: "RCRA_EVALUATIONS.csv" which is a component of the zip archive download described above. I remove from this data evaluations marked (in the field EVALUATION_DESC) as being self-disclosure,[73] though as a practical purpose these comprise only a few percent of the total data and their inclusion or exclusion makes no discernible impact on any of my analyses. I extract the year (based on the EVALUATION_START_DATE field) for these inspections, and then merge these annual records of inspections into the annual TRI disclosure data in order to record whether a given facility in the TRI data received one or more RCRA related inspections in a given year.

For information on RCRA enforcement actions, I access the "RCRA_ENFORCEMENTS.csv" file that is part of the same zip archive that contains the RCRA inspection information described above. I obtain the year of the enforcement based on the ENFORCEMENT_ACTION_DATE field. I record the penalty amount of the enforcement based on the value of the FMP_AMOUNT.[74]

To distinguish between what I term "formal" and "informal" enforcement actions, I look at the "ENFORCEMENT_DESC" field in this data. Any type of enforcement that contains the word "informal" (e.g. "written informal" and "verbal informal") I mark as informal. EPA documents specifically note that in most cases, informal actions correspond to smaller and more isolated problems.[75]

Table A.1 gives summary statistics on the RCRA inspection and enforcement actions described in this section.

A.4 Matching RCRA to TRI

The TRI and RCRA databases use separate systems of numeric IDs to track facilities, but resources exist to cross reference one set of IDs to another. In particular, I draw on the EPA's centralized Facility Registry System (FRS).[76] I download the national-level zip archive associated with this[77] and access the "national alternative name file" from within this. This file in turn contains a list of facilities and their respective IDs for both the TRI data and the RCRA data, along with a centralized ID across all EPA databases (which the EPA terms the "Registry ID"). I thus first create a mapping from RCRA facility IDs to the centralized Registry ID and then a mapping from these Registry IDs to TRI IDs.

By using this centralized FRS database, I am able to complete almost all of the matching that I utilize between TRI and RCRA facility IDs. The EPA does have one additional source of data for matching IDs that allows me to match a few more facilities that were not matched from the FRS system. In particular, I access the EPA's "TRI EZ Search" reference.[78] This gives detailed information on the facilities in the TRI data, including in some cases the RCRA ID associated with the facility. In most cases, these identifications match those in the FRS. But, there are a few cases where this database has additional matches. From investigation, I believe a cause of this is that there is some ambiguity across EPA systems as to what precisely constitutes a facility - in other words, there are a small number of instances where a given set of operations will be considered a single facility in one database, but as multiple facilities in another database. Thus, if there is a TRI facility not matched to a RCRA ID via the FRS system, but that is matched via this TRI EZ Search, then I use that identification as well.

[72] As of September 2018, this downloads section is available at this address: https://echo.epa.gov/tools/data-downloads and the specific RCRA data is available on this page under the heading: "RCRAInfo Data Set" and at the link: https://echo.epa.gov/files/echodownloads/rcra_downloads.zip. Data documentation is also provided on this same site.

[73] This includes two labels, differing only in capitalization: "FACILITY SELF DISCLOSURE" and "Facility Self Disclosure."

[74] FMP stands here for "Final Monetary Penalty" amount. It reflects the amount of money a facility must pay as a fine, and does not reflect any adjustments to this as credits for the cost of upgrades to equipment that the facility agrees to make as part of the process of settling the enforcement action.

[75] See "Informal and Formal Actions Summary of Guidance and Portrayal on EPA Websites" available: https://www.epa.gov/compliance/informal-and-formal-actions-summary-guidance-and-portrayal-epa-websites. Accessed September 10, 2018.

[76] Data on this is available at https://www.epa.gov/enviro/epa-state-combined-csv-download-files. I downloaded these files on June 18, 2018.

[77] https://www3.epa.gov/enviro/html/fii/downloads/state_files/national_combined.zip

[78] Available here: https://www.epa.gov/enviro/tri-ez-search. I accessed this database on June 18, 2018.

A.5 Safety of Specialized Waste Treatment Facilities

Section 3.1 mentions in its discussion that sending wastes to specialized treatment and disposal facilities is generally regarded by environmental law experts and practitioners to be a safer and preferable approach as compared to individual facilities disposing of such wastes on site. Some evidence of this can also be seen directly in the data analyzed in this study, though it is admittedly of a relatively informal and suggestive nature. In particular, I consider the six-digit NAICS industry-activity classifications, which are included for facilities in both the TRI and RCRA databases. I focus in particular on the code "562211 - Hazardous Waste Treatment and Disposal." I look first at the TRI data and examine total on-site releases of each RCRA-regulated chemical across all facilities and total on-site releases just for facilities with NAICS 562211. On average across these chemicals, facilities with NAICS 562211 account for roughly 30% of all such releases. I then look at violations of RCRA regulations, first across all RCRA-regulated facilities and then across facilities with NAICS 562211. These facilities account for only 4.6% of all enforcement actions, 4.7% of all formal enforcement actions, and 10.6% of total monetary penalties.

Table A.1
RCRA Enforcement Summary Statistics. This table contains summary statistics for the RCRA related inspections and enforcement actions reported for the facilities whose data from TRI is used in the paper's main analyses. Probabilities in this table are given at a yearly basis - e.g. probably of being assessed a fine for RCRA violations by a given facility in a given year. The standard deviation of fine amounts is calculated over all facilities in a given group, rather than any kind of intra-firm metric as for the summary statistics for the Compustat data.

	All Firms	**All 7th Cir**	**7th Cir Local**	**7th Cir Local - 95%**	**7th Cir Local - 70%**
Number of Firms	1,564	263	55	86	140
Number of Facilities	3,788	389	61	98	167
Number of Inspections	12,793	1,156	155	262	495
Inspection Probability	30.7%	27%	25.2%	24.8%	27.6%
Number of Fines	724	59	12	17	30
Fine Probability	1.7%	1.4%	1.9%	1.6%	1.7%
Median Fine Amount	15,422	10,200	15,200	12,960	12,082
SD Fine Amount	325,385	1,002,425	36,715	32,820	1,401,989
Unique Firms with Fines	301	40	11	14	25
Total Fine Amount	54,589,813	9,551,307	394,078	455,232	8,359,057
Number of Violations	5,696	492	84	129	235
Violation Probability	13.7%	11.5%	13.6%	12.2%	13.1%
Unique Firms with Violations	976	157	34	53	88
Number of Formal Violations	2,175	225	44	61	110
Formal Violation Probability	5.2%	5.3%	7.1%	5.8%	6.1%
Unique Firms with Formal Violations	559	96	25	35	58

Appendix B Robustness and Extension Results

B.1 RCRA Inspections Actions

Is it possible that there was some change in environmental enforcement activity that occurred concurrently with the *Apex* decision that could have caused the reactions of firms that are documented in Section 5? To investigate this, I start by considering a simple plot of the total number of RCRA-related facility inspections occurring in the Seventh Circuit versus other circuits and then proceed to a more formalized regression analysis.[79]

Figure B.1 shows the number of inspections in the Seventh Circuit was essentially flat throughout the study period. There is somewhat of an uptick in total inspections outside of the Seventh Circuit, which if anything might suggest a *decrease* of inspection activity in the Seventh Circuit relative to other circuits during the period of the study, thus producing results opposite to those obtained in Section 5. But, this uptick in enforcements outside the Seventh Circuit starts well before the *Apex* decision, and in any case, total non-seventh circuit enforcements end the sample period at largely the same level as they began with. In short, while this analysis is admittedly quite rough and informal, it is hard to square the patterns depicted in Figure B.1 with a story that they are driving the results measured for the *Apex* decision as depicted in, for instance, the main parallel trends analyses in Figure 1.

More formalized regression analyses also confirm the heuristic results presented in Figure 1. In particular, I consider the difference in differences and triple difference specifications used in Section 5, but now using as the response an indicator for whether the facility is subject to a RCRA inspection in a given year. Figure B.2 plots the annual coefficients estimated from these regressions. Neither of the regression results depicted in those plots gives much indication of a structural change in the likelihood of RCRA inspections around the time of the *Apex* decision.[80] As always, however, it is important to note that the absence of evidence of an effect is not equivalent to evidence of an effect's absence. Thus, because the error bars on these estimates of inspection probabilities are relatively large, some change in inspection probability cannot be conclusively ruled out.

B.2 New Disposal Facilities in or Near the Seventh Circuit?

Another possible explanation for why on-site releases might decrease in the 7th circuit and off-site treatment increase would be if a new treatment facility opened in the area that offered more attractive pricing options than were previously available.[81] To investigate this, I turn again to the TRI data but no longer restrict my sample to facilities that operate throughout the entirety of the sample period, as I do for my primary analyses. The TRI data contains, for each facility, the North American Industry Classification System (NAICS) code associated with that facility. NAICS codes are a way to identify firms and facilities based on the type of business or activity they are primarily engaged in. I use these NAICS codes to identify facilities that specialize in hazardous waste treatment and to investigate whether large new facilities opened in the Seventh Circuit near the time of the *Apex* decision.

I identify hazardous waste treatment and disposal facilities in the TRI data based on NAICS code 562112 - "hazardous waste collection" and NAICS code 562211 "hazardous waste treatment and disposal." I calculate the total number of such facilities in the 7th circuit and in the nation as a whole, and then calculate the percentage of all such facilities within the seventh circuit. In 2008, there were 19 such facilities in the 7th circuit and 183 nationally, giving the Seventh Circuit 10.3% of the national share. In 2010, the numbers were 17 and 176 respectively moving the Seventh Circuit share to 9.7%.[82] I also check individually to see if these net number of facilities mask the opening of a very large new facility and the closing of small facilities, and find no evidence of this. Results are much the same when I expand consideration to the Sixth and Eighth Circuits, which completely surround the Seventh and provide for the possibility that a major new facility with competitive prices might have opened near the Seventh circuit. Results are also much the same when I restrict consideration to just NAICS code 562211 "hazardous waste treatment and disposal." Finally, results are consistent when I also look at facilities based on NAICS codes "5621 - waste collection," "5622 - waste treatment and disposal" and "5629 - remediation and other waste management services."

[79] This draws on the data on inspections and enforcements described in Appendix A.3

[80] These depicted results are for the baseline specification of "local" firms. Results are much the same when considering the alternative specifications for local firms considered elsewhere in this investigation.

[81] In interviews, several practitioners raised this as a possibility to investigate, though none knew of specific instances of this occurring.

[82] This figure remains relatively consistent, declining slightly but steadily through the remainder of the sample period.

B.3 Placebo Tests

Is it possible that there was some other event or change that influenced the incentives of firms processing toxic chemicals that occurred in the Seventh Circuit around the time of the *Apex* decision but that was unrelated to the decision itself? In Appendix B.1 I consider one such possibility: changes in regulatory enforcement, and in Appendix B.2 I consider another: the opening of new hazardous waste disposal facilities that might have changed the economics of firms choosing to process their own toxic chemicals or outsource this to specialists. But, there could be some other change contemporaneous with the *Apex* decision that these tests fail to detect.

To investigate this, therefore, I consider several "placebo" tests that investigate the handling of toxic wastes in settings which might plausibly be influenced by some other unobserved factor contemporaneous with the *Apex* decision but which should not be directly influenced by the decision. To the extent that these placebo tests fail to show any effect where the legal analysis of the *Apex* case predicts there should be none, they help to bolster confidence that the main empirical specifications employed in this paper are not merely picking up false positive results on account of other factors contemporaneous with the *Apex* decision.

As discussed Section 4.1, I exclude from my analyses chemicals not governed under the RCRA statute, as these are less likely to have been influenced by the case. But, if there were some change in the regulation, technology, economy, etc. of industries handling toxic chemicals more generally, and this occurred contemporaneous with the *Apex* decision, it might be expected that non-RCRA regulated chemicals would also be impacted. Thus, for my first placebo test, I consider the same set of facilities that I do in my main empirical specifications, but look now at their handling of non-RCRA regulated toxic chemicals as they are reported in the TRI database.

Another issue discussed in Section 4.1 is my exclusion of what are termed CESQGs - Conditionally Exempt Small Quantity Generators. These are facilities that are governed by RCRA but that handle small enough quantities of the toxic chemicals at issue that they are not subject to as extensive of regulation. Naturally, I exclude these facilities because they are less likely to give rise to catastrophic toxic contamination of the type impacted by the *Apex* ruling. But, if there were some change contemporaneous with the *Apex* decision that impacted economic or regulatory environment facing firms more generally that handle toxic chemicals, these firms might be anticipated to show an effect.

Table B.1 presents the results of these two sets of placebo tests. It considers both the difference in differences and triple differences methodologies employed in Section 5 and looks at the on-site waste disposal and off-site treatment of chemicals that are the key outcomes of the main analyses. The majority of the coefficient estimates in the table are extremely small, around 0.01 or 0.02 in magnitude, whereas the coefficient estimates for the main analyses are an order of magnitude greater. Three of the eight analyses do show coefficients on the order of 0.1, yet in one of these cases, it is actually showing that positive increase for the on-site disposal variable - precisely the opposite of the result predicted by the legal analysis of the *Apex* decision. Only one coefficient out of the eight presented has any statistical significance, and that only at the 10% level. One coefficient in eight showing significance at the 10% level is roughly what would be anticipated by pure random chance. Overall then, the results in Table B.1 provide essentially no evidence of any impact of the *Apex* decision in the specifications where the legal analysis predicts none. Nevertheless, it is important to note that in many of the cases, the standard errors on the estimates are relatively large. As such, while these tests show no evidence for an impact of *Apex*, they by no means amount to hard proof that there was indeed no impact.

B.4 Alternative Identifications of "Local" Firms

Section 4.1.3 discusses the primary way in which I identify "local" firms which are most likely to be file for bankruptcy locally and thus most likely to be impacted by the *Apex* ruling. In my main specifications, I identify these as firms that have facilities in the TRI database in only a single circuit. In this robustness and extension section, I expand that definition to cover firms that have a majority but not all of their operations in a single circuit. In particular, I consider two additional definitions of "local" firms - first that have at least 70% of the total waste produced (which likely is at least a rough proxy for total economic activity) in a single circuit, and firms that have at least 95% of their total waste produced in a single circuit. I make these determinations based on the full set of TRI data - thus, for example, prior to excluding non-RCRA regulated chemicals.

An advantage of expanding the definition of local firms in this way is that it enables some tests of the robustness of the legal and statistical analyses - in other words, it helps to address concerns that the results in the main analyses might somehow be a fluke of the particular firms identified as "local" in the Seventh, and other, Circuits.

Related to this is the potential advantage in expanding the sample size in the "treatment" group. This in particular can be useful for some of the supplemental analyses, such as those looking at firms' violations of RCRA regulations (consider in Appendix Section B.6 below), in which the frequency of violations is relatively low, meaning that looking just at a more limited definition of local firms can give a sufficiently small amount of underlying data as to make meaningful statistical analyses difficult.

But, the expansion of treatment group size comes with a tradeoff. Not only is it reasonable to expect that a firm that operates exclusively within the Seventh Circuit will be more likely to file for bankruptcy in that circuit, firms that operate exclusively within a single circuit are in general smaller than those that operate primarily within a circuit, and it is well established that smaller firms are considerably more likely to file locally as well. Thus, by loosening my definition of "local" I identify more firms that are potentially impacted by *Apex*, but there is a good chance that the additional firms identified will be on average impacted less.

Table B.2 presents summary statistics demonstrating that expanding the definition of "local" results in not just more firms, but larger firms, being designed as "local." In particular, this table presents statistics for local firms identified according to these two alternative designations of "local" firms, and then repeats the summary statistics given in Table 1 for the baseline definition of "local" firm that requires exclusive operations in the Seventh Circuit. Looking for instance at total waste produced by firms, under the baseline local definitions, local firms in the Seventh Circuit produce on average 16.7 million pounds of such waste during the sample period. Under the 95% local definition, this average is 20.8 million pounds, and under the 70% local definition, this average is 35.9 million pounds.

Table B.3 presents triple differences analyses and compares results across the baseline definition of "local" analyzed in Section 5 as well as these two alternative definitions. The basic form of the analyses presented here are the same as those in Section 5, but now I also consider two modifications. In the first variation (contained in the first three columns of the table), the regression specification is the same as in Section 5, except standard errors are clustered at the circuit level, rather than the state level. In the second variation (contained in columns four through six of the table), standard errors return to being clustered at the state level, but I switch from using state x year fixed effects to circuit x year fixed effects. The final variation (in columns seven through nine of the table) is precisely the same as in Section 5 - namely clustering errors at the state level and using state x year fixed effects.[83]

These two variations, clustering errors at the circuit rather than state level[84] and using circuit by year fixed effects rather than state x year fixed effects are clearly less conservative than the baseline specifications. But, both are generally reasonable. A common best-practice recommendation is to cluster standard errors at the geographic level at which the "treatment" in question is occurring (Cameron and Miller, 2015). Under this then, clustering at the circuit level would in fact seem the most natural and appropriate. The challenge here is that clustering at the circuit level yields twelve instead of fifty-two clusters,[85] with the larger number of clusters clearly preferable from a statistical perspective (Cameron and Miller, 2015). Yet, this number of clusters is comparable to that used in other contemporary leading empirical legal research (see, e.g. Honigsberg et al., 2017).[86] Similarly, controlling for circuit x year fixed effects would seem to be a reasonable and natural approach for a triple differences methodology in which the treatment occurs at a circuit level, even if state x year fixed effects admittedly give rise to even stronger controls for other contemporaneous changes that could impact the handling of toxic chemicals in the affected states.

This context of decisions in statistical modeling thus guides interpretation of the results in Table B.3. First, one notes that expanding from the "baseline" definition of "local" firms to the more expansive definitions results in effects that are consistent in direction but smaller in magnitude for the broader definitions of "local" firms - precisely what would be predicted by the analysis given above and the fact that these expanded definitions encompass firms with potentially lower likelihoods of filing for bankruptcy in the Seventh Circuit. This is true across all of the different model specifications in Table B.3.

Second, in the alternative specification that uses circuit level error clustering and state x year fixed effects

[83] I do not explicitly present a variation that uses both circuit level clustering and circuit x year fixed effects. As can be expected, however, results under this show even stronger levels of statistical significance for the *Apex* decision (and entirely consistent signs and magnitudes of effects).

[84] In particular, by this I mean double clustering of errors at the circuit and company level, as opposed to double clustering at the state and company level in the baseline specifications.

[85] Accounting for Washington DC and Puerto Rico.

[86] In this study, one of the three main specifications uses state-level error clustering in a sample of eight states for difference in differences and triple differences specifications.

(columns one through three of the table), the results retain uniformly strong statistical significance across all of the outcome variables and all of the definitions of "local" firms. When considering the specification that uses state-level error clustering and circuit x year fixed effects (columns four through six of the table), half of the results for the broader definitions of "local" firm retain statistical significance. When considering the most exacting specification (columns seven through nine), only one of the coefficients for the alternative definitions of "local" retains statistical significance, though the signs and magnitudes of the coefficients remain consistent with the other specifications.

B.5 Alternative Control Groups

As another robustness check, I consider a series of variations on my analyses that restrict the data to exclude various circuits. The goal here is to investigate whether, for instance, there might be one or a few states or circuits other than the Seventh (perhaps including the Ninth, which is particularly large) that had unusual patterns of toxic chemical handling in roughly the opposite directions as those in the Seventh, such that the effects measured for *Apex* in the Seventh Circuit actually simply reflect the absence of the unusual activity occurring elsewhere in the country for reasons unrelated to the court case.

For the first of these tests, I consider my baseline triple differences specifications for the outcomes of on-site releases, off-site treatment, and the proportional difference between the two.[87] I then run ten alternative specifications in which I eliminate in turn each of the circuits other than the Seventh from my data.[88] In every one of these specifications, all three outcomes remain statistically significant ($p < 0.05$) and retain comparable magnitudes and identical directions as in my main analyses.

For the next set of investigations, I restrict my analyses to just those circuits that already have settled precedents on the topic of the *Apex* decision. Circuits without precedent on the topic of the *Apex* decision might be viewed as being more likely to adopt precedent that follows *Apex* after the decision. As such, it is possible that including these other circuits in the analysis could attenuate the magnitude of results measured for the *Apex* decision. In one variation, I look just as the Second, Third, and Sixth circuits as controls. In another, I look at just the Second and Third Circuits as controls, to account for the possibility that the Sixth Circuit's precedent in *Whizco* might have been viewed as more likely to be reversed following the *Apex* decision. In general, in these specifications, there is a modest increase in the magnitude of coefficients. But, the differences tend to be small and not statistically distinguishable from the baseline results.[89]

B.6 Impact of *Apex* on Violations of RCRA Regulations

The primary dimension along which I analyze firms' efforts to reduce their risks of catastrophic pollution liability in the wake of the *Apex* decision is the amount of wastes they dispose of on site versus the amount they outsource for off-site processing and disposal. A key reason for this is that the data on these outcomes is rich and extensive, with consistent yearly observations across many facilities. Information on violations of RCRA regulations, by contrast, is far more scarce, simply because these occur rarely, particularly when considering relatively serious violations. Table A.1 gives summary statistics on these violations and their frequency. For instance, during my whole sample period, there are only a total of twelve fines that are assessed to local firms (under my primary definition of such) within the Seventh circuit. These fines though are arguably the most reliable metric of compliance, both since they represent instances in which the violation is presumably particularly severe so as to warrant a fine, but also because they give at least some meaningful quantification of that severity, whereas other violation metrics merely record that a violation of one type or another occurred. It is for this reason of data sparsity that I save analyses of RCRA regulatory violations for the appendix and present it mainly as an extension and robustness analysis.

In this analysis, I consider the same set of outcomes described in the summary statistics in Table A.1: namely, the logarithm of one plus the amount of a fine that a facility receives (which will thus be zero if no fine is assessed), the probability that a fine is assessed, the probability that a violation of any type is recorded, and the probability that a "formal" violation is recorded. Table B.4 presents the results of these analyses using my triple differences

[87] That is, the set of outcomes analyzed in Table B.2.

[88] The one circuit I omit this for is the DC circuit, as there are, unsurprisingly, no local firms by my definitions in the DC circuit.

[89] And, as expected with a noisy measure, in a smaller number of cases the magnitudes are actually reduced modestly, though statistical significance is maintained.

methodology.[90] When using the most expansive definition of "local" firms considered in Appendix B.4 above (required 70% or more of a firm's waste production to occur within a single circuit),

Table B.4 first presents results under the most expansive definition of "local" firms considered in Appendix B.4 above (required 70% or more of a firm's waste production to occur within a single circuit), as this data has the greatest number fines and other violations available to analyze for local companies. Under this specification, there is a statistically significance ($p < 0.05$) 9% reduction in fine amount for local Seventh Circuit firms following the *Apex* decision, and a marginally significant ($p < 0.1$) decrease in the probability of a fine of any sort being assessed. In general, however, the results across the different metrics of violations and definitions of "local" firms presented in Table B.4 show statistically insignificant, and generally relatively small, effects. Furthermore, given that there are twelve results presented in the table, while the fact that two of them are statistically significant (and in the predicted direction, given the anticipated impact of *Apex*) is perhaps somewhat unlikely to occur due to pure chance, that possibly cannot be strongly ruled out. Overall then, the safest interpretation of the results in Table B.4 are that they present no evidence contrary to the predictions of the impact of *Apex* (i.e. they present no strong evidence of a large increase in violations by firms after the *Apex* decision), and at best provide relatively heuristic, almost anecdotal evidence in support of the main analyses in Section 5.

B.7 Was *Apex* Simply a Signal that the Seventh Circuit was Getting Tough on the Environment?

Throughout this paper, I have interpreted the *Apex* decision in light of its change in dischargeability of claims in bankruptcy. It is to these changes in bankruptcy that I attribute the changes in firm and creditor behavior that I observe. Is there, however, a possible alternative explanation? In particular, could it be that firms interpreted the Seventh Circuit's *Apex* decision as informative not so much about bankruptcy in particular but instead as a sign that the Seventh Circuit would begin taking a "stronger" stance on environmental matters more generally? If so, the analyses themselves that I have performed would remain valid, but their interpretation would change.

There are several reasons though to believe that *Apex* was relevant, at least for the results I document, for its impact on bankruptcy and not for some broader signal about the environmental stance of the Seventh Circuit. First, if *Apex* represented some broader signal about environmental enforcement, one would expect to potentially see effects in the places where the placebo tests I implement show none: for instance, in air releases or in non-RCRA chemical releases. Secondly, although the difference in differences methodology might have difficulty distinguishing between the effects of *Apex* on bankruptcy law vs. the effects of broader environmental signal, the triple difference methodology should be able to distinguish the two. In particular, "national" firms operating in both the Seventh and other circuits would be expected to be impacted similarly by a general tightening of Seventh Circuit environmental enforcement, and if this were the case, then the triple difference specifications should yield a null or attenuated result, which is far from the case.

B.8 Plausibility of Measured Effect Sizes

Throughout the course of the legal analyses presented in the body of this article and in the appendix, I discuss a set of factors that make it difficult for firm managers and creditors to predict precisely how they will be impacted by the *Apex* decision. For instance, in Section 3.6 I discuss choice of venue in bankruptcy filings and the potential that firms might be able to avoid the *Apex* decision by filing in the Sixth Circuit. In Appendix C.4 I discuss uncertainty about how easy it would be to sell an industrial facility with chemical contamination to a third party and what that means for the practical differences between the *Apex* holding vs. the rule in the Sixth Circuit under *Whizco*. Section 3.4 discusses ambiguity about the precise extent to which *Apex* was a surprising vs. an anticipated development (before the *Apex* ruling, would the consensus probability assigned to such a ruling have been 40%, 60%, 75%?).

Viewed from a certain perspective, each of these elements of uncertainty can be viewed to attenuate the impact of the *Apex* decision. Given the number of these aspects of uncertainty, one might begin to wonder whether it is plausible to find any effect of the *Apex* decision at all, or at least, to find effects as large as I document. In this section, I address this concern via two prongs. First, I provide additional analysis to contextualize and interpret the magnitude of the effects that I estimate from *Apex*, and argue that they are not necessarily as dramatic as

[90] Results from differences in differences methodologies are similar but with less statistical significance and are omitted for brevity.

they may seem. Second, I examine in further depth the plausible channels through which *Apex* may impact firm behavior and how those relate to the various elements of uncertainty for any given firm.

The analyses in this paper report a roughly 15% reduction in on-site releases of RCRA regulated chemicals in response to the *Apex* decision for firms located exclusively or primarily within the Seventh Circuit. It is important to recognize that even though this is a relatively large measured effect, its context in terms of the total production processes and firms may be relatively modest. For instance, Table 1 documents that on-site chemical releases account for only 5-15% of total disposal for RCRA-regulated chemicals, and Section 4.1 notes that the RCRA-regulated chemicals comprise only about one hundred out of the six hundred different chemicals tracked in the TRI data. Furthermore, disposal expenses are only one component of the total costs of using those chemicals in production processes. The costs of acquiring or synthesizing those chemicals factor in here as well. And, for most facilities, chemicals are only one of the raw materials for their production processes, and raw materials are only one of the total costs, placed along side costs for labor, capital, and so forth.

Thus, the cavalcade of attenuating factors must be placed in context of the corresponding line of factors that allow these investigations to telescope precisely in to the types of firms likely impacted by the *Apex* decision and the precise aspects of the operation of those firms that are likely to respond. Indeed, that this study is even possible is in many ways a testament to the incredible detail and richness of the TRI data. With its coverage of 600 chemicals and 40 means of disposing each, this yields 24,000 potential data points on each facility in each year, and for firms with multiple facilities, this can easily expand to around fifty or one hundred thousand separate firm-specific data points in just a single year.[91] In many respects, the level of firm-level information available in a data set like this makes that of many other very commonly used data sets, such as Compustat, absolutely pale by comparison.

The takeaway here is that although I estimate a relatively large effect in my key analyses, it is a large effect for a very precisely aimed investigation into a relatively small component of firms' overall production processes. And, indeed, when I use coarser measures of those firm and facility-level production processes, such as looking at total waste produced, I find no meaningful impact from the *Apex* decision. This context, therefore, helps to lend credibility to the reasonableness of the effect sizes I report.

The second factor to address in interpreting the coefficient estimates, however, is what precisely the causal mechanism may be through which the *Apex* decision impacted the behavior of firms and creditors and how to interpret that mechanism in light of the various sources of uncertainty mentioned at the beginning of this discussion.

In theory, it could perhaps be possible to take each of those sources of uncertainty (e.g. will a firm be successful in avoiding *Apex* by filing outside of the Seventh Circuit?) and try to estimate probabilities for the different possible outcomes. By going through the series of points of uncertainty, and the different ways that each could resolve itself, one could in theory build a large, branching decision tree, potentially with hundreds or even thousands of final nodes for each combination of possible outcomes. Probabilities could be assigned to each of these nodes, and costs to a firm (on account of *Apex*) could be likewise estimated. In so doing, one could, in theory, calculate an "expected cost" of *Apex* to a firm or its creditors. One could then try to calculate the added marginal costs of the changes in waste disposal practices that I document in this investigation. Finally, one could compare the magnitudes of the expected costs of *Apex* with the magnitudes of the costs of changes in waste disposal that I document, and make a judgment about the reasonableness of the effects I measure based on this.

There are, however, two substantial problems with an analysis such as this. First, the level of uncertainty that would go into trying to estimate all of the probabilities, conditional probabilities,[92] and expected costs would almost certainly render any "expected costs of *Apex*" calculations all but meaningless.

Even beyond this challenge, however, there is a very real question as to the ways that these elements of uncertainty factor in to the decision making of firm managers, lenders, and so forth. Almost certainly they cannot calculate the full "expected cost" of *Apex* as described above. In some instances, they have more detailed inside information and insight and thus may be able to calculate certain sets of probabilities and expectations more accurately than a researcher could. But, what assumptions would they make about the probabilities they cannot calculate? Thus, even if managers or lenders tried to apply some kind of rigorous probabilistic analysis of costs

[91] As I explain through this paper, I of course don't utilize all of these, but instead zero in on precisely the ones to most plausibly look for effects in, using others of these observations and data points for controls, placebo tests, and so on.

[92] Absolute probabilities would not be useful here, instead, the probability of each outcome given other outcomes would be needed, since a great many of the uncertainties in outcome will not be independent of each other. E.g. how a judge rules on one aspect of a bankruptcy case will likely be significantly correlated with how they will rule on another aspect of that case.

and benefits of various responses to *Apex*, the results of this might end up not being that much different from a relatively heuristic analysis of the law.

And, it is quite likely that at least a significant set of managers, loan officers, and so forth are not even attempting to conduct such a probabilistic, cost-benefit analysis of responses to *Apex*. These economic actors see the *Apex* decision. They discern the fairly obvious fact that it is not on its face friendly to the interests of firm creditors in the event of a significant pollution contamination. These actors know that the threat of such contamination is real, and they see that there are no obvious, surefire ways to circumvent the ruling. They then look around for what moderately priced steps they can take to make some meaningful reduction in their risk of incurring catastrophic contamination liabilities.

Overall then, it is unquestionably important in a study such as this to consider the factors that may attenuate the impact of *Apex*. In particular, it is important to rule out legal mechanisms that would be widely recognized as simple, cheap, and riskless ways to completely circumvent the *Apex* decision (for instance, see the analysis of §363 asset sales in Appendix C.3). But, beyond that, the goal of the empirical researcher in a context such as this is to demonstrate a plausible channel of influence for the *Apex* decision, and then to test whether there is evidence in support of an effect through such a channel.

B.9 Alternative Functional Forms

As described in Section 5, the primary outcome that I study is the logarithm of one plus the amount of each chemical released on site or sent off-site for treatment. Here, I consider two alternatives to that which yield both robustness and additional insights.

For the first alternative outcome, I replace these with a simple indicator for whether a facility releases any amount of a chemical on-site or sends any amount of the chemical off-site for treatment. Some of the motivation behind this alternative is that, for instance, for a firm looking to reduce its risk of toxic chemical contamination, completely eliminating on-site disposal of a given chemical may be disproportionately valuable as compared to just cutting on-site releases of that chemical in half. For on-site releases, this analysis yields a reduction of four percentage points ($p = 0.0004^{***}$) in the likelihood of a given facility disposing of a given chemical on-site.[93] For off-site treatment, this yields an increase of 2.6% ($p = 0.16$) in the probability that a given facility will use at least some off-site treatment for a given chemical.[94] As one might expect, the effect is larger and stronger for the probability of completely eliminating on-site disposal of a given chemical: going from some on-site releases to no on-site releases is likely more valuable in reducing contamination risk, whereas going from no off-site treatment to some off-site treatment does not in and of itself impact risk as directly (though of course, this is likely correlated with going from some to no on-site disposal).

For the second alternative outcome, I calculate the following:

$$\text{Pct Off-Site} := \frac{\text{Off-Site Treatment}}{\text{On-Site Releases} + \text{Off-Site Treatment}}$$

and use this as an outcome variable. One potential challenge of my baseline specification (using log amounts of chemicals disposed) is that, given the fixed effects, it essentially measures percent changes in the amounts of chemicals released on site or sent off-site for treatment. If, for instance, the amount sent off-site starts as a small amount, then a modest increase could result in a relatively large percentage increase. This "Pct Off-Site" measure would then be potentially more robust against results being skewed by large percentage changes that represent small absolute changes.

A disadvantage of this measure, and one of the key reasons I don't use it in my primary analyses, is that for some facility-chemical-year combinations, facilities did not have any on-site releases or off-site treatment. In these instances, then, the "Pct Off-Site" variable is undefined and must be dropped from the data. In particular, therefore, this has the potential to miss valuable information, such as instances where a facility might completely stop using a given chemical, perhaps in response to the *Apex* decision.[95] Despite this challenge, the metric can still

[93] This result is for the triple difference formulation. Under the difference in differences formulation, the result is a 2.4% decrease ($p = 0.0024^{***}$).

[94] Again, the given result is the triple difference estimator. For the difference in differences estimator, the result is a 3.4% increase ($p = 0.095^{*}$)

[95] Another disadvantage of the measure is that it is in some respects less detailed: the "Pct Off-Site" can change either from a reduction in on-site disposal, an increase in off-site disposal, or both. Thus, if on-site releases stay constant, and off-site treatment goes up, it is less clear that really represents a reduction in contamination risk for a firm.

be valuable as a robustness check. In the triple difference formulation, I find a 5.2 percentage point ($p = 0.007^{***}$) increase in this metric associated with the *Apex* decision and for the difference in differences formulation, I find a 3.6 percentage point ($p = 0.0003^{***}$) increase.

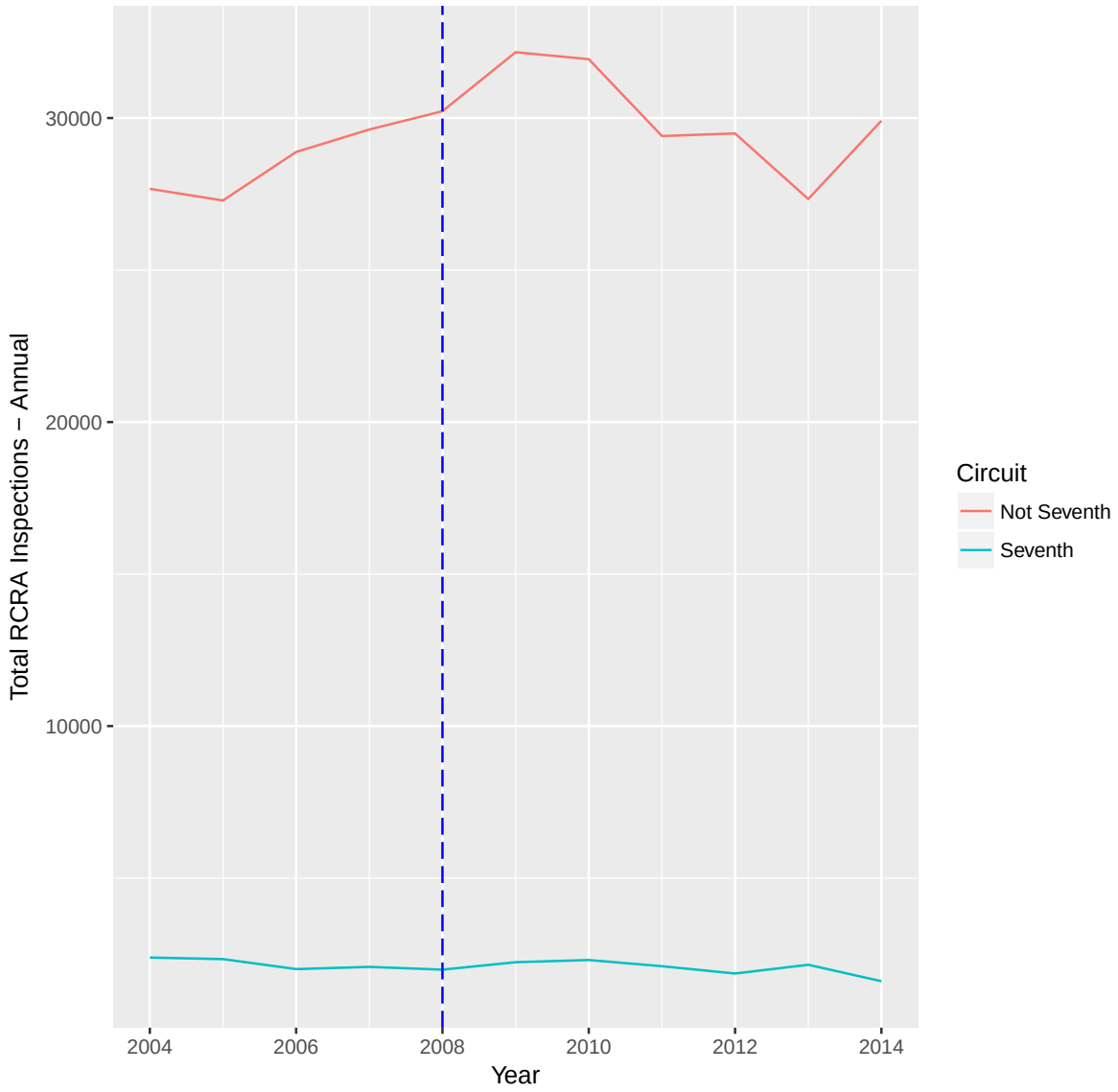

Figure B.1. RCRA Inspections. This plot depicts the total number of annual RCRA-related inspections of facilities in the Seventh Circuit and outside of the Seventh Circuit. Details on this inspection data are provided in Appendix A.3.

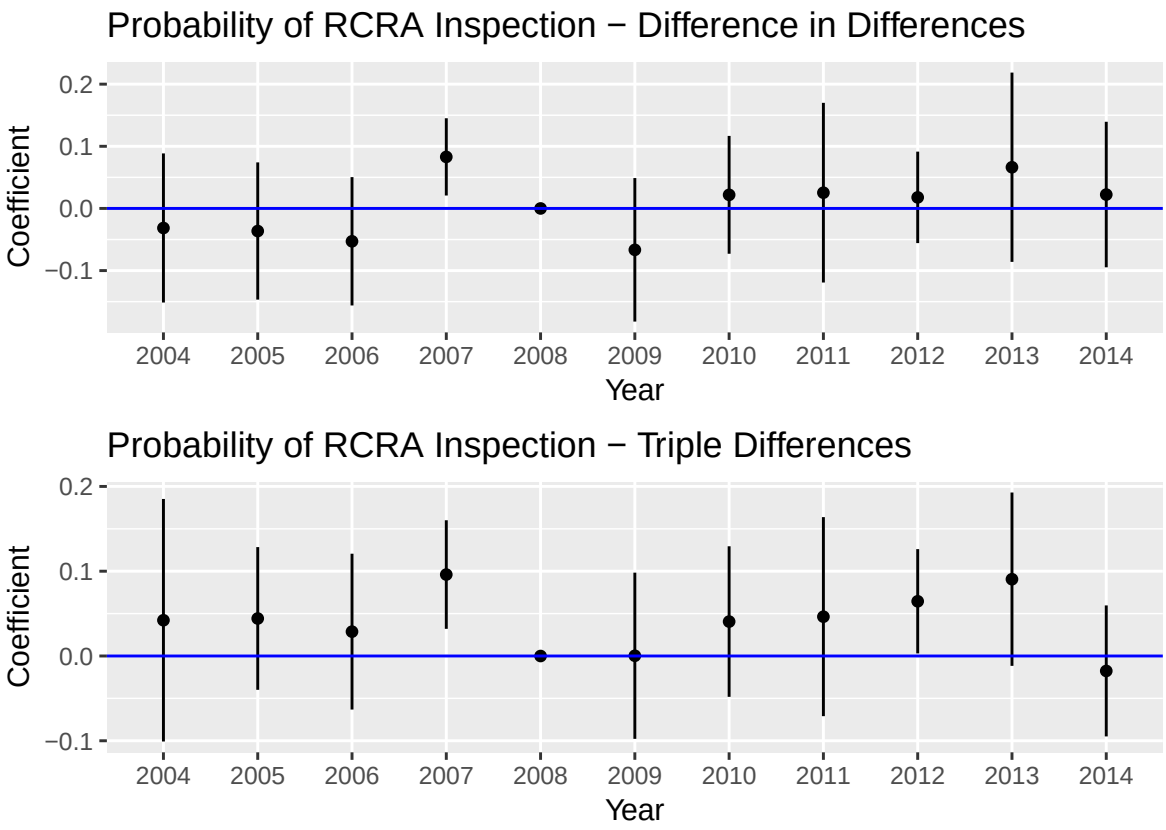

Figure B.2. RCRA Probability of Inspection. This figure depicts results from the difference in differences and triple difference formulations described in Appendix B.1. These analyses test for whether the probability of receiving a RCRA related inspection changed for local firms in the Seventh Circuit in the wake of the *Apex* decision. Observations are at a facility-by-year level, rather than facility-by-year-by-chemical level in the main analyses of the TRI data, but otherwise take the same form. Robust errors are clustered at the state level and vertical bars depict 95% confidence intervals.

Table B.1
TRI Placebo Tests. This table presents the results of fitting the same difference in differences and triple difference formulations given in equations 1 and 2 and with the same outcomes as presented in Table 3 but fitted over different sets of data. In "Placebo Test 1: non-RCRA Chemicals" the tests are fit only over chemicals not directly governed by RCRA and thus in general substantially less likely to lead to the kind of catastrophic contamination cleanup for which the *Apex* case addressed. In "Placebo Test 2: CESQG" the sample returns to consideration of the RCRA-regulated chemicals analyzed in the main analyses, but now restricts the set of facilities in the investigation to those designated as Conditionally Exempt Small Quantity Generators, or CESQGs, under RCRA. Robust standard errors are double clustered at the state and company level.

	(Difference in Differences)		(Triple Differences)	
	(On-Site Release)	(Off-Site Treatment)	(On-Site Release)	(Off-Site Treatment)
Placebo Test 1: non-RCRA Chemicals				
Apex x Seventh Circuit	-0.011	0.022		
	(0.0976)	(0.126)		
Apex x Seventh Circuit x Single Circuit			-0.02	-0.012
			(0.0658)	(0.1599)
Observations	28403	28403	185103	185103
Adjusted R^2	0.725	0.625	0.757	0.627
Placebo Test 2: CESQG Facilities				
Apex x Seventh Circuit	-0.029	0.106 *		
	(0.0967)	(0.0633)		
Apex x Seventh Circuit x Single Circuit			0.152	0.102
			(0.1574)	(0.1051)
Observations	19370	19370	95721	95721
Adjusted R^2	0.85	0.419	0.848	0.645
Facility x Chem FE	yes	yes	yes	yes
Chem x Year FE	yes	yes	yes	yes
State x Year FE	no	no	yes	yes
Local Firm x Year FE	no	no	yes	yes

Cluster robust standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table B.2
TRI Summary Statistics - alternative definitions of "local" vs. "national" firms. This table presents precisely the same summary statistics for TRI firms and facilities presented in Table 1 but now considers two additional definitions of "local" firms in Panels 1 and 2 of this table. Panel 3 is a precise duplicate of the information in Table 1 and is included to contextualize the information in Panels 1 and 2.

Panel 1: 95% "local" threshold	**All Circuits**			**Seventh Circuit**	
Firm Type	All Firms	National	Local	National	Local
All Firms: Total Waste	87,347	59,314	28,033	6,699	1,788
Firm Avg. Total Waste	55.8	78.4	34.7	37.8	20.8
Facility Avg. Total Waste	23.1	20.5	27.2	22	18.2
Facility Avg. On-Site Releases	3.5	2.1	7	2	2.2
Facility Avg. Off-Site Treatment	0.4	0.4	0.4	0.3	0.3
Facility Avg. Stack Air Releases	0.3	0.4	0.2	0.3	0.3
Observations	360,197	263,997	96,200	28,672	10,306
Unique Facilities	3,788	2,894	1,030	304	98
Unique Companies	1,564	757	807	177	86

Panel 2: 70% "local" threshold	**All Circuits**			**Seventh Circuit**	
Firm Type	All Firms	National	Local	National	Local
All Firms: Total Waste	87,347	42,838	44,508	3,465	5,022
Firm Avg. Total Waste	55.8	89.4	41	28.2	35.9
Facility Avg. Total Waste	23.1	19.9	24.3	14.1	30.1
Facility Avg. On-Site Releases	3.5	1.5	5.4	1.5	2.7
Facility Avg. Off-Site Treatment	0.4	0.4	0.3	0.4	0.2
Facility Avg. Stack Air Releases	0.3	0.4	0.2	0.3	0.3
Observations	360,197	189,526	170,671	21,421	17,557
Unique Facilities	3,788	2,156	1,831	245	167
Unique Companies	1,564	479	1,085	123	140

Panel 3: Baseline "local"	**All Circuits**			**Seventh Circuit**	
Firm Type	All Firms	National	Local	National	Local
All Firms: Total Waste	87,347	77,163	10,183	7,567	921
Firm Avg. Total Waste	55.8	82.4	16.2	36.4	16.7
Facility Avg. Total Waste	23.1	23.9	15.2	22.4	15.1
Facility Avg. On-Site Releases	3.5	3.2	3.9	2	2.5
Facility Avg. Off-Site Treatment	0.4	0.4	0.4	0.3	0.4
Facility Avg. Stack Air Releases	0.3	0.4	0.2	0.3	0.2
Observations	360,197	302,033	58,164	33,457	5,521
Unique Facilities	3,788	3,230	670	338	61
Unique Companies	1,564	936	628	208	55

Table B.3
Alternative identifications of "single-circuit" companies. This table presents difference in differences formulations from the model in Equation 2 and thus equivalent to the baseline results presented in Table 3. For additional context, this table considers the on-site disposal and off-site treatment variables studied in the main analyses of this investigation plus their difference, represented as "On-Site - Off-Site" in this table. The final three columns of this table include the same specifications for fixed effects and error clustering as in Table 3. Earlier columns represent modifications on these to use judicial circuits rather than states to cluster standard errors and for interactions with time fixed effects. Panel 1 of this table uses the "baseline" identification of single-circuit companies used in Table 3 - that is, requiring 100% of TRI facilities associated with a company to be located in a single circuits. Panels 2 and 3 relax this local definition. All specifications contain fixed effects for chemical x year, single circuit x year, and facility x chemical, as in the models in Table 3.

	(Circuit Cluster + State x Year FE)			(State Cluster + Circuit x Year FE)			(State Cluster + State x Year FE)		
	(On-Site)	(Off-Site)	(On-Site - Off-Site)	(On-Site)	(Off-Site)	(On-Site - Off-Site)	(On-Site)	(Off-Site)	(On-Site - Off-Site)
1: "Single Circuit" Baseline									
Apex x Seventh Circuit x Single Circuit	-0.232 ***	0.295 ***	-0.527 ***	-0.258 ***	0.294 ***	-0.551 ***	-0.233 **	0.294 ***	-0.527 ***
	(0.0385)	(0.0294)	(0.033)	(0.0865)	(0.1031)	(0.1111)	(0.0901)	(0.0977)	(0.1131)
Observations	354250	354250	354250	355176	355176	355176	355176	355176	355176
Adjusted R^2	0.828	0.669	0.795	0.827	0.667	0.794	0.828	0.669	0.795
2: "Single Circuit" 95% Threshold									
Apex x Seventh Circuit x Single Circuit	-0.102 **	0.071 ***	-0.173 ***	-0.133 **	0.086	-0.219 *	-0.103 **	0.07	-0.173
	(0.0434)	(0.0187)	(0.0348)	(0.0518)	(0.0959)	(0.1119)	(0.0514)	(0.0914)	(0.1051)
Observations	354250	354250	354250	355176	355176	355176	355176	355176	355176
Adjusted R^2	0.828	0.669	0.795	0.827	0.667	0.794	0.828	0.669	0.795
3: "Single Circuit" 70% Threshold									
Apex x Seventh Circuit x Single Circuit	-0.085 **	0.134 ***	-0.218 ***	-0.103 *	0.149	-0.252	-0.085	0.132	-0.217
	(0.033)	(0.0257)	(0.0392)	(0.0579)	(0.1533)	(0.1664)	(0.0559)	(0.1512)	(0.1586)
Observations	354250	354250	354250	355176	355176	355176	355176	355176	355176
Adjusted R^2	0.828	0.669	0.795	0.827	0.667	0.794	0.828	0.669	0.795
State x Year FE	yes	yes	yes	no	no	no	yes	yes	yes
Circuit x Year FE	no	no	no	yes	yes	yes	no	no	no
Clustered Errors:	circuit	circuit	circuit	state	state	state	state	state	state

Cluster robust standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table B.4
RCRA Enforcement Actions. This table depicts triple difference investigations of the same set of facilities considered in the main TRI analyses in this paper. The difference in sample construction is that the units of observation here are facility-by-year observations, rather than facility-by-chemical-by-year. Apart from omitting chemical-level fixed effects and interactions, the regression specifications are the same here as in equation 2. "Fine Amount" represents the total fines (in dollars) levied on a facility in a given year for violations of RCRA regulations. The other columns of this table, for probabilities of fines or types of violations, are from a regression of an indicator for whether the given type of violation was found for a given facility in a given year on the same set of controls as in 2. Robust standard errors are double clustered at the state and company level.

	log(1 + Fine Amount)	(Probability of Fine)	(Probability of Violation)	(Probability of Serious Violation)
1: "Single Circuit" 70% Threshold				
Apex x Seventh Circuit x Single Circuit	-0.091 **	-0.008	0.004	-0.003
	(0.0416)	(0.0049)	(0.0129)	(0.0107)
Observations	41668	41668	41668	41668
Adjusted R^2	0.125	0.11	0.216	0.196
2: "Single Circuit" 90% Threshold				
Apex x Seventh Circuit x Single Circuit	-0.082	-0.008	-0.019	-0.013
	(0.0558)	(0.0058)	(0.0145)	(0.0085)
Observations	41668	41668	41668	41668
Adjusted R^2	0.125	0.11	0.216	0.196
3: "Single Circuit" Baseline				
Apex x Seventh Circuit x Single Circuit	0.073	0.01	0.014	0.01
	(0.1359)	(0.0143)	(0.0382)	(0.0242)
Observations	41668	41668	41668	41668
Adjusted R^2	0.125	0.11	0.216	0.196
Facility FE	yes	yes	yes	yes
State x Year FE	yes	yes	yes	yes
Single Circuit x Year FE	yes	yes	yes	yes

Cluster robust standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Appendix C Legal Details

C.1 Bankruptcy Choice of Venue - Additional Details

Under 28 U.S.C.A §1408, a Chapter 11 bankruptcy may be commenced in the federal court district:

> (1) in which the domicile, residence, principal place of business in the United States, or principal assets in the United States, of the person or entity that is the subject of such case have been located ... or (2) in which there is pending a case under title 11 concerning such person's affiliate, general partner, or partnership.

Here "domicile" is generally interpreted to mean a company's place of incorporation (Cole, 2002). A great many companies are incorporated in Delaware (and a lesser but still significant number in New York). Thus, it is not uncommon that a corporation will have at least two natural venues to file for bankruptcy: the location of its principal place of business (e.g. generally corporate headquarters)[96] or its location of incorporation. By incorporating a subsidiary in another jurisdiction and then having that subsidiary file for bankruptcy, a corporation can achieve greater flexibility still.

Given the flexibility corporations have in where they are legally allowed to file for bankruptcy, the more relevant question often then becomes the practical considerations that will influence them to file in one place or another. Existing literature documents the considerations at play.[97] In general, firms will choose either to file in their local venue (i.e. where their headquarters or principal operators are) or in one of the established bankruptcy "hubs" - meaning usually in Delaware and to a lesser extent in New York.

Filing locally caries several potential advantages for firms. Local judges and bankruptcy receivers may be more familiar with (or perhaps sympathetic to) the firm and its industry, and thus may be able to make decisions throughout the bankruptcy process that are more informed (or at least favorable to the firm's management). Filing locally also will tend to mean that the legal precedents that govern the bankruptcy proceeding will be more familiar to a firm's internal and external counsel, thus reducing the legal costs of the filing and potentially obviating the need to retain a new counsel that specializes in the law of another jurisdiction in which a filing could be made. A local bankruptcy also means reduced need for a firm's officers and counsel to travel to a foreign jurisdiction to participate in the bankruptcy proceedings.

Filing in a bankruptcy hub such as Delaware of New York carries different potential advantages. Judges and receivers in these jurisdictions may have more experience with bankruptcies (particularly large, complex ones) and thus may be able to handle certain proceedings more quickly and efficiently. Key legal precedents may also be more developed in these venues, leading to greater predictability of results.

As an empirical matter, Cole (2002) documents that 10-20% of all bankruptcies are filed in Delaware, meaning that 80-90% (the vast majority) are not filed in Delaware and thus in all likelihood are filed where firms' primary places of business are. Relatively small businesses account for the vast majority of both US firms and bankruptcy filings, meaning that these statistics are dominated by small firms. Large firms, by contrast, much more heavily favor Delaware or New York. Lynn LoPucki has compiled a database on bankruptcy filings of firms with assets over $250 billion. Of the firms in this database whose corporate headquarters are not in Delaware or New York, roughly 55 - 60% choose to file in Delaware or New York.[98]

Additionally, I use LoPucki's data to fit a regression to predict the likelihood that a firm headquartered outside of Delaware or New York will file for bankruptcy in either of those two jurisdictions. The regression uses just a constant plus the logarithm of the firm's pre-bankruptcy assets. It shows a significant result ($p < 0.05$) that for every doubling of a firm's assets (e.g. from $500 million to $1 billion), its probability of filing in New York or Delaware increases by 4 percentage points (e.g. from 51% to 55%). This further illustrates the relationship between firm size and bankruptcy choice of venue.

In order to identify firms potentially impacted by *Apex*, I start by considering firms that operate either primarily or exclusively within the Seventh Circuit. Section 4 discusses details of how I identify these firms. It is possible

[96] See Norton and Norton (2018) §6.1 for more details.

[97] See, for instance, Cole (2002); Ellias (2018).

[98] Delaware generally captures about 40 - 45% of filings and New York 10 - 15%, depending on the particular time frame in question.

that a small number of firms that operate primarily outside of the Seventh Circuit might have chosen to file for bankruptcy there, but the above discussion suggests that this is in general relatively unlikely.[99]

The more relevant question then is how likely it is that firms that operate primarily within the Seventh Circuit would file for bankruptcy within the Seventh Circuit. Clearly, the less likely a firm is to file in the Seventh Circuit, the less impact the *Apex* case would be expected to have. There are two facets of this question to consider: first, would firms seek to strategically avoid the Seventh Circuit post-*Apex* to circumvent the ruling? Second, would firms, even pre-*Apex*, be sufficiently likely to file in the Seventh Circuit so as to be impacted by the *Apex* ruling?

An important point of consideration in this instance is that as described in Section 3.3 both the Second and Third Circuits (home to the primary bankruptcy hubs of New York and Delaware) already had precedents congruent with that in *Apex*. This means, for instance, that a firm could not simply escape the impact of the *Apex* ruling by filing for bankruptcy in one of the hubs that already attract a significant amount of bankruptcy activity.

It is conceivable that a firm whose operations are primarily in the Seventh Circuit could, for instance, attempt to file for bankruptcy in the Sixth Circuit so as to avoid the *Apex* ruling. There is no guarantee that this would succeed. The Bankruptcy Code allows for other parties in a bankruptcy to object to the venue in which a case is filed and for the District Court to move the venue "in the interest of justice or for the convenience of the parties." (28 U.S.C.A. §1412). If a firm had little or no connection to the Sixth Circuit and appeared to be blatantly filing there to take advantage of its differing legal precedent[100] then it could be vulnerable to an attack to move venue back to the Seventh Circuit under 28 U.S.C.A. §1412.

Eisenberg and LoPucki (1998) document that while changes of bankruptcy venue under 28 U.S.C.A. §1412 are uncommon, they do occur. Furthermore, one key factor that Eisenberg and LoPucki (1998) cite for the limited number of these transfers is an absence of interested parties who submit motions for them. If an environmental regulator were pursuing an injunction against a firm that appeared to be blatantly forum shopping to avoid the *Apex* precedent, it seems hard to imagine the regulator would not try vigorously to resist such forum shopping. Furthermore, the arguments that changing venue would advance the interests of justice would seem much stronger in the context of a firm trying to avoid *Apex* than in the situations discussed by Eisenberg and LoPucki (1998).

Furthermore, even if a firm succeeded in having its bankruptcy filing remain in the Sixth Circuit, that would not necessarily protect it from the effects of *Apex*. The reason here is that a court in the Seventh Circuit would not necessarily consider a ruling by a bankruptcy court in the Sixth Circuit regarding discharge of obligations to be binding. In *Zerand-Bernal Grp., Inc. v. Cox*, 23 F.3d 159 (7th Cir. 1994), for instance, a firm filed for bankruptcy in Chicago (within the Seventh Circuit) and effected a §363 sale of assets in the course of that bankruptcy.[101] Plaintiffs then brought a successor liability suit against the purchaser of those assets in Pennsylvania, which is part of the Third Circuit. The purchaser of the assets sought an injunction in the Seventh Circuit to stop this suit from within the Third Circuit, on the ground that the asset sale had discharged successor liability and that the bankruptcy court should retain jurisdiction over any remaining disputes to that effect. The Seventh Circuit in *Zerand-Bernal* rejected this argument, however, writing in its opinion, "a court cannot write its own jurisdictional ticket." In other words, even if a firm filed for bankruptcy in the Sixth Circuit and obtained a discharge of cleanup liabilities from a bankruptcy court in that circuit, it could not be certain that the Sixth Circuit could adequately protect it from suits emanating from the Seventh.[102]

A strategy to file in the Sixth Circuit would also come with costs. In particular, a firm would face all of the costs described above of filing outside of its home circuit, while receiving none of the benefits of filing in a bankruptcy

[99] In any case, since my analyses are based on comparing the behavior of firms in the Seventh Circuit to those outside of the Seventh Circuit in the pre- and post-*Apex* periods, if there are a small number of firms outside of the Seventh Circuit who nevertheless would be likely to file in the Seventh Circuit and thus may be impacted by *Apex*, this would simply serve to attenuate any impacts of the decision that I document.

[100] This could be, for instance, by creating a new shell-company or empty subsidiary in the Sixth Circuit and having it file for bankruptcy, or by a company moving its state of incorporation in the Sixth Circuit relatively soon before filing.

[101] See Appendix C.3 for more details on §363 asset sales.

[102] The precise contours of this legal question have not fully been scoped by courts, however, particularly if it came to be the case that there were disagreement between circuits on such suits. Also, it should be noted that it is still clearly preferable (for the debtor and its creditors) to have the bankruptcy court rule that environmental cleanup obligations are dischargeable than not, even if the ruling of dischargeability can be susceptible to potential attack from other circuits. Thus, the existence of potential suits of this nature should not be interpreted to indicate that, for instance, the *Apex* ruling was meaningless because the Second and Third circuits already had similar precedents. Finally, particularly for the small, local firms that are the focus of my study, if such a firm caused pollution contamination in the Seventh Circuit, and had operations and headquarters and incorporation in that circuit, it could be quite difficult for the EPA to get jurisdiction to sue that firm in the Second or Third circuits to try to take advantage of their precedents. By contrast, it would be much easier to get such jurisdiction for large, national firms that have operations in the Seventh circuit but also in other circuits, and quite possibly incorporations in the Second or Third Circuits.

hub. Furthermore, if a company sought venue in the Sixth Circuit by moving its place of incorporation there (which could give it a greater chance of resisting an attack under 28 U.S.C.A. §1412 than would establishing an empty subsidiary in the Sixth Circuit), this would need to be done at least six months prior to a bankruptcy filing, under 28 U.S.C.A §1408. Since a firm might not be able to anticipate bankruptcy this far in advance, in practice this could potentially mean needing to shift its place of incorporation well before significant risks of the firm entering bankruptcy arose.[103] This shift in state of incorporation then would amplify costs for a firm since, for instance, its local counsel would no longer be as familiar with the corporate law governing the firm's state of incorporation.

If the impact of the *Apex* decision for firms handling toxic chemicals were truly catastrophic, then the costs and risks of attempting to avoid the decision by filing for bankruptcy in the *Sixth* circuit might still be worth it. As a practical matter, however, many facilities that handle toxic chemicals do so in ways that are profitable while also minimizing the risks of catastrophic chemical contamination. And, the evidence that I present on how firms responded to the *Apex* decision is generally consistent with *Apex* inducing changes that meaningfully reduce firms' risks of catastrophic contamination but which do not fundamentally transform the nature or scope of their operations. As such, in at least a large number of instances, there is reason to believe that it is simply more cost-effective for firms to respond to *Apex* by tweaking their operations to improve safety, rather than attempting to pursue an awkward, expensive, and risky strategy of choosing the Sixth Circuit as a bankruptcy venue in the event the firms find themselves in financial distress.

Finally, as a simple practical matter, not all of the attorneys I spoke with who advise Seventh Circuit firms on RCRA and related matters were aware of the Sixth Circuit precedent contrary to *Apex*. This suggests that at least some firms could be constrained from seeking to avoid the *Apex* ruling (and from planning on such avoidance in structuring their pre-bankruptcy operations) by virtue of simply being unaware that avoiding *Apex* would be possible.

Nevertheless, it is certainly possible that in some instances, the existence of a precedent contrary to *Apex* in the Sixth Circuit may have tempered the responses of firms in the Seventh Circuit to the *Apex* decision. To the extent that this is true, then, it would simply mean that the effects I estimate from the decision would be perhaps less than those that could be expected if, for instance, the *Apex* precedent came to govern nation-wide, either through judicial or legislative action.

The second question to address is the extent to which firms in the Seventh Circuit might be less impacted by the *Apex* decision if they already were highly likely to have filed for bankruptcy outside of the Seventh Circuit. As the statistics on bankruptcy filings given above document, small to mid-sized firms are extremely likely to file for bankruptcy locally. And, even large firms have a significant probability (roughly 40-45%) of filing locally. As documented in Section 4 the firms that operate in the Seventh Circuit primarily or exclusively tend to be larger than firms that operate across multiple different circuits, thereby likely increasing their probability of filing locally. And, in most cases, firms likely weigh the options near the time of bankruptcy to decide where to file, rather than making a firm commitment well in advance.

Again, of course, it is natural to expect that some firms may have been less impacted by *Apex* on account that their management may have been under the assumption that they would likely file for bankruptcy in the Second or Third Circuits, and thus the *Apex* decision would have had a less material impact on the law that would govern a prospective future bankruptcy. As with before, however, this simply means that the impacts that I measure from the *Apex* decision may be smaller than they otherwise would be if a judicial or legislative change were to impact claim dischargeability on a national level.

C.2 Apex Decision - Details

C.2.1 Background Facts

Apex Oil was formed in 1979 and in 1981 merged with Clark Oil and Refining Corporation, owner of the "Hartford Refinery" in Hartford, Illinois.[104] Throughout the 1970s and 80s, the refinery and pipelines connected to it suffered repeated and significant failures in their environmental controls. This led to significant pollution of

[103] A change of place of incorporation precisely (and suspiciously) six months before filing for bankruptcy could also cause problems for a firm seeking to resist a change of venue attack under 28 U.S.C.A §1412.

[104] Except as otherwise noted, all information in this background facts section is from the district court judgment: U.S. v. Apex Oil Co., Inc., Not Reported in F.Supp.2d (2008).

the soil and groundwater in and around the town of Hartford, including one striking incident in which several public streets in Hartford were flooded, four to five inches deep, with fuel oil from the refinery.

In 1987, Apex filed for Chapter 11 bankruptcy. In 1988, while in bankruptcy, Apex sold the Hartford Refinery to Premcor Refining Group. In 1989, a new Apex Oil company was incorporated, merging with the old Apex Oil company in bankruptcy, thus effecting a reorganization. Pollutants continued to escape from the Hartford refinery under its ownership by Premcor. Pollutants also escaped throughout the 1970s and 80s from several other pipelines and facilities near or connected to the refinery, which were owned by a several other corporations.

In 2003, the US EPA assumed primary responsibility for enforcing cleanup of the area around Hartford. In 2003 and 2004, the EPA obtained agreements to begin cleanup operations from four companies it identified as responsible for the pollution in Hartford: Premcor Refining, Shell Oil, BP Amoco, and Sinclair Oil Co. Apex was the fifth and final responsible party identified by the EPA as responsible. Apex refused to participate in the cleanup with these other corporations, arguing that any responsibility it had for the cleanup was discharged in its bankruptcy. In filings, Apex argued that it would cost it $150 million to fulfill its cleanup obligations.

C.2.2 The Apex Holding and Bankruptcy Law

In this section, I provide an overview of the *Apex* case and its situation in US bankruptcy law. The goal here is not to survey every important legal nuance of the case or the arguments it sought to resolve. Instead, the goal is to give additional context for understanding the decision and in particular to convey that although *Apex* lost in its appeal to the Seventh Circuit, its arguments had reasonable grounding and a reasonable chance of success. This in turn supports the notion that the Seventh Circuit's decision was a meaningful and impactful ruling and not simply a confirmation of what all relevant companies in the Seventh Circuit already accepted as settled law. The analysis here also helps to better understand the impact of the *Apex* case, particularly in laying the foundation for why the reasoning in the case is also applicable to environmental laws beyond just RCRA.

Under US bankruptcy law, a corporation that reorganizes under Chapter 11 receives a discharge:

> from "any debt that arose before the date of" confirmation, 11 U.S.C. §1141(d)(1)(A), with immaterial exceptions. "Debt" is defined as "liability on a claim," §101(12), and "claim" as either a "right to payment," §101(5)(A), or - the critical language in this case - a "right to an equitable remedy for breach of performance if such breach gives rise to a right to payment..."
> *U.S. v. Apex Oil Co., Inc.*, 579 F.3d 734 (2009).

The key issue for courts to resolve in *Apex*, therefore, was whether the injunction sought by the EPA against Apex Oil constituted a "claim" for the purposes of US bankruptcy law. If it were a claim, then it would have been discharged when Apex reorganized in Chapter 11 bankruptcy. If not, then Apex could still be ordered to clean up damage from pollution it contributed to prior to its bankruptcy.

Apex Oil Co. argued that the only way that it could comply with the EPA injunction was by paying a third party the estimated $150 million in clean-up costs,[105] and that being required to pay this money to a third party was the functional equivalent of being required to pay the money directly to the EPA.[106] Apex Oil Co. bolstered this notion by arguing that its situation was analogous to that in the earlier case *Ohio v. Kovacs*. In that case, the state of Ohio ordered a polluter to clean up contaminated property. When the polluter failed to do so, the state of Ohio seized the property and demanded reimbursement from the polluter to cover the state's costs in cleaning up the site. The polluter then filed for bankruptcy. In *Kovacs*, both the Sixth Circuit and the Supreme Court noted that the polluter "cannot perform the affirmative obligations properly imposed upon him by the State court except by paying money." Apex Oil Co. therefore argued that this precisely described its situation: that the only way it could comply with the EPA's injunction was by paying money and thus the injunction should be a claim that was discharged in bankruptcy.

The Sixth Circuit Court of Appeals had previously found the analogy to the situation in *Kovacs* persuasive, ruling in *U.S. v. Whizco, Inc.*[107] that an injunction demanding cleanup of a polluted site, in a situation similar to that in *Apex*, was dischargeable in bankruptcy. The Seventh Circuit, however, was unpersuaded. Writing for the

[105] Apex pointed to the fact that it was no longer in the oil refining business and argued that it thus lacked the specialized equipment, personnel, and so forth that would be needed for the cleanup.

[106] Brief of Defendant-Appellant Apex Oil Company, Inc., United States Court of Appeals, Seventh Circuit, 2009 WL 927822.

[107] 841 F.2d 147, (6th Cir. 1988)

three-judge panel, Judge Posner wrote that if the EPA had pursued remedies that gave it a direct right to demand payment (as was the case in *Kovacs*, in which the state had an explicit right to demand compensation after seizing property and initiating its own cleanup), then the EPA would indeed have a claim dischargeable in bankruptcy. But, because the government brought its action under a provision of RCRA which on its face entitled it only to an injunction and not to demand payment in any form, that the EPA's demand was not a dischargeable claim.

The Seventh Circuit acknowledged tension between its decision and the Sixth Circuit's decision in *Whizco*. But, the Seventh Circuit's opinion argued that the mere fact that Apex Oil Co. would need to spend money to comply with the injunction should not be determinative because nearly every injunction imposes costs which can be expressed in monetary terms and that the statutory language of the bankruptcy code implied that it meant for only some, and not all, injunctions and similar remedies to be dischargeable. Judge Posner made a further appeal to policy, noting that a ruling contrary would make it "unlikely that the state could effectively enforce its laws."[108]

C.3 Do Asset Sales Make *Apex* Irrelevant?

On its face, *Apex* addressed liability for a firm following a Chapter 11 reorganization in bankruptcy. As those who closely follow bankruptcy and corporate law are aware, however, classic Chapter 11 reorganizations are becoming less common in bankruptcy practice. Instead, modern firms in bankruptcy frequently will sell most or essentially all of their assets to a new entity[109] and then liquidate the remaining estate in a Chapter 7 proceeding. These procedures, known as "363 sales" (based on 11 U.S.C.A. §363(f), the provision of the bankruptcy code that authorizes them), thus effect what is in many ways a substantive equivalent to a bankruptcy reorganization but with certain advantages such as speed and flexibility with which an effective reorganization can be accomplished.

A recent prominent example of this use of 363 sales can be seen in *In the Matter of: Motors Liquidation Co.* 829 F.3d 135 (2d Cir. 2016), *cert denied*, in which the Second Circuit held that a 363 sale will bar most forms of successor liability claims, even for harms that have not yet materialized, as long as the individuals with potential claims are given fair notice and the ability to dispute the sale in court. In the wake of the *Apex* decision, could firms simply use a 363 sale to sell assets to a different or newly formed corporation that ostensibly or arguably had no direct legal connection to the prior corporation (which contributed to toxic contamination) and thus could not be required to clean up that contamination under RCRA?

I address this question via two methods. One method is to look at the specific case law and to describe why there is significant doubt as to whether this use of 363 sales would be successful in avoiding the cleanup obligations that *Apex* found to be non-dischargeable. Before getting to the details of that, however, I first start by reviewing circumstantial evidence of the kind of legal guidance on this matter that firms impacted by *Apex* may well have been receiving at the time of the decision. I present this evidence first because ultimately, it is the beliefs of key decision-makers associated with a firm (including its creditors) that matter most in determining firm behaviors in response to *Apex*. I follow with a more detailed legal analysis to show that the guidance that I argue firms received was indeed reasonable and plausible.

My goal here is not to argue that it is inconceivable that a court could rule that a 363 sale could enable a purchaser to escape responsibility for the type of cleanup obligation that *Apex* made non-dischargeable. To my knowledge, this precise question has yet to be addressed by a court. Instead, the purpose of this discussion is simply to demonstrate that it would be a risky proposition at best to assume that *Apex* could be ignored on account of 363 sales, and thus there are very solid reasons for firms to have taken the *Apex* decision seriously and to therefore adjust their operations in response to it.

C.3.1 Circumstantial Evidence

As I note earlier in this paper, there were more than two-dozen law firm client alerts addressing *Apex* in the wake of this decision. More precisely, through online searches, I found ten alerts by major national firms and seventeen by smaller local firms. Of these alerts, only two of the twenty-seven even mention 363 sales.

If a 363 sale were a simple and obvious way to essentially negate the *Apex* opinion, one would think that it would be in law firms' clear interests to point this out to their clients. In particular, doing so would be a powerful way to demonstrate the value of the law firms' services to their clients: the law firms would be highlighting how

[108] This phrase was quoted by Poser and originated from *In re Torwico Elecs., Inc.*, 8 F.3d 146 (3d Cir. 1993), one of two cases in other circuits whose decisions were largely in line with the decision in *Apex*.

[109] Or sometimes to an already existing company.

their skillful use of legal tools (that would likely be non-obvious to non-lawyers) could help their clients avoid detrimental impacts from what could otherwise be a significantly disadvantageous decision for the interests of those clients. Conversely, if 363 sales were an obvious escape from the *Apex* holding, and a given law firm failed to mention this, but their competitors did, it would represent not just a lost opportunity to demonstrate value to a firm's clients, it might in fact make those clients question the skill and knowledge of their lawyers.

Other circumstantial evidence also suggests that there was no widespread belief that 363 sales could effectively circumvent the *Apex* ruling. For instance, the beginning of this article quotes a top lawyer for Lockheed Martin commenting on the significance of the *Apex* case. If the *Apex* ruling were essentially vacuous, it would seem odd for a lawyer in such a position to make these comments. Similarly, two attorneys at Perkins Coie (a major, sophisticated national firm) authored a 2016 article for aptly titled "Section 363 Is No Magic Bullet For Environmental Liability" (Jennings and Wilson-McNerney, 2016). The article was published by Law 360, a major source of legal analysis used by practicing lawyers. In the article, the authors argue that even when a 363 sale does not relate to contaminated property itself, if it is selling assets formerly owned by a firm with significant environmental contamination there is no guarantee that the purchaser will be able to escape environmental responsibilities on account of the asset purchase.

C.3.2 Legal Analysis

11 U.S.C.A. §363(f) states:

> The trustee may sell property . . . free and clear of any interest in such property of an entity other than the estate, only if–
> (1) applicable nonbankruptcy law permits sale of such property free and clear of such interest;
> (2) such entity consents;
> (3) such interest is a lien and the price at which such property is to be sold is greater than the aggregate value of all liens on such property;
> (4) such interest is in bona fide dispute; or
> (5) such entity could be compelled, in a legal or equitable proceeding, to accept a money satisfaction of such interest.

I highlight here two points that would likely cause significant difficulties for a party attempting to use a §363 sale to circumvent the *Apex* ruling. The first challenge concerns the five conditions, enumerated in §363(f) above, at least one of which must be met to use such a sale. The first four prongs would not likely apply in this analysis.[110] Most important for this analysis is the fifth prong, which very frequently is the basis of selling assets "free and clear" via a 363 sale.[111] This prong requires the entity with the interest to be able to be compelled to accept money satisfaction of such interest. Yet, a key issue in the *Apex* case is that the Seventh Circuit found that the RCRA statute at play does not allow the EPA to accept money satisfaction in lieu of cleanup performance. Under an opposite finding, the *Apex* case almost certainly would have reached the opposite result under *Kovacs*, as detailed in Section 3.3 above.

The second challenge relates to whether cleanup obligations under RCRA would qualify as "interests" which §363 allows assets to be sold "free and clear" of. Some early cases to consider this, such as *In re White Motor Credit Corp*. 75 B.R. 944 (Bankr. N.D. Ohio 1987) interpreted this to be limited so-called *in rem* interests that adhere specifically to the property being sold, such as liens. Under this interpretation, *in personam* interests that attached to the holder of the assets would still travel with the property. Many later cases, such as *In re Leckie Smokeless Coal Co.*, 99 F.3d 573 (4th Cir. 1996) and *In re Trans World Airlines, Inc.*, 322 F.3d 283 (3d Cir. 2003) have taken broader interpretations of "interests," reasoning that Congress intentionally left the term to be flexible and more expansive than just encompassing liens and similar devices.

The courts in *Leckie* and *Trans World* give relatively few details in their reasoning to support their more expansive reading of "interests." But, a telling recent case by the Second Circuit does give more detail. In *In the Matter of: Motors Liquidation Co.*, 829 F.3d 135 (2d Cir. 2016), cert. denied, the Second Circuit explicitly links the bankruptcy court's abilities to sell property free of with its ability to discharge "claims" under 11 U.S.C.A. §1141, precisely the provision of bankruptcy law that *Apex* held could *not* discharge RCRA cleanup obligations.

[110] Details on this reasoning are omitted for brevity and are available upon request.
[111] See, e.g. *In re Trans World Airlines, Inc.*, 322 F.3d 283 (3d Cir. 2003).

In particular, the Second Circuit, in *Motor Liquidation*, wrote: "successor liability claims must also still qualify as 'claims' under Chapter 11 ... the bankruptcy court's power to bar 'claims' in a quick §363 sale is plainly no broader than its power in a traditional Chapter 11 reorganization." At least under this reasoning, it seems all but certain that if a cleanup obligation is not dischargeable in a reorganization under *Apex*, it could likewise not be circumvented via a §363 sale. Even outside of the Second Circuit, it is reasonable to expect that courts would be reluctant to give broader powers to escape liabilities under a §363 sale than via a Chapter 11 reorganization.[112]

C.4 Differences in Outcomes Between Sixth and Seventh Circuit Holdings

As discussed in Section 3.3 there are notable differences between how certain environmental obligations are treated in bankruptcy in the Sixth Circuit, under *Whizco*, where they are dischargeable, and the Seventh Circuit, under *Apex*, where they are not. Yet, even in the Sixth Circuit, other statutes operate to restrict, but by no means eliminate, the practical impacts of dischargeability. In particular, under both federal law for CERCLA (Comprehensive Environmental Response, Compensation, and Liability Act) and state equivalents, the owner or operator of a property is frequently liable for containing and cleaning up pollution on that property.

As a practical matter, therefore, even in the Sixth Circuit, if a firm declares bankruptcy, reorganizes, and continues operating on a contaminated site, the dischargeability of cleanup obligations may have less relevance. In this section, I examine some implications of this. I demonstrate that while the requirements for owners or operators of sites to address pollution contamination reduce the practical differences between the Sixth and Seventh Circuit's rules, there is still substantial variance in the prospects for creditor recovery against a bankrupt estate between the two circuits. As such, *Apex* represented a significant practical development, even in light of these considerations.

For this discussion, I consider the scenario of a firm that has generated a significant toxic contamination at the site of one of its facilities. The EPA gets an injunction under RCRA §7003 ordering the firm to clean up the contamination, and the firm files for bankruptcy.

In all of these scenarios I assume that the bankrupt firm will reorganize either under Chapter 11 or via a 363 asset sale.[113] Section 3.5 addresses issues associated with liquidations, which are largely separate from those analyzed here. Similarly, I do not explicitly address issues associated with strategic settlements with the EPA.[114] I consider in sequence the scenarios in which cleanup costs exceed and do not exceed the value of the contaminated land.

C.4.1 Cleanup Costs Exceed Value of Contaminated Land

First, suppose that the cleanup costs for the contaminated site are worth more than the land (and immovable equipment) on the site. Under the Sixth Circuit's precedent, this firm could reorganize in Chapter 11 or via an asset sale and continue operations on the contaminated site. But, the ability to obtain a discharge from the EPA's cleanup injunction will be less useful if the EPA can simply issue a new injunction to the reorganized company operating on the site. Similarly, it would be difficult for the company to sell the contaminated site for a positive amount, since the new owner would then be liable for the clean which exceeds the land's value. Practically speaking then, the best option may be to, in effect, abandon the site (legal details of how this could be accomplished are discussed below). Thus, the company may lose the value of the contaminated land and immovable equipment on the site, despite its ability to discharge the cleanup obligations.

Nevertheless, the discharge would still be valuable as it would likely enable the firm to sell its remaining assets unencumbered via a 363 sale, an outcome that would not be possible in the same way under *Apex*, as discussed in Appendix C.3 above.

On this point, *In re Heldor Indus., Inc.*, 131 B.R. 578 (Bankr. B.N.J. 1991)[115] is instructive. This was a case in the Third Circuit, but it came two years before the *Torwico* ruling that established a precedent similar to *Apex*.

[112]For instance, although the Fourth Circuit in *Leckie* held that §363(f) sales are free in clear of "interests" beyond just *in rem*, and denied finding successor liability under the particular facts of that case, the Fourth Circuit expressly criticized the District court in that case for applying "an unduly broad interpretation" of "interests" under §363(f), and the Fourth Circuit listed specific examples that it would not consider to be interests under §363(f) but that would likely be dischargeable under §1141.

[113]Here, I include a sale of a large portion of assets via 363 sale as a type of reorganization, even though it may more appropriately be seen as a type of merger or acquisition. The important concept is that I am distinguishing from the scenario of a piecemeal liquidation.

[114]Instead, what I describe below can be seen as representing firms' BATNAs, or Best Alternatives To Negotiated Agreements. These BATNAs will then in turn impact amounts firms would be willing to pay to the EPA in a settlement.

[115]rev'd and vacated on other grounds sub nom. *N.J. Dept. of Envt'l Protection & Energy v. Heldor Indus., Inc.*, 989 F.2d 702 (3d Cir. 1993).

As such, the bankruptcy court here found that environmental cleanup requirements were dischargeable claims, as would be the case today under Sixth Circuit precedent. The debtor in this case owned various assets apart from those that were subject to environmental contamination and a cleanup order. It sought to sell essentially all assets apart from the contaminated property in a 363 sale. The court, specifically relying on the powers of the bankruptcy court to discharge claims (powers which *Torwico* and *Apex* subsequently circumscribed), held that the debtor was entitled to do so, despite objections by the New Jersey Department of Environmental Protection and Energy that doing so was prohibited until cleanup of the environmental contamination had been completed.

Thus, under the Sixth Circuit precedent, the firm in this situation may lose the value of the contaminated land. But, because it can discharge the cleanup obligations, it can sell the rest of its assets unencumbered, achieving full value for them to satisfy creditor obligations. Under the Seventh Circuit precedent, by contrast (as discussed in Appendix C.3), if the firm wished to sell these assets without successor liability attaching to them, it would need to satisfy the EPA regarding its cleanup obligations,[116] thus eating in to the funds received from the sale of assets that are available to satisfy other creditors' claims.

At a minimum, therefore, in jurisdictions where cleanup obligations are dischargeable, creditors stand to gain value proportional to the amount by which cleanup costs exceed the value of contaminated land. There are, however, at least two reasons why the benefits to creditors may be even greater.

The first reason is that in at least some instances, it may not even be necessary to in effect abandon the contaminated site, even if cleanup costs exceed the value of that site.[117] In some situations, such as the *Apex Oil* case, for instance, contamination that begins at a specific site leaches into surrounding areas, and those surrounding areas occasion significant cleanup requirements. Thus, given the shield of dischargeability, it may well be possible for a firm to clean up the site of a facility, thereby preventing further harm from that facility but not fully ameliorating harm beyond the facility that has already been caused. Any amount saved by cleaning up just the facility but not the surrounding area then would represent additional surplus that a firm and its creditors would enjoy under the Sixth Circuit's precedent as compared to the Seventh's.

The second reason the surplus may be greater is that it may, in at least some instances, be possible to sell the contaminated property and recoup gains from it. Previously, I stipulated that it may be difficult to sell the contaminated property. But, this does not mean that it is impossible. In particular, the EPA, as authorized by the 2002 Brownfields Revitalization Act, has established a "Bona Fide Prospective Purchaser" (BFPP) program.[118] This program allows a new owner who knowingly purchases a contaminated property and complies with certain requirements (such as not impeding cleanup at the site and not taking actions to make the contamination worse) to escape the normal requirements of landowners to abate pollution on sites they own, regardless of whether they contributed to that pollution.

The BFPP program has been criticized for placing overly onerous requirements on land purchasers, requirements which if violated can subject those purchasers to potentially significant cleanup liabilities.[119] But, sale transactions under the program do continue to occur. I have not yet been able to find comprehensive statistics on the number or characteristics of such transactions. But, court cases continue to be decided with some regularity that address interpretations of the program,[120] and there is an active field of practice guides advising companies on how to conduct transactions under BFPP.

Furthermore, it is in some instances possible for a purchaser to achieve additional assurances from federal and state regulators that they will not take adverse actions against it if it purchases property under the BFPP program and complies with certain agreed-upon conditions.[121] The obligations that a purchaser would take on under the

[116] This could be either via fully cleaning up the contamination or by reaching a settlement under which specified activities are committed to, with funds set aside to finance those activities, and with the EPA in turn delivering a commitment not to bring further action.

[117] As the above discussion of *Heldor* demonstrates, under the Sixth Circuit's precedent it may well be possible to achieve the equivalent of an abandonment of property through a 363 sale, even without invoking the Bankruptcy Code's formal provisions for abandonment of property. But, it may also be possible even without a 363 sale. The signature case on this issue is *Midlantic Nat. Bank v. New Jersey Dep't of Envtl. Prot.*, 474 U.S. 494 (1986), in which the Supreme Court placed restrictions on when property subject to environmental contamination can be abandoned. But, many lower courts have interpreted these restrictions narrowly, allowing abandonment in a variety of circumstances. See §17:7 of Broun and O'Reilly (2018) for a summary.

[118] Not to be confused with the EPA's BFFP, or Best Friends Forever Program.

[119] See, e.g. Weissman and Sowinski Jr (2015).

[120] See, for instance, *PCS Nitrogen Inc. v. Ashley II of Charleston LLC*, 714 F.3d 161 (4th Cir. 2013).

[121] See Cahoon (2006). In particular, this article notes that while the EPA is reluctant to enter into binding agreements, it is more willing to issue "comfort letters" that can offer buyers some assurance that a specified course of action will be considered to comply with BFPP requirements. Cahoon (2006) notes that the EPA tends to be particularly willing to do this when (a) it has already conducted substantial investigation of a site such that it has a greater certainty about needed cleanup and (b) where entering such agreements or giving such comfort

BFPP, and the risks that remain despite those, almost certainly will mean that property sold subject to the program will sell for a significant discount as compared to unpolluted sites. But, any amount that can be received through such as sale further increases the benefits a bankrupt firm (and its creditors) would enjoy under the Sixth Circuit's *Whizco* precedent as compared to under the Seventh Circuit's *Apex* precedent.

C.4.2 Cleanup Costs Are Less Than the Value of Contaminated Land

In the event that cleanup costs are less than the value of contaminated land (and immovable equipment), a firm filing for bankruptcy under the *Whizco* precedent still enjoys advantages as compared to the *Apex* precedent, though these advantages may be smaller than the scenario in which cleanup costs outweigh the value of contaminated land. As with the above discussion, a key consideration here is that the ability to discharge a cleanup obligation in bankruptcy is less valuable if a firm plans to continue operating a contaminated facility, as that operation will simply generate new cleanup obligations. And, if the cleanup costs are less than the value of the contaminated land, the responses of effective abandonment of that land discussed above will generally be strategically suboptimal. Nevertheless, there are still three reasons why a firm operating under the Sixth Circuit's precedent will be better positioned than one operating under the *Apex* precedent.

First, as discussed above, it may be possible for the firm to sell the contaminated property to a buyer under arrangements such as the EPA's BFPP that would enable the purchaser to avoid the majority of the cleanup responsibilities. In this way, the bankrupt firm cleanses itself of cleanup obligations through the discharge, while the purchaser avoids at least many of those obligations via the BFPP. This could then allow something closer to the full value of the contaminated site to be available to satisfy other claims in the bankruptcy, as opposed to just the difference between that site's value and the cleanup costs, as would be the case under the *Apex* precedent.

Second, so far, my discussions have presumed that the costs of cleanup operations are known at the time of the bankruptcy filing. A more realistic assumption, however, is that these costs are unknown, with at best general estimates available. On the one hand, these uncertainties could themselves be priced in to the measured "costs" and the calculations above performed based on some form of "certainty equivalent" of costs. But, in a fuller consideration of the scenario, it is quite possible that the uncertainties will come with different economic costs depending on which party bears them.

In particular, even if a facility is worth more than the expected costs of cleanup, or even risk-adjusted expected costs of cleanup, it may be advantageous to sell that facility to a larger firm that is more able to bear the risks of variable cleanup costs and that has more access to different funding mechanisms. By contrast, a firm that emerges from reorganization with a significant uncertain liability could have difficulty obtaining future funding, thereby impeding its recovery efforts.

Because of the expansiveness of environmental laws such as RCRA, even if a bankrupt firm sold a contaminated facility to another party, the selling firm could still be liable for cleanup costs at that facility. This is far from speculative: indeed, this is precisely what occurred in the factual situation in *Apex*: Apex Oil Co. had sold the contaminated refinery as part of its bankruptcy proceedings, but was still liable for cleanup obligations under RCRA. Thus, under a precedent such as the Sixth Circuit's that allows for broader discharge, it may be easier for a bankrupt firm to transfer a facility to an economic actor that will have a higher value for it.[122]

The third and final reason that a firm operating under the Sixth Circuit's precedent may be better off than one operating under the Seventh's in *Apex* is that the enhanced ability to sell a facility can facilitate not just more effective risk allocation, but also greater flexibility in the bankruptcy reorganization. Again, the situation with Apex Oil is illustrative. As discussed in Appendix C.2, Apex Oil sold the contaminated refinery as part of a strategy to completely change the focus of its business, from oil refining to wholesale distribution. And, whereas the facts of the case demonstrate that Apex Oil had failed for many decades to competently run an oil refinery, the fact that it is today still a viable company suggests that its decision to switch business lines was an apt one. Thus, the greater ability to sell contaminated facilities and change business lines (or similarly, geographic scopes,

letters facilities public aims, such as when, for instance, a purchaser agrees to partially contribute to cleanup of a site which would otherwise have little or not private support for cleanup without the sale occurring. Both of these conditions may well be met in the kinds of situations envisioned in this article.

[122]There are of course added complications here. In theory, for instance, the purchasing party can provide assurances that it is assuming all cleanup obligations. But, these may not be fully protective. The purchasing party may itself become bankrupt, or it may challenge the validity of its indemnification agreements if, for instance, pollution is discovered to be worse than expected on the site and thus gives rise to a breach of warrant claim. Another issue that can complicate the application of sales such as this is of course the suite of asymmetric information problems that exist between buyer and seller.

etc.) enables the potential for greater creditor recovery under the Sixth Circuit's precedent as compared to the Seventh's under *Apex*.

In summary then, it is relatively clear that the advantages (for creditors) of the *Whizco* precedent are greater in situations in which the costs of contamination exceed the value of the contaminated facilities. But, even where the reverse holds and the value of the facilities exceeds the costs of their cleanup, the Sixth Circuit's precedent results in outcomes that are potentially more favorable to creditors along several different dimensions. All of these considerations therefore further support the notion that the *Apex* decision represented a significant development.

C.5 Proximity to Bankruptcy and the Impact of Apex

Given that *Apex* affected the treatment of creditors in bankruptcy, it is natural to expect that the impacts of the decision may be most acute for firms that are near bankruptcy. In unreported tests, I take the subset of companies in the TRI data for which I also have Compustat data. For each company, I calculate Merton's Distance to Default.[123] I then interact this with the key indicators in the triple difference and difference in differences formulations that measure the causal impact of the *Apex* decision. This yields coefficients of the anticipated sign (firms closer to default decrease on-site releases more and increase off-site treatment more). But, the effects are small and not statistically significant. One possible reason is simply the relatively sparse data - only about one third of the firms in the TRI data are public companies with information available in Compustat. And, as discussed elsewhere in this paper, there are reasons to believe these public firms will be less impacted by *Apex* overall.

But, another potential explanation for this largely null result lies in the nature of catastrophic pollution risk. With costs for cleanup of this type of contamination easily entering in to the hundreds of millions of dollars, even a firm in a relatively strong financial position could easily be forced into bankruptcy if it is discovered to have created a major chemical contamination. Furthermore, many major contaminations occur when improperly handled chemicals build up in the environment over months or years. For this reason, risks of catastrophic contamination are by nature long-term. Even if a firm is in healthy financial condition now, over a five or ten year horizon there will be a high variance in its potential financial condition, even setting aside issues of how that condition could be impacted by the contamination cleanup costs directly. As such, it may be a prudent decision for lenders and managers of firms in a wide array of financial conditions to take steps to reduce risks of catastrophic contamination in response to the *Apex* decision.

[123] See Shumway (2001) for references.