The Limits of Limited Liability: Evidence from Industrial Pollution

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Introduction [1/2]

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- However, an inherent **moral hazard problem**
  - Firms' assets may not be enough to cover claims
  - Incentive for privately profitable, socially costly behavior
- A number of mitigating factors:
  - Minimum capital requirements
  - Regulation
  - **Legal liability**

Introduction [2/2]

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  - Largely confined to closely held corps and parent-sub relationships
- **This paper:** Study parent liability for subs' environmental cleanups
- **Our question:** *How does limited liability in the parent-sub context affect subs' incentives to pollute and economic activities?*

Empirical setting

The setting: ***U.S. v. Bestfoods*** (1998)

- Strengthened LL protection for some parents under CERCLA
- Overruled circuit courts that previously adopted weaker standards

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Methodology: Exploit circuit split in diff-in-diff framework

Results preview

Stronger limited liability protection associated with:

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- 5–9% increase in toxic emissions

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Findings highlight moral hazard problems associated with limited liability protection.

Institutional Background

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- **Goal** = Address ex-post cleanup of toxic sites
- Currently 1,300+ sites on the National Priorities List (NPL) that are eligible for cleanup

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2. **Deter creation of future sites**
   - *"Induce the highest standard of care"* (Senator Stafford)
   - *"Powerful incentives to deter risky industrial and commercial practices that can result in releases"* (EPA, 2011)

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- More recent examples of CERCLA claims:
  - Hercules Chemical Corp: **$900 million**
  - Marcal Paper Mills Inc: **$943 million**
  - Chemtura Corp: **$2.0 billion**
  - Asarco LLC: **$3.6 billion**

Paying for cleanups

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2. **Liability rules**
   - CERCLA also imposes liability on "owners or operators"
   - Federal circuit courts adopted **different standards for parent liability**

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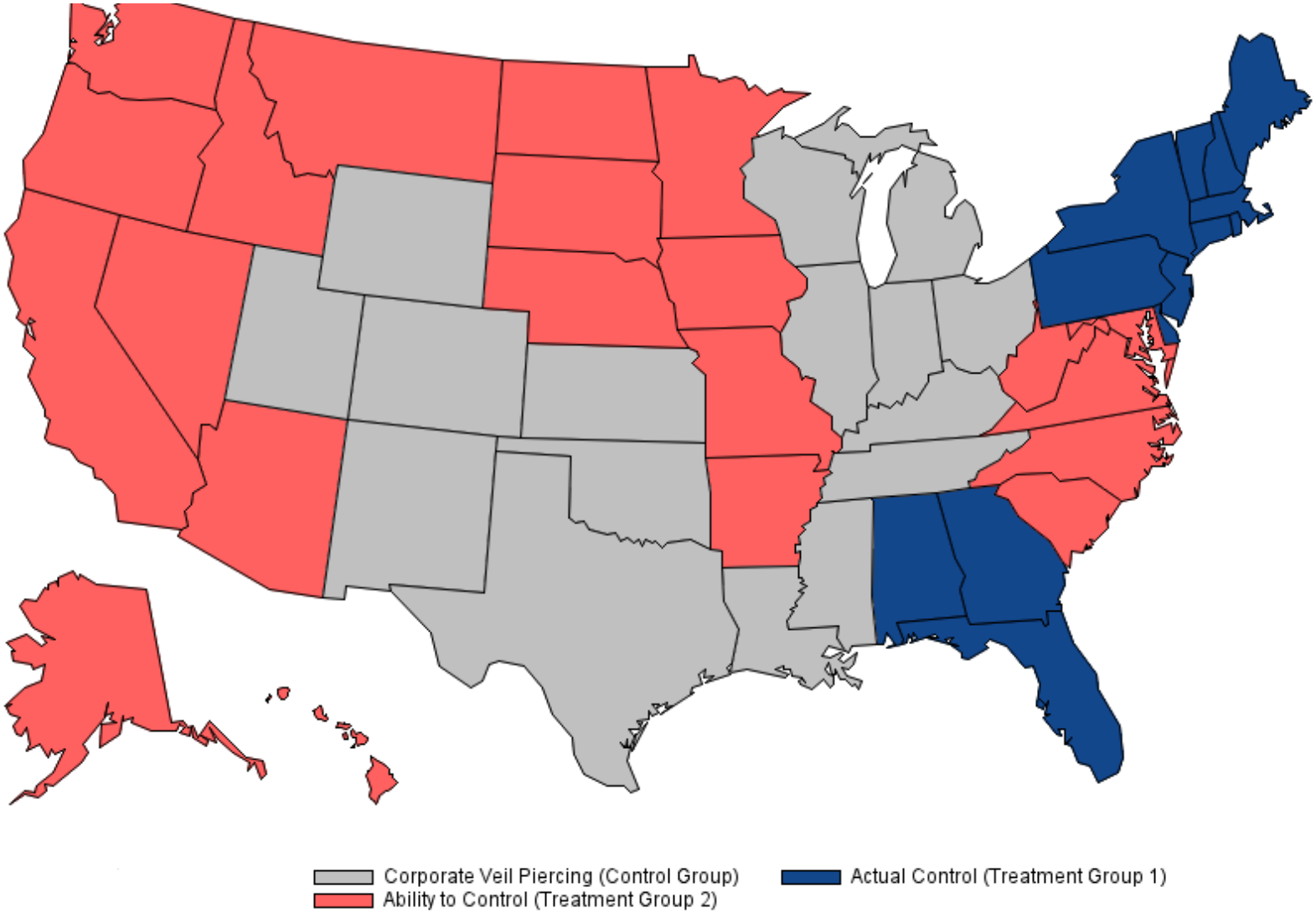
3. **Veil Piercing** — imposed liability if the corporate veil could be pierced under state law

Map of liability standards



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Rejected Ability-to-Control and Actual-Control standards

- Parents liable for cleanups under **veil piercing standard**
  - Requires showing abuse of corporate form (e.g., fraud, undercapitalization, "alter ego")
- Direct operation of sub's facility by parent also grounds for liability
  - E.g., employee of parent (but not sub) controls hazardous waste operations of sub

Methodology & Data

Empirical strategy

We use *Bestfoods* as a natural experiment in a diff-in-diff framework:

$$Y_{c,p,t,i} = \beta\, Bestfoods_{p,t} + \alpha_p + \alpha_{i,t} + \alpha_{c,t} + \epsilon_{c,p,t,i}$$

- $Bestfoods_{p,t}$ — equals one after decision for ATC/ AC subs
  - Liability standard based on plant's location
- α_p — plant fixed-effect
- $\alpha_{c,t}$ — chemical×year fixed-effect
- $\alpha_{i,t}$ — parent company×year fixed-effect
- Some specifications include industry×year fixed-effects

Data sources

- **Plant toxic emissions** – *EPA Toxic Release Inventory*
  - Pounds of ground, water, and air emissions at chemical level
  - 7,833 parent corps; average 3 subs using 4 chemicals

- **Pollution abatement activities** – *EPA P2 database*
  - Facilities report if they undertook abatement related to operating practices, production process, etc.

- **Plant production** – *EPA P2 database*
  - Facilities report "production ratios" — e.g., $\frac{\#\ Refrigerators\ Produced_t}{\#\ Refrigerators\ Produced_{t-1}}$

Results

Does parent liability affect subsidiary toxic emissions?

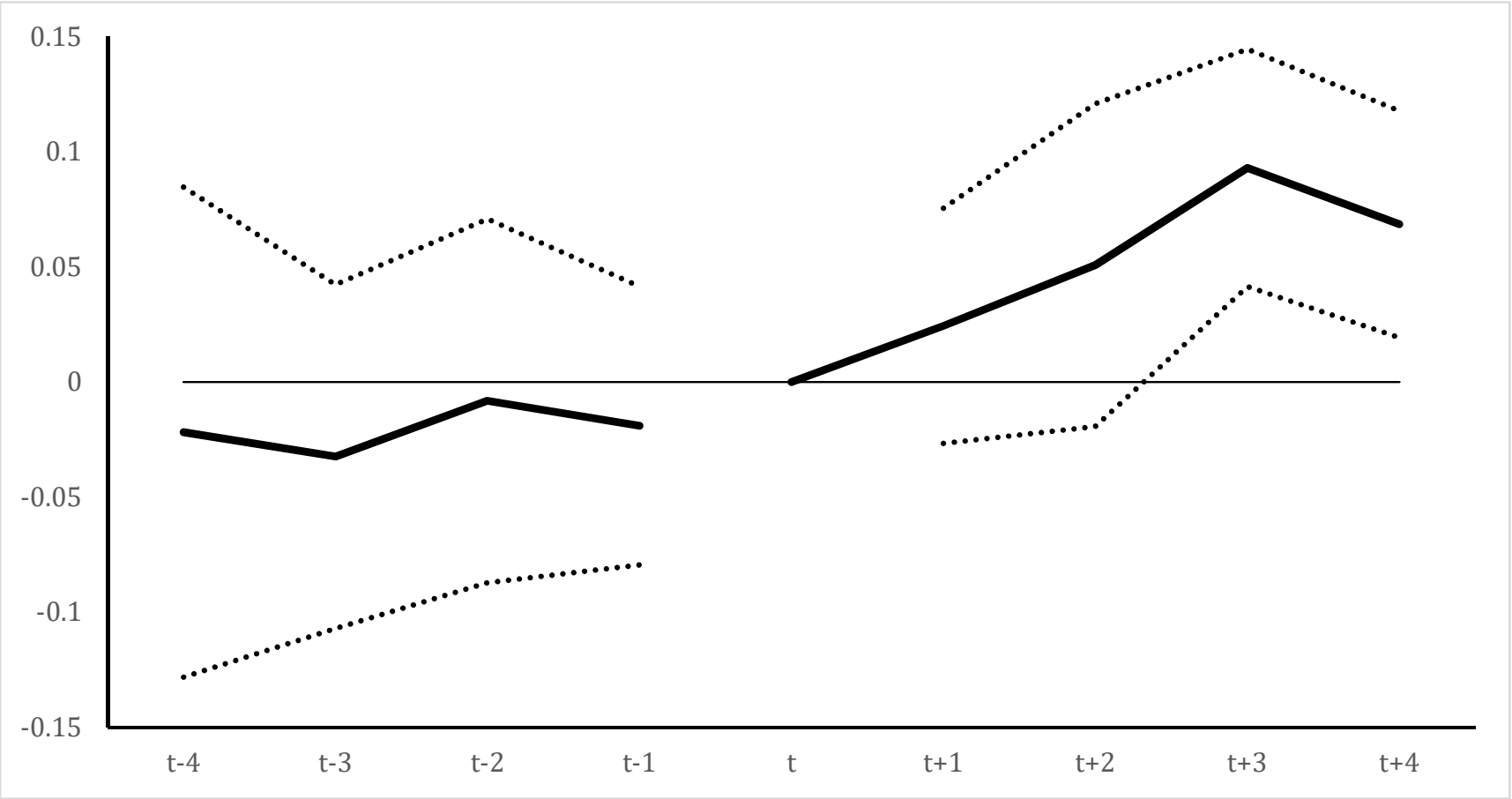
- Main focus of CERCLA: **Ground pollution**
- Examples:
  - Landfills
  - Surface impoundments
  - Injection wells
  - Spills and leaks released into the ground

Ground pollution increases

	Ln(1+ Lbs Ground Pollution)					
	All Subs		Subs w/ Public Parent		Non-Subs	
	(1)	(2)	(3)	(4)	(5)	(6)
Bestfoods	0.0861***	0.0812***	0.220***	0.224***	-0.0063	-0.0184
	(0.0193)	(0.0188)	(0.0309)	(0.0415)	(0.0259)	(0.0324)
Plant FE	x	x	x	x	x	x
Chem-Year FE	x	x	x	x	x	x
Parent-Year FE	x	x	x	x		
Industry-Year FE		x		x		x
Observations	488,739	488,009	154,404	153,951	107,695	106,839
R-squared	0.683	0.688	0.741	0.748	0.630	0.654

Economic magnitude: Increase of 5–9% relative to sample mean

Coefficient dynamics



Robustness tests

Results are robust to...

- Omitting any individual circuit court
- Limiting treated group to AC or ATC regions
- Using proportion of ground pollution as outcome
- Collapsing observations
- Alternative clustering of SEs (e.g., by state and parent company)

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3. **Reallocation across plants**
   - *See paper for details*

Channel #1: Abatement

- Pollution abatement = 5–7% of capex
- Measure using the EPA's Pollution Prevention (P2) database

  → Indicator for different types of abatement

- Most common types:
  1. **Operating practices** *[e.g., improved record-keeping, monitoring]*
  2. **Production process** *[e.g., modified equipment, optimized reaction conditions, used biotech]*

Decrease in abatement related to production process

	1(Abatement - Operations)		1(Abatement - Process)			
	All Subs		All Subs		Subs w/ Public Parent	
	(1)	(2)	(3)	(4)	(5)	(6)
Bestfoods	0.000998	0.00194	-0.00647*	-0.00614**	-0.0130***	-0.0144***
	(0.00533)	(0.00713)	(0.00302)	(0.00259)	(0.00287)	(0.00314)
Plant FE	x	x	x	x	x	x
Chem-Year FE	x	x	x	x	x	x
Parent-Year FE	x	x	x	x	x	x
Industry-Year FE		x		x		x
Observations	593,533	592,592	593,533	592,592	186,215	185,779
R-squared	0.601	0.611	0.452	0.462	0.397	0.425

Economic magnitude: Decrease of 12–25% in process-related abatement

Channel #2: Economic Activity

- Increased pollution may also reflect more economic activity

  $\rightarrow$ *Bestfoods* **decreases** cost of polluting

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- We measure this using the **production ratio** reported to the EPA

No evidence of change in production

	Production Ratio			
	All Subs		Subs w/ Public Parent	
	(1)	(2)	(3)	(4)
Bestfoods	0.0097	0.0028	0.0078	0.0103
	(0.0073)	(0.0062)	(0.0097)	(0.0100)
Plant FE	x	x	x	x
Chem-Year FE	x	x	x	x
Industry-Year FE		x		x
Observations	463,955	463,336	146,572	146,141
R-squared	0.482	0.502	0.450	0.491

Also no effect on estimated employment from D&B

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- Potentially reflects **fixed costs** associated with future cleanups
  - *"Land cleanup is distinct from many environmental regulatory programs because much of the cleanup cost burden is comprised of fixed costs"* (EPA 2011)
- Also less need for current abatement with fixed costs
  - *E.g., changes to production process*

Cross-sectional tests

1. **Subsidiary solvency**
   - Parent liability more likely for less solvent subsidiaries
   - Measure solvency at plant-level using **Paydex Score**

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   - Measure solvency at plant-level using **Paydex Score**

2. **Parent distress risk**
   - Firms in distress have incentive to shift harm to other stakeholders
   - May view investments in abatement as less important than short-term financing needs

Results driven by less-solvent subs

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

Results driven by parents with higher distress risk

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

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- Key findings:
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  - Drop in abatement; no change in production or allocation of emissions across plants
  - Effects driven by less-solvent subs and parents with higher risk of distress
- Findings highlight moral hazard problem associated with limited liability, though aggregate welfare effects unclear