Boomhower (2019): Drilling Like There's No Tomorrow: Bankruptcy, Insurance, and Environmental Risk

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Central Research Question

- **The effect of bankruptcy protection on industry structure and environmental outcomes**
- **Judgment-proof problem**
  - Firms with assets less than their potential worst-case liabilities face inadequate incentives for safety.
  - This can lead to excessive environmental and public health risks.
- The study uses oil and gas extraction in Texas as a case study, exploiting a change in insurance requirements.

The Judgment-Proof Problem: Key Distortions

The ability to discharge debts in bankruptcy can distort behavior and markets:

- **Distorted Safety Incentives:** Firms are insulated from the full cost of worst-case outcomes, leading them to take on excessive environmental risk.

- **Distorted Industry Structure:**
  - Bankruptcy protection creates a private cost advantage for small, undercapitalized firms.
  - This may increase the market share of small firms, even if larger firms have lower social costs of production.

- **Distorted Production Decisions:**
  - It may encourage low-value production where social cost exceeds social benefit.

The Texas Oil & Gas Industry

This industry is an ideal setting to study the judgment-proof problem:

- **High Environmental Risk:** Onshore production carries significant risk of groundwater contamination from oil, gas, and wastewater.
- **Many Small Producers:** The industry includes thousands of small operators, many with few assets besides their income from oil and gas.
- **Pervasive Regulatory Challenge:**
  - Before the policy change, Texas was unable to collect 68% of assessed penalties for rule violations.
  - The most common reason was firm bankruptcy.

Policy Response & Natural Experiment

- A common policy tool to mitigate the judgment-proof problem is requiring **financial assurance** (e.g., bonds or insurance).

- This paper exploits a natural experiment: **Texas Senate Bill 310**.
  - Passed in 2001, it mandated that all oil and gas producers post a bond to cover environmental damages.
  - Implementation was phased in from March 2002 to February 2003.

- Most firms (97%) purchased **surety bonds** from private insurers.
  - This forced firms to internalize expected environmental costs through ongoing, risk-based premium payments.

Empirical Design

- **Regression Discontinuity (RD):**
  - Exploits the sharp policy change at a firm's annual license renewal month.
  - The timing of renewal is exogenously assigned by the regulator.

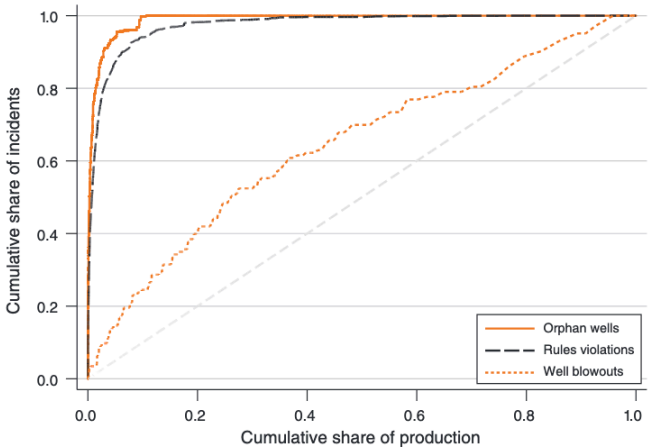
- **Event Study / Difference-in-Differences:**
  - Leverages the quasi-random 12-month phase-in of the policy.
  - It compares firms that have just become bonded to those not yet bonded in the same time period.

Data Sources

A novel dataset was constructed by merging administrative databases from the **Railroad Commission of Texas (RRC)**.

- **Production & Ownership:** Monthly production data for 257,318 leases from 1993-2012.
- **Firms:** Entry and exit dates for 10,489 producers.
- **Environmental Outcomes:**
  - **Orphan Wells:** Wells abandoned by insolvent firms without being safely plugged. A major source of groundwater contamination.
  - **Rules Violations:** Field inspection records for violations of "Water Protection" and "Plugging" rules.
  - **Well Blowouts:** Records of blowouts and well control problems.

Descriptive Evidence: Small Firms, Large Share of Problems

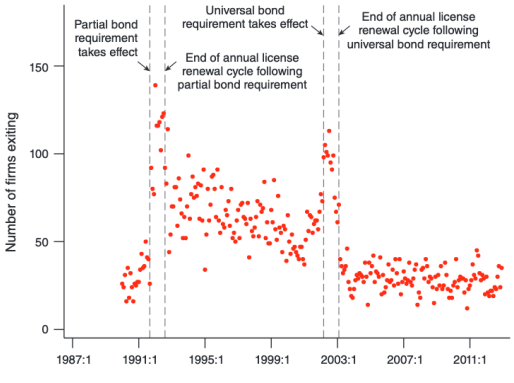


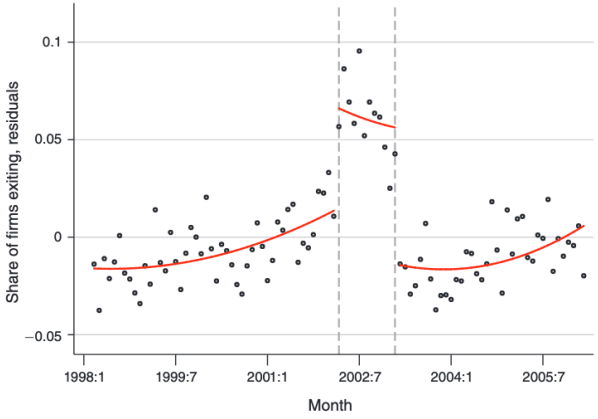
The smallest firms, which account for 20% of total production, were associated with:

- 100% of orphan wells
- 98% of field rules violations
- 41% of well blowouts

This highlights the potential scale of the limited liability problem.

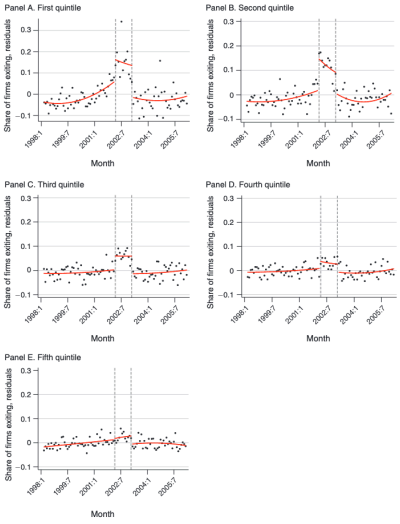
Firm-Level Results: Exit





$$\mathbf{1}[\text{ Exit }]_{it} = \alpha + \beta_1 \mathbf{1}[\text{ Implemented }]_t + \beta_2 T_t + X_t \beta_3 + \eta_{it} \quad (1)$$

Firm-Level Results: Exit



	Q1	Q2	Q3	Q4	Q5
1[Implemented]	0.093	0.126	0.058	0.030	0.007
	(0.041)	(0.015)	(0.024)	(0.020)	(0.013)
Constant	0.220	0.158	0.091	0.061	0.063
	(0.016)	(0.012)	(0.020)	(0.018)	(0.008)
Observations	1,872	2,064	2,220	2,424	2,557

- The effect was strongly concentrated among **small firms**.
  - >10 p.p. increase for the smallest firms.
  - No effect for the largest firms.

Firm-Level Results: Production Reduction

	(1)	(2)	(3)
1[Bonded]	-0.036		
	(0.013)		
1[Bonded] × Q1-4		-0.048	
		(0.017)	
1[Bonded] × Q1			-0.108
			(0.065)
1[Bonded] × Q2			-0.059
			(0.036)
1[Bonded] × Q3			-0.043
			(0.032)
1[Bonded] × Q4			-0.018
			(0.018)
1[Bonded] × Q5		-0.004	-0.004
		(0.016)	(0.016)

$$\ln(\text{ Production }_{it}) = \gamma + \psi \mathbf{1}[\text{ Bonded }]_{it} + \delta_i + \tau_t + \nu_{it} \quad (2)$$

Lease-Level Results: Reallocation

	Observations	Impl. Year (%)	Baseline (%)	Excess (%)
Panel A: Transfers, All Leases				
Q1-3	83,310	16.1	9.4	6.6
Q4	86,442	11.2	9.8	1.4
Q5	261,090	10.0	10.8	-0.8
Panel B: Transfers, High-Quality Leases				
Q1-3	9,621	13.3	4.0	9.3
Q4	11,505	11.0	10.2	0.8
Q5	92,576	11.2	11.6	-0.4
Panel C: Shut-ins, All Leases				
Q1-3	83,310	6.2	4.2	2.0
Q4	86,442	3.8	3.7	0.0
Q5	261,090	4.4	4.1	0.2
Panel D: Shut-ins, Low-Quality Leases				
Q1-3	35,787	9.1	6.7	2.4
Q4	27,734	5.9	5.7	0.2
Q5	38,433	7.4	7.3	0.1

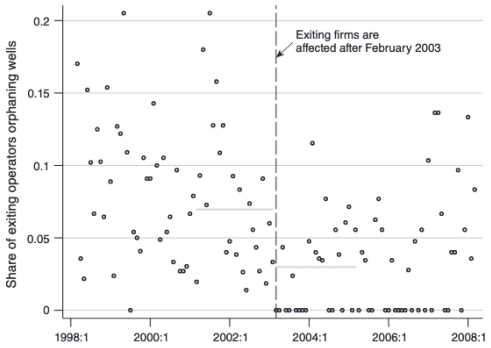
Lease-Level Results: Reallocation

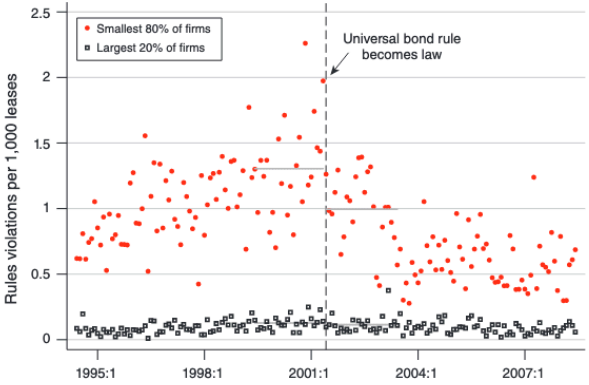
What happened to the wells operated by small firms?

- **Reallocation (Prediction I):**
  - There was a 6.6 percentage point "excess" rate of lease transfers from small firms to other operators during the policy implementation year.
  - These transfers were concentrated among relatively **high-quality** (i.e., high-producing) leases.

- **Shutdown (Prediction II):**
  - There was a 2.0 percentage point "excess" rate of lease shut-ins by small firms.
  - These shut-ins were concentrated among **low-quality** (i.e., low-producing) leases, where environmental risk is most likely to exceed the value of production.

Lease-Level Results: Environmental Outcomes





Lease-Level Results: Environmental Outcomes

The policy led to sharp improvements in environmental performance.

- **Orphan Wells:**
  - The rate of well orphaning fell dramatically and permanently.
  - The policy reduced the industry-wide orphan well rate by **65%**.
  - This represents an approximately 70% decrease in orphan wells created by insolvent firms.
  - The effect was driven entirely by small producers.

- **Rules Violations:**
  - The industry-wide rate of water protection rule violations fell by **25%**.

- **Well Blowouts:**
  - The rate of well blowouts per active drilling rig also saw a sharp and sustained drop.

Welfare Impacts

- **Large Environmental Benefits:**
  - Back-of-the-envelope calculation suggests the policy averted ∼3,900 orphan wells since enactment.
  - This implies avoided environmental damages of approximately **$470 million**.
  - The costs to firms for plugging these wells were much smaller ($22-$90 million), implying substantial net welfare gains.

- **Efficient Industry Reallocation:**
  - Production was reallocated from small, high-risk firms to larger firms.
  - The most socially inefficient projects (low-production, high-risk) were shut down.
  - Overall oil and gas output for the state was essentially unaffected by these changes.

Conclusion

- The ability to avoid liability through bankruptcy is a **significant determinant of market structure and safety** in hazardous industries.

- Requiring firms to internalize environmental risks via an insurance mandate proved highly effective:
  - It induced the exit of the highest-risk firms.
  - It reallocated production to safer operators and shut down socially inefficient projects.
  - It led to substantial and lasting improvements in environmental outcomes.

- **Policy Implication:** The results strongly support increasing bond requirements in other oil- and gas-producing jurisdictions, as many remain well below the levels in Texas and are still below potential damages.

References I

Boomhower, Judson, "Drilling Like There's No Tomorrow: Bankruptcy, Insurance, and Environmental Risk," *American Economic Review*, 2019, *109* (2), 391–426.