

# Leaving money on the table: self-selection and administrative contests in the U.S. mining industry

Thomas Coleman <sup>1</sup>   Anastasia Shcherbakova <sup>2</sup>

<sup>1</sup>The University of Chicago

<sup>2</sup>Texas A&M University

36th USAEE/IAEE North American Conference  
September 26, 2018

# Motivation

Most energy and natural resource firms operate in highly regulated environments (environmental, safety and health, financial, etc.)

Regulations are a way for government to internalize externalities (mostly negative) and improve social efficiency of market outcomes

Liability for social damages increases firms' operating costs, creates incentives to evade regulation

## How do firms evade regulations?

- participating in creation of rules
- lobbying to affect enforcement of rules
- appealing regulatory fines

## How do firms evade regulations?

- participating in creation of rules
- lobbying to affect enforcement of rules
- appealing regulatory fines

Why do firms appear to underutilize administrative appeals?

	fine upheld	fine reduced	total
uncontested	84.4%	0.04%	84.4%
contested	8.1%	7.5%	15.6%
total	92.5%	7.5%	100.0%

## Leaving money on the table?

We use U.S. mining industry data to characterize strategic interaction between firms and regulators around the administrative appeals process

Three types of agents:

1. **firm**: profit maximizing, aims to minimize regulatory costs
2. **regulator**: self-interested (Stigler 1971, Peltzman 1976, Becker 1983, Weingast & Moran 1983, Levy 2005), aims to maximize chance of reappointment, sometimes coincides with social welfare
3. **judge**: self-interested (Levy 2005), aims to maximize chance of attaining a more lucrative post, sometimes coincides with fair and consistent judgments

## Leaving money on the table?

We use U.S. mining industry data to characterize strategic interaction between firms and regulators around the administrative appeals process

Three types of agents:

1. **firm**: profit maximizing, aims to minimize regulatory costs
2. **regulator**: self-interested (Stigler 1971, Peltzman 1976, Becker 1983, Weingast & Moran 1983, Levy 2005), aims to maximize chance of reappointment, sometimes coincides with social welfare
3. **judge**: self-interested (Levy 2005), aims to maximize chance of attaining a more lucrative post, sometimes coincides with fair and consistent judgments—ALJs (merit-based lifetime appointment, no hierarchy, flat salary structure)

# Agents' objective functions

**Firm:**

$$\begin{aligned}\max \pi &= \min C(q) \\ &= \min\{ c(q) + r(q) \} \\ &= \min\{ c(q) + \delta \times E[f(v)] - \alpha(\gamma) \times h \times s(v) \}\end{aligned}\tag{1}$$

$c(q)$  is production cost,  $r(q)$  is regulatory cost,  $\delta$  is probability of detection,  $E[f(v)]$  is expected fine for violation with characteristics  $v$ ,  $\alpha$  is probability of contesting,  $\gamma$  is gap between expected and received fine,  $h$  is probability of a fine reduction (i.e., reversal) given a contest,  $s$  is reduction in fine after contest

For given  $c(q)$ ,  $\delta$ ,  $E[f(v)]$ ,  $\min C(q) \equiv \max\{ \alpha(\gamma) \times h \times s(v) \}$

# Agents' objective functions

**Firm:**

$$\begin{aligned}\max \pi &= \min C(q) \\ &= \min\{ c(q) + r(q) \} \\ &= \min\{ c(q) + \delta \times E[f(v)] - \alpha(\gamma) \times h \times s(v) \}\end{aligned}\tag{1}$$

$c(q)$  is production cost,  $r(q)$  is regulatory cost,  $\delta$  is probability of detection,  $E[f(v)]$  is expected fine for violation with characteristics  $v$ ,  $\alpha$  is probability of contesting,  $\gamma$  is gap between expected and received fine,  $h$  is probability of a fine reduction (i.e., reversal) given a contest,  $s$  is reduction in fine after contest

For given  $c(q), \delta, E[f(v)]$ ,  $\min C(q) \equiv \max\{ \alpha(\gamma) \times h \times s(v) \}$

Testable hypothesis: firms are more likely to contest penalties with higher fines and those not consistent with expectations



## Agents' objective functions

### Regulator:

$$\max B = \max\{ k(t) - h(\alpha, f(v)) \} \quad (2)$$

$B$  is regulator benefits,  $k(t)$  is regulator's perceived knowledge (ability), which rises with time or experience  $t$ ,  $h$  is probability of being reversed by judge after contest

For given  $v, t$ ,  $\max B \equiv \min h(\alpha, f(v))$

# Agents' objective functions

## Regulator:

$$\max B = \max\{ k(t) - h(\alpha, f(v)) \} \quad (2)$$

$B$  is regulator benefits,  $k(t)$  is regulator's perceived knowledge (ability), which rises with time or experience  $t$ ,  $h$  is probability of being reversed by judge after contest

For given  $v, t$ ,  $\max B \equiv \min h(\alpha, f(v))$

Testable hypothesis: regulator chooses fines so as to minimize probability of reversal

# Empirical approach

All data from MSHA Open Government portal

- details on over 2.3 million unique violations, 2000-2017, including violation characteristics, violator characteristics, penalty points (regular assessment), proposed and adjusted fines, contest outcomes

Construct firms' expectations about fines using MSHA penalty point guidelines and penalty conversion tables

# Empirical approach

All data from MSHA Open Government portal

- details on over 2.3 million unique violations, 2000-2017, including violation characteristics, violator characteristics, penalty points (regular assessment), proposed and adjusted fines, contest outcomes

Construct firms' expectations about fines using MSHA penalty point guidelines and penalty conversion tables

Firm's contesting choice:

$$\Pr(\text{contest}_{i,\nu}) = \Phi(\text{ProposedFine}_{\nu}, \text{ExpectationsGap}_{\nu}, \mathbf{X}_{i,\nu}), \quad (3)$$

where  $\mathbf{X}_{i,\nu} = \{v_{i,\nu}, \text{minerAct}_{\nu}, \text{coal}_{i,\nu}, \eta_{\nu}\}$

# Empirical approach

All data from MSHA Open Government portal

- details on over 2.3 million unique violations, 2000-2017, including violation characteristics, violator characteristics, penalty points (regular assessment), proposed and adjusted fines, contest outcomes

Construct firms' expectations about fines using MSHA penalty point guidelines and penalty conversion tables

Firm's contesting choice:

$$\Pr(\text{contest}_{i,\nu}) = \Phi(\text{ProposedFine}_{\nu}, \text{ExpectationsGap}_{\nu}, \mathbf{X}_{i,\nu}), \quad (3)$$

where  $\mathbf{X}_{i,\nu} = \{v_{i,\nu}, \text{minerAct}_{\nu}, \text{coal}_{i,\nu}, \eta_{\nu}\}$

Regulator's penalty choice:

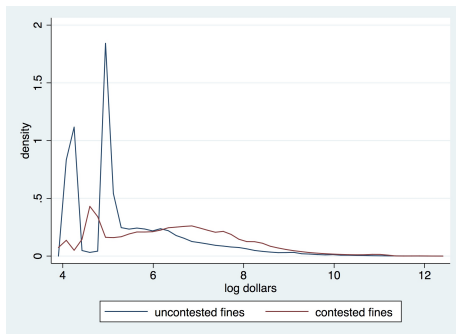
$$\Pr(\text{proposed/expected}_{i,r,t}) = \Phi(\text{contests}_{r,t-1}, \text{reversals}_{r,t-1}, \mathbf{Z}_{i,r,t}) \quad (4)$$

where  $\mathbf{Z}_{i,r,t} = \{v_{i,\nu}, \text{minerAct}_{\nu}, \text{coal}_{i,\nu}, \rho_r\}$

# Empirical approach

We exploit two sources of variation in propensity to contest in our data:

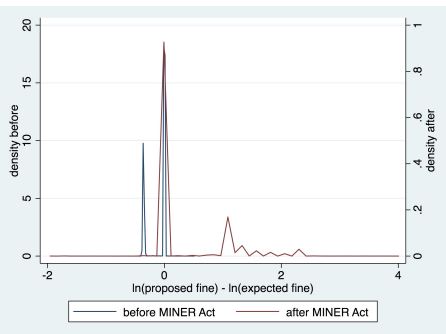
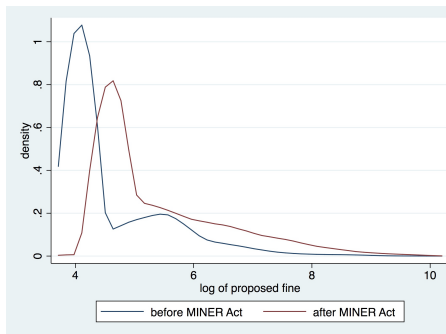
1. variation in proposed fines (based on violation characteristics)



# Empirical approach

We exploit two sources of variation in propensity to contest in our data:

2. variation in uncertainty about fines (post-MINER Act regime change)



## Summary statistics

	proposed fine (\$)	expected fine (\$)	expectation gap (%)	share contested (%)
full sample	176.12	178.99	-5.4	15.3
uncontested	139.70	152.08	-9.7	
contested	618.57	450.13	22.5	
before MINER Act	100.25	102.18	-7.7	6.2
after MINER Act	246.33	248.86	-4.1	20.7
	<i>uncontested citations</i>			
before MINER Act	93.26	99.50	-9.2	
after MINER Act	185.90	204.66	-10.0	
	<i>contested citations</i>			
before MINER Act	293.40	161.61	22.9	
after MINER Act	706.46	528.42	22.5	

*Note:* table reflects means of log distribution of fines



## Empirical results: strategic behavior of firm

	probability of contesting a citation					
	(1)	(2)	(3)	(4)	(5)	(6)
ln(proposed fine)	0.120*** (0.003)	0.112*** (0.004)	0.097*** (0.005)	0.121*** (0.004)	0.114*** (0.004)	0.122*** (0.005)
gap proposed v. expected	0.311*** (0.006)	0.328*** (0.007)	0.350*** (0.010)	0.291*** (0.006)	0.305*** (0.007)	0.320*** (0.010)
MINER Act	0.027*** (0.005)	0.035*** (0.006)	-0.010 (0.013)	0.024*** (0.006)	0.029*** (0.006)	-0.014 (0.016)
coal mine	0.042*** (0.007)	0.037*** (0.007)	0.032*** (0.011)	0.014 (0.014)	0.011 (0.014)	-0.003 (0.043)
lag total violations			-0.001*** (0.000)			-0.001*** (0.000)
lag total contests			0.002*** (0.000)			0.001*** (0.000)
lagged contest success rate			-0.075*** (0.010)			-0.026*** (0.010)
violation characteristics	no	yes	yes	no	yes	yes
fixed effects	no	no	no	violator	violator	violator
Adjusted $R^2$	0.277	0.284	0.351	0.386	0.393	0.424
N	2257734	2163826	866426	2257734	2163826	866426

Note: standard errors in parentheses. Results reported for a linear probability model.

\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

## Empirical results: strategic behavior of regulator

	ln(proposed fine/expected fine)				
	(1)	(2)	(3)	(4)	(5)
lag total office contests	0.000** (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
miner act × lag contests		0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)	0.000 (0.000)
lag office reversal rate	0.031*** (0.007)	-0.034** (0.014)	-0.042*** (0.013)	-0.038*** (0.013)	-0.035*** (0.012)
miner act × lag reversal rate		0.092*** (0.016)	0.093*** (0.014)	0.088*** (0.014)	0.086*** (0.014)
miner act	0.061*** (0.010)	0.004 (0.012)	-0.001 (0.012)	-0.010 (0.013)	0.131*** (0.032)
coal mine	-0.014** (0.007)	-0.014** (0.007)	0.090*** (0.033)	0.023* (0.013)	0.036*** (0.013)
violation characteristics	no	no	no	yes	yes
miner act interactions	no	contests	contest	contest	contest, chars
fixed effects	no	no	inspection office	inspection office	inspection office
Adjusted R <sup>2</sup>	0.007	0.008	0.015	0.033	0.053
Obs	889032	889032	889032	866339	866339

Note: standard errors in parentheses. OLS results reported.

\* p < 0.1, \*\* p < 0.05, \*\*\* p < 0.01

## What have we learned so far?

Firms' strategic use of administrative contests is statistically linked to gap between expected and actual regulatory penalties

- When regulatory costs are formulaic, firms can form fairly decent cost expectations
- Greater uncertainty in costs, conversely, leads to more intensive use of administrative appeals

Judicial reversals appear to play a role in regulator's choice of regulatory noncompliance penalties

- Strategic behavior by self-interested regulator imposes obvious social costs (here through greater tolerance of mining safety and health infractions)

Thank you!  
Questions? Comments?

[ashcherb@tamu.edu](mailto:ashcherb@tamu.edu)