What do we know about improving environmental compliance? A whirlwind tour of the research literature

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Motivation

- Environmental compliance creates sizeable benefits.
  - Central estimates of monetized benefits from CWA are in the tens of billions annually, largely via recreation, aesthetics, and housing values. (EPA 2000)
- Promoting compliance involves sizeable resource outlays.
- The scope of environmental compliance is huge.
  - EPA and states oversee more than 41 million entities under 58 programs (EPA 2005; Gray and Shimshack 2011).

What explains environmental compliance? Theoretical motivations

- Compliance costs and benefits
- …. Including traditional deterrence pressures.
  - This is the simplest 'rational actor' model.
  - The scholarly foundations date back to Bentham (1789), with modern formalism taking off after Becker's (1968) economics of prohibited behavior model.
  - Agents consider privately beneficial action that may generate harm to others.
  - Undertake action if Expected Benefits > Expected Costs.
  - Undertake action if $g > pF$.
    - Expected Gain (g) > Probability of Detection (p) $\times$ Fine conditional on detected noncompliance (F)

What explains environmental compliance? Theoretical motivations

- Compliance costs and benefits
- …. including stakeholder pressures.
  - This includes input market pressures (investors, employees, supply chains in), output market pressures (consumers, supply chains out), and community / activist pressures.
  - This is still the "rational actor model."
  - Entities are still weighing benefits and costs of decisions, but regulatory activity is not the sole source of pressure.
  - Entities are still undertaking an action:
    - if expected benefits > expected costs.
    - g > pF , with p and F not restricted to regulator activity only.
  - Note if regulatory activity "leverages" stakeholder pressures, stakeholder pressures are deterrence pressures.

(Vandenbergh 2007, Kitmueller & Shimshack 2012)

What explains environmental compliance? Theoretical motivations

- Many important motivations do not directly address traditional compliance costs and benefits, including:

  - Social norms and social interactions.
  - Spillovers from other compliance domains.
  - Trust, fairness, and intrinsic moral considerations.
  - Regulatory complexity and knowledge.
  - Behavioral / psychological considerations.

Kagan and Scholz 1984; Tyler 1990; Ayres & Braithwaite 1992; Burby & Patterson 1993; Kagan et al. 2003, 2011; Delmas & Toffel 2008; Congdon et al. 2011; Arielly 2008; Gunningham 2004; May 2005; Thornton et al. 2005; Simpson et al. 2013. Gray & Silbey 2014; Rorie et al. 2015; Short et al. 2015, Hindin & Silberman 2016, Vandenbergh 2003, 2007; Truelove et al. 2014. See Alm 2012 for the related lab and tax compliance lit.

Put differently …

- In principle at least, what explains noncompliance?
  - Compliance costs and benefits
  - Cultural norms and/or big social changes
  - Regulatory complexity or vagueness
  - Lack of awareness of the law
  - Disagreement with the law
  - Beliefs about fairness and applicability of rules to competitors.

The empirical account

- An interdisciplinary research literature assesses environmental compliance from an empirical perspective.
- This large and growing literature uses diverse methods:
  - Qualitative methods: surveys, semi-structured interviews, case studies.
  - Quantitative deterrence and compliance measurement: traditional regression analysis or “natural experiments” applied to large administrative datasets.
  - Field experiments and randomized controlled trials.
  - Laboratory experiments.
- Leverages local, state, regional, and federal *data* … and *partnerships* with local, state, regional, and federal agencies

The empirical account

- Studies formally assessing environmental compliance from an empirical perspective:
  - Disproportionately address larger municipal or industrial polluting facilities, rather than small businesses or individuals.
  - Do consider local, state, regional, and national monitoring and enforcement and jurisdictions.

(International studies include Hettige et al. 1996, Pargal and Wheeler 1996, Pargal et al. 1997, Dasgupta and Wheeler 1997, Tang et al. 1997, Dasgupta et al. 2001, Lo and Fryxell 2003, 2005, van Rooij 2006, Lo et al. 2009.)

Key lessons

- What does the evidence from the empirical literature tell us?
  - The basic insights of a rational polluter model explain *a lot* of real world environmental compliance behavior.
  - Nearly all quantitative studies taking causality reasonably seriously find that traditional inspections / fines:
    - reduce immediate environmental harm, as evaluations and requirements of administrative and judicial actions generate pollution reductions.
    - This *direct reduction* in the penalized harm is widely recognized, by scholars and by practitioners.

Key lessons

- Nearly all quantitative studies taking causality reasonably seriously find that inspections / fines *also*:
  - improve *future* environmental performance at the evaluated or sanctioned facility (i.e. generate specific deterrence).
  - spillover to improve environmental performance at *other* facilities in the same jurisdiction as the sanctioned facility via a regulator reputation effect (i.e. generate general deterrence).
  - induce facilities to reduce pollution below permitted levels (i.e. generate beyond compliance effects).

→ On average, inspections and fines get results.

→ These impacts are often greater than immediate reductions in penalized harm alone.

(Literatures reviewed in Cohen 1998; Gray & Shimshack 2011; Shimshack 2014. Influential early contributions include Epple &Visscher 1984; Cohen 1987; Magat & Viscusi 1990.)

Other central messages: Inspections

- Greater inspection frequencies lead to greater compliance, often at a diminishing rate.

  A. ↑inspection frequency from once every 5 years to once every 2 years is expected to ↑ compliance.
  B. ↑ inspection frequency from once every 2 years to once every 1 year is expected to ↑ compliance … but the incremental change in compliance is expected to be smaller than the change in (A).
  C. ↑ inspection frequency from once every year to once every quarter is expected to ↑ compliance … but the incremental change in compliance is expected to be smaller than the change in (B).

(Literatures reviewed in Cohen 1998; Gray & Shimshack 2011; Shimshack 2014. Early important contributions include Epple &Visscher 1984; Cohen 1987; Magat & Viscusi 1990.

Other central messages: Enforcement

- On average, formal enforcement actions (especially fines) lead to greater compliance at the sanctioned facility … and at other facilities in the jurisdiction.
    - Informal enforcement actions without "teeth" generally have little or no impact on the sanctioned facility's compliance.
    - Informal enforcement actions without "teeth" have no known impact on other facilities' compliance.
    - An implication is that formal enforcement actions with penalties are important compliance motivators.

(Literatures reviewed in Cohen 1998; Gray & Shimshack 2011; Shimshack 2014. Important early work includes Epple &Visscher 1984; Cohen 1987; Magat & Viscusi 1990. See also Shimshack &Ward 2005, 2008; Gray &Shadbegian 2007.)

Other central messages: Enforcement

- Higher formal penalties (bigger fines) increase compliance, often at a diminishing rate.

  A. Increasing the typical fine by (say) $2000 ↑ compliance.
  B. Further increasing the typical fine by another $2000 ↑ compliance, but by less than the amount in (A).
  C. If there are trade-offs between the fine amounts and the number of penalties, more frequent penalties may generate more overall deterrence than a few large penalties.
  D. For many reasons, entities can be induced to comply even when penalty amounts seem low… provided *fines* are imposed when violations occur. Traditional tools might be leveraged to have unusually far reaching impacts on environmental compliance.

(Literatures reviewed in Cohen 1998; Gray & Shimshack 2011; Shimshack 2014. Important early work includes Epple &Visscher 1984; Cohen 1987; Magat & Viscusi 1990. See also Shimshack &Ward 2005; Gray &Shadbegian 2007; Landsberger & Meilijson ‘82, Harrington ‘88, Harford ‘91/93, Harford & Harrington ‘91, Heyes & Rickman ‘99, Friesen ‘03, Shimshack & Ward ‘08)

Other central messages: Spillovers

- Enforcement spillovers within jurisdictions, where actions targeting one entity spillover to ↑ compliance at other entities facing the same regulator, appear large.
    - These 'general deterrence' effects can be as large as the 'specific deterrence' effects for the sanctioned entity itself.
    - But the 'reach' of these spillovers can be limited….Deterrence-promoting spillovers are often restricted to the same jurisdiction.
    - Deterrence-promoting spillovers are much stronger among more similar facilities.

→ Ignoring such "positive" spillovers may misrepresent deterrence in the real world.

(Shimshack and Ward 2005; Gray and Shadbegian 2007; Evans et al. 2019)

Other central messages: Spillovers

- Enforcement spillovers in a devolved (decentralized) system can also lead to *unintended* enforcement spillovers across jurisdictional boundaries.
    - e.g., Increases in enforcement pressure in one state can provide incentives for competitors in other states to increase production and pollution.
    - Without coordination across jurisdictions, pollution reductions from more enforcement pressure in one state can be partially offset by increased pollution by competitors in other states.

→ Ignoring such "negative" spillovers may misrepresent deterrence in the real world.

(Shimshack and Ward 2005; Gray and Shadbegian 2007; Evans et al. 2019)

What else have we learned?

- Standard 'environmental' deterrence is extremely important for motivating compliance in the real world.
- Yet, the "rational polluter model" alone cannot explain all real observed environmental compliance behavior.
  - Compliance is not solely determined by compliance costs and benefits.
- Other explanations appear especially strong … and may dominate traditional benefit and cost considerations … for the behavior of:
  - Individuals.
  - Smaller businesses.

Kagan and Scholz 1984; Tyler 1990; Ayres & Braithwaite 1992; Burby & Patterson 1993; Kagan et al. 2003, 2011; Delmas & Toffel 2008; Congdon et al. 2011; Arielly 2008; Gunningham 2004; May 2005; Thornton et al. 2005; Simpson et al. 2013. Gray & Silbey 2014; Rorie et al. 2015; Short et al. 2015, Hindin & Silberman 2016, Vandenbergh 2003, 2007; Truelove et al. 2014. Alm 2012 reviews related lab and tax compliance lit.

Illustrative examples

- A small literature suggests reducing *complexity* and improving *information* may increase compliance.
  - Burby and Patterson (1993) – Compliance with erosion control programs was strongly influenced by clarity and simplicity of control procedures.
  - Winter and May (2001) - Farmers' awareness of agro-environmental rules importantly influenced compliance.
  - Stafford (2006) – Small facilities with more complex rules had more frequent violations.

Illustrative examples

- A larger literature provides evidence that *trust*, *fairness*, *moral, and internal norm* issues influence compliance.
  - Winter and May 2001 - Farmers' beliefs about environmental rule fairness and personal moral obligations influenced compliance
  - Gunningham et al. 2005 - Chemical facility personnel reported that compliance was motivated by perceptions about 'the right thing to do' and 'if egregious violators were getting punished fairly'
  - Simpson et al. 2013 - Manufacturing companies violated less if personnel believed they might lose respect among family or peers for environmental noncompliance
  - Truelove et al. 2014 – Summarizes a growing literature on how behavioral spillovers from one pro-environmental behavior (PEB) to other PEBs depend on motivations and action characteristics.

Illustrative examples

- A distinguished and still growing literature documents that environmental compliance is a social process influenced by *social norms* and *social interactions*.

    - Social comparisons with other entities' environmental performance influence compliance.
    - Informal social sanctions, including stigma and shaming, influence outcomes.
    - Decision-makers' relationships with management, regulators, other facilities influence outcomes.
    - Reciprocity norms influence outcomes.

(Scholtz 1984; Winter & May 2000; Vandenbergh 2003, Gray & Silbey 2014; Jin & Leslie 2014; Rorie et al. 2015; Short et al. 2015; Muehlenbachs et al. 2016; Hindin & Silberman 2016)

Implications of compliance motivations going beyond simple compliance costs and benefits.

→ Noncompliance and penalties should be well publicized.

- Public disclosure that leverages non-regulatory pressures by disclosing particularly good or bad performers can be effective.

→ However, publicizing good behavior as the norm - and "the right thing to do" - is also important.

- Perceptions that noncompliance is the norm can lead to high levels of noncompliance.

→ Regulations and penalty determinations should be clear, consistent, supported by services, & evenly applied.

- Compliance is enhanced when facilities perceive that regulators are: (1) fair, (2) trying to promote compliance, (3) applying rules similarly across facilities, and (4) providing benefits and services for good behavior.

Implications of compliance motivations going beyond simple compliance costs and benefits.

- Oversight tools beyond inspections and fines may be effective in select circumstances.
  - However, while a large and diverse literature indicates that inspections and fines enhance compliance and reduce pollution ….
  - *… the literature on the effectiveness of alternative approaches to promoting compliance is much smaller and the results are mixed.*
  - This applies to cooperative enforcement without penalties, voluntary programs, information disclosure, and compliance assistance.
- My interpretation of the existing literature is that alternative tools can be effective when used as *complements* to traditional regulatory approaches …. but not when used as *substitutes* to traditional approaches.

Illustrative example: Disclosure

- Does publishing performance lists of “best” or “worst” performers influence compliance?
- Would requiring regulated sources to publicly post information on their own compliance or performance status affect environmental performance?
- Do regulated entities that are required to submit proof of performance to the government comply more than facilities that are required only to keep compliance documentation on-site for review by inspectors?

Illustrative example: Disclosure

- The *theory* is that transparency and disclosure may:
  - Influence expected compliance costs and benefits via activist and community pressure; citizen complaints, monitoring, lawsuits; employee loyalty, consumer WTP, capital markets
  - Serve reminder and reassurance functions that compliant behaviors matter, that noncompliant behaviors will be detected, and that organizations are committed to compliance.
  - Trigger subtle psychological cues associated with being watched. These cues significantly increase prosocial (in this case, compliance) behaviors in lab & in real-world settings.
  - Reinforce decision-makers' self-conceptions as honest individuals or honest organizations.

(Earnhart 2004; Eesley and Lenox 2006; Innes and Sam 2008; Konisky and Reenock 2013; Earnhart and Leonard 2016; Grant and Grooms 2012; Langpap and Shimshack 2010; Thornton et al. 2005; Hindin and Silberman 2016; Pittet et al. 2000; Lowry and Joslyn 2014; Duval and Wicklund 1973; Wicklund 1975; Mazar et al. 2008; Hayley and Fessler 2005; Bateson et al. 2006; Pruckner & Sausgruber 2013).

Illustrative example: Disclosure

- The *empirical* evidence finds:
  - Many disclosure programs generate inconsistent results, generate no effects, or even generate unintended consequences.
  - Pessimistic results, on average, for environmental health hazard advisories (and likely for self-assessment and self-certification).
  - Mixed results, on average, for product labeling and warnings; performance registries like the TRI.
  - Favorable results, on average, for "name and shame" or "name and proclaim" programs that leverage and complement formal regulation.
  - Examples include frequent violator watchlists, community notifications for drinking water violations, signs at outfall points containing source contact and permit information, etc.

(Weil et al. 2006; Hamilton 1972; Hamilton 1995; Konar & Cohen 1997; Viscusi 1997; Bui 2005; Shimshack and Ward 2010; Bae et al. 2010; Jin and Leslie 2003, Jin and Leslie 2009, Ho 2012, Foulon et al. 2004, Evans 2016, Bennear and Olmstead 2009, etc.)

Discussion

- The literature I've discussed today is not without caveats.
  - Results do not necessarily apply to the entire regulatory universe.
  - The literature focuses on larger firms, where data are more available and more reliable (where compliance is more frequently assessed).
  - The literature analyzes water settings, but also air, waste, etc.
  - The literature analyzes SNC outcomes, but also other compliance metrics.
  - Results come from scholarship that strives to enhance causal attribution and external validity, but no single study is perfect.

Discussion and conclusion

- Nevertheless, messages from the literature are consistent.
  - Inspections and enforcement actions “with teeth” get results.
  - The deterrence impacts of inspections and fines often go well beyond immediate clean-up requirements or commitments.
  - Inspections and fines can and do:
    - *improve future compliance at the sanctioned or evaluated facility*
    - *spillover to improve compliance at other facilities*
    - *spur beyond compliance behaviors*.

Implications

- Metrics assessing environmental deterrence via enforcement counts or court-order clean-ups (etc.) may substantially understate the impact of inspections and fines.
- Alternative approaches to promoting compliance – like enforcement without penalties, voluntary programs, information disclosure, and compliance assistance – are often effective as complements to traditional enforcement but not necessarily as substitutes for traditional enforcement.
- The evidence on the effectiveness of alternatives approaches to promoting compliance is smaller and more mixed.

Evaluation

- The literature does not have all the answers.
- The literature does, however, reinforce the importance of evaluation.
- Given ever-tightening budgets, using resources effectively and efficiently is important.
- Evaluation and testing can help. This applies to new innovations and long-standing approaches.
- Well-trained social science researchers are often eager to partner with agencies for evaluation.
  - Many researchers want to be relevant. Your agencies are laboratories for experimentation. Your questions are the important ones.
  - Researchers can help identify where, when, and how: existing data can be used for evaluation of new questions; additional data can inform decision-making; and simple experimentation may provide insights.