

Bankruptcy, Insurance, and Environmental Risk: Too Many Small Oil & Gas Producers?

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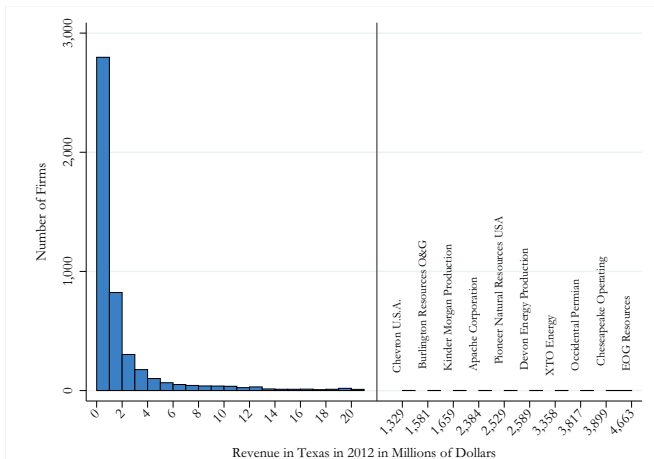
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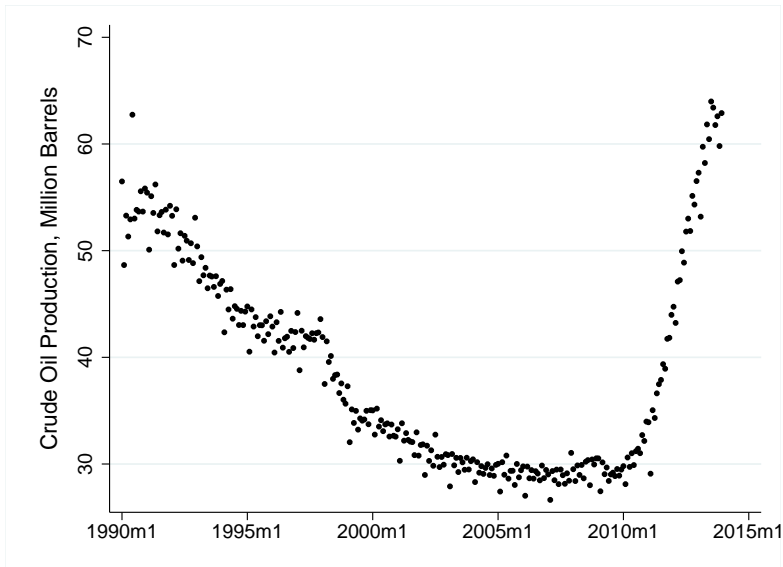
Bankruptcy may distort firms' safety decisions

Theory implies that firms underinvest in environmental safety when they can escape liability through insolvency. This may favor smaller firm size in hazardous industries.

Regulators have tried to mitigate this problem, but there is little evidence about the benefits and costs of these policies.



Hydraulic fracturing makes this topic very salient



I find that bankruptcy protection has important effects on industry structure and the environment

I exploit a quasi-randomized rollout of a surety bond requirement in Texas. This policy should lead firms to internalize environmental costs through premiums and coverage terms.

I find changes in industry composition, firm-level production, and environmental outcomes. There are fewer small firms after the policy change, and the remaining firms improve their environmental performance.

Small firms may not internalize accident costs

Bankruptcy protection may lead to too little safety effort, too much production, and too many small firms.

Possible instruments:

- ▶ Minimum asset requirements
- ▶ Uniform tax on oil production
- ▶ Mandated liability insurance
- ▶ Technology standards
- ▶ Bond requirement

Insurance may correct incentives, but moral hazard problems could make insurance expensive

- ▶ **Screening:** Firms with the highest default risk also have the grossest misalignment of environmental incentives; bond requirements discourage participation by these firms.
- ▶ **Care:** Bonding may increase safety effort if bond premiums depend on indicators of care, or if surety agreements are collateralized.
- ▶ **Cost:** Bond premiums increase producer costs, reducing the supply of oil and gas
- ▶ If insurers cannot accurately price default risk, bond premiums could be very high.

Texas changed its insurance requirements twice

1991: Partial Bond Requirement

1. Bond: \$2 per foot, or blanket \$25k – \$250k depending on number of wells.
2. Annual fee of 3% of bond amount.
3. “Good Guy Option”: \$100 annual fee. (70+% of operators)

2002: Universal Bond Requirement

Firms had to comply at their annual operating license renewal, creating a de-facto randomized rollout.

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I merge several firm-level administrative datasets

Production

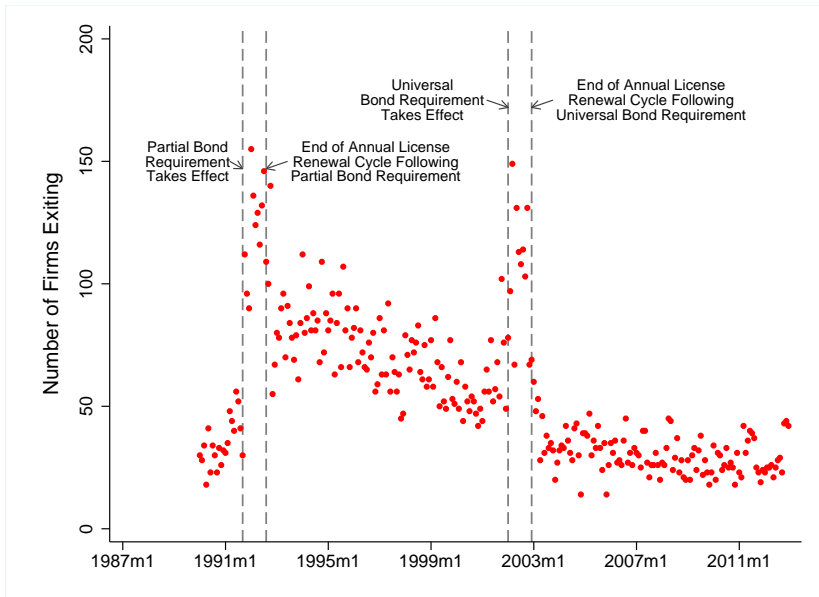
- ▶ Entry, exit, license renewals since 1983
- ▶ Monthly lease-level oil & gas production since 1990

Accidents

- ▶ Oil spills
- ▶ Blowouts and well control problems
- ▶ Citations for field rule violations
- ▶ Orphan wells
- ▶ Groundwater contamination cases (coming soon)

Detailed historical bond data (coming soon)

Insurance requirements caused immediate exit



I compare exit during the rollout to just before and after

$$1[Exit]_{it} = \alpha + \beta_1 1[Bond\ Rollout]_t + X\beta_2 + \epsilon_{it}$$

- ▶ Sample includes 1997 – 2006.
- ▶ One observation per firm per year, in its anniversary month.
- ▶ **X** includes oil and gas prices and a parametric time trend.

Most of this exit was among small firms

	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5
	\$0 – \$27,000	\$27,000 – \$88,000	\$88,000 – \$277,000	\$277,000 – \$1,193,000	> \$1,193,000
1[Bond Rollout]	0.167** (0.024)	0.121** (0.015)	0.043** (0.011)	0.022** (0.005)	0.011 (0.007)
Oil Price	-0.0023** (0.0006)	-0.0015** (0.0005)	-0.0002 (0.0004)	-0.0003 (0.0003)	0.0003 (0.0003)
Gas Price	-0.0015 (0.0038)	0.0015 (0.0024)	-0.0030 (0.0026)	-0.0018 (0.0015)	-0.0022 (0.0019)
Constant	0.140** (0.007)	0.107** (0.005)	0.078** (0.004)	0.053** (0.003)	0.055** (0.003)
N	10,938	12,190	13,755	14,745	14,225
Firms	2,046	2,084	2,093	2,097	2,094

To measure the effect of bonding on production by remaining firms, I use an event study design

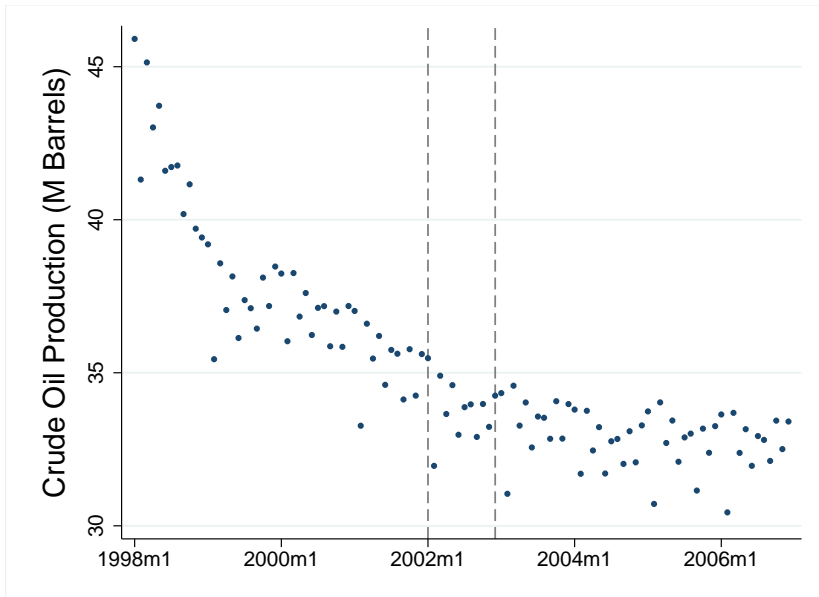
$$\ln(\text{Production})_{it} = \gamma + \psi 1[\text{Bonded}]_{it} + \delta_i + \phi_t + \eta_{it}$$

- ▶ Sample includes 2002 only.
- ▶ Monthly observations for every month.
- ▶ Firm and month-by-quintile fixed effects.

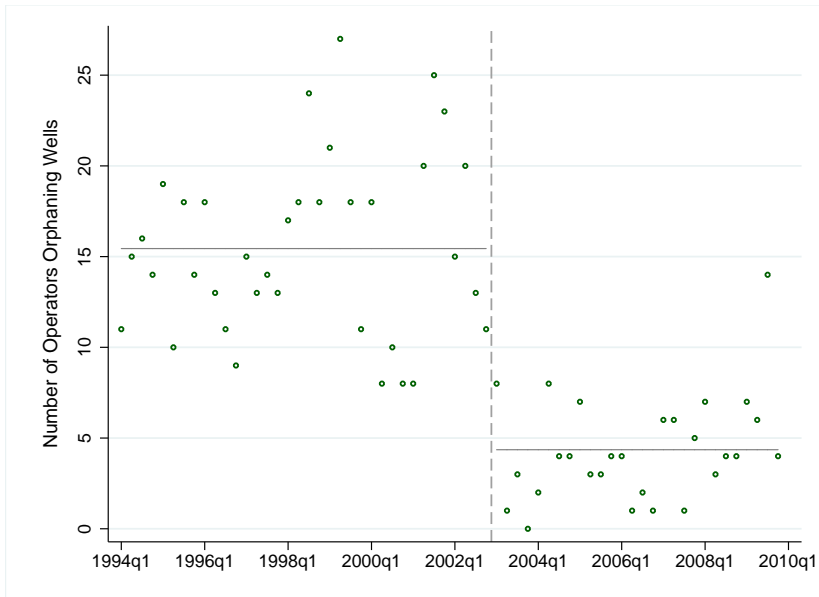
Remaining small firms decreased their oil production

	Implementation Year		Placebo Year	
Bonded	-0.04**(0.01)		0.01 (0.01)	
Bonded *				
Quintile 1		-0.08 (0.04)		0.08* (0.04)
Quintile 2		-0.09**(0.03)		-0.02 (0.03)
Quintile 3		-0.06**(0.02)		-0.00 (0.02)
Quintile 4		-0.01 (0.02)		0.02 (0.02)
Quintile 5		0.01 (0.02)		0.01 (0.02)
Constant	6.06** (0.01)	6.05** (0.01)	5.91**(0.01)	5.91**(0.01)
Firm FE	Yes	Yes	Yes	Yes
Month*Quint. FE	Yes	Yes	Yes	Yes
Observations	48,149	48,149	54,030	54,030
Firms	4,499	4,499	5,184	5,184

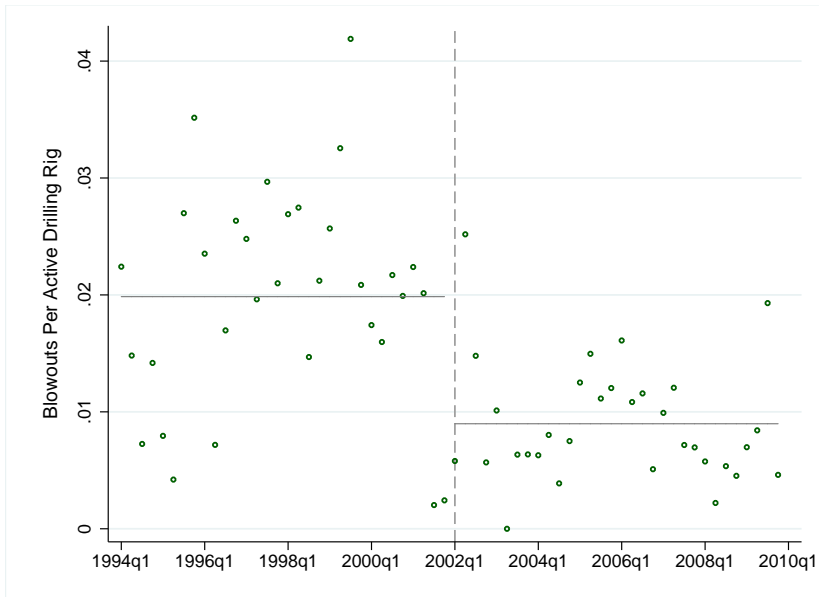
Total oil and gas production changes very little



Environmental outcomes improve: Orphan Wells



Environmental outcomes improve: Well Blowouts



Conclusion

I find empirical support for the “judgment-proof problem” as a determinant of industry structure and environmental outcomes. The ability to avoid environmental costs through insolvency inflated the number of small firms and increased environmental harm.

An insurance mandate reduced the number of small firms and reduced environmental impacts with little effect on total oil and gas production.

The ability of private insurance markets to overcome potentially severe moral hazard problems in this case is striking.

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