

2013

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David A. Weisbach

Maciej H. Kotowski

Richard Zeckhauser

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David A. Weisbach, Maciej H. Kotowski & Richard Zeckhauser, "Audits as Signals" (Coase-Sandor Institute for Law & Economics Working Paper No. 651, 2013).

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CHICAGO

COASE-SANDOR INSTITUTE FOR LAW AND ECONOMICS WORKING PAPER NO. 651
(2D SERIES)



COASE-SANDOR INSTITUTE
FOR LAW AND ECONOMICS
THE UNIVERSITY OF CHICAGO LAW SCHOOL

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Maciej H. Kotowski, David A. Weisbach, and Richard J. Zeckhauser

THE LAW SCHOOL
THE UNIVERSITY OF CHICAGO

August 2013

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Maciej H. Kotowski
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September 2013
RWP13-026

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Audits as Signals

Maciej H. Kotowski,[†] David A. Weisbach,[‡] Richard J. Zeckhauser[□]

August 14, 2013

Abstract

A broad array of law enforcement strategies, from income tax to bank regulation, involve self-reporting by regulated agents and auditing of some fraction of the reports by the regulating bureau. Standard models of self-reporting strategies assume that although bureaus only have estimates of the of an agent's type, agents know the ability of bureaus to detect their misreports. We relax this assumption, and posit that agents only have an estimate of the auditing capabilities of bureaus. Enriching the model to allow two-sided private information changes the behavior of bureaus. A bureau that is weak at auditing, may wish to mimic a bureau that is strong. Strong bureaus may be able to signal their capabilities, but at a cost. We explore the pooling, separating, and semi-separating equilibria that result, and the policy implications. Important possible outcomes are that a cap on penalties increases compliance, audit hit rates are not informative of the quality of bureau behavior, and by mimicking strong bureaus even weak bureaus can induce compliance.

[†] The Kennedy School of Government, Harvard University.

[‡] The University of Chicago Law School.

[□] The Kennedy School of Government, Harvard University

Those charged with enforcing laws or regulations, or rules of any sort, (collectively bureaus) often require regulated entities or individuals (agents) to submit reports on their activities. Bureaus enforce compliance by auditing the reports and imposing punishments when misreporting is identified. For example, a bureau charged with enforcing environmental laws might require polluters to report whether they are in compliance. A bureau charged with enforcing occupational safety rules might require companies to report accidents. In both cases, it is common practice to audit some fraction of reports and to impose penalties when underreporting is discovered. Similarly, tax administrators rely heavily on self-reporting of tax liability and audit only a fraction of reports. Prosecutors or police regularly ask for self-reports from suspects by asking for a confession. They offer to lower the criminal sanction for a confession. Higher sanctions for failure to confess if guilt is ultimately assessed is akin to a sanction for underreporting. Contracts, commercial relationships, and personal relationships may use similar principles.

The apparent purpose of this type of enforcement system, which we will call an SRA—self-report audit—strategy, is to reduce enforcement costs. If only a fraction of reports has to be audited, costs may be lower than the alternative of directly monitoring a population. For this strategy to work, however, agents must have an incentive to send in informative reports. In some settings only biased reports can be expected. Reports of emissions, accidents, and income may be shaved downwards if agents suspect that there will be little expected cost to doing so. In many settings, however, appropriate incentives can elicit accurate reports. If agents know, for example, that an inaccurate report is likely to be detected and punished, they may send in accurate reports rather than face sanctions.

Most of the literature on auditing and self-reporting considers the case where a regulated party has private information and the goal of the reporting system is to induce the individual to reveal that information.¹ The regulated party

¹ The modern statement of the problem in the tax enforcement context began with, J.F. REINGANUM & L. WILDE, *Income tax compliance in a principal-agent framework*, 26 *Journal of Public Economics* 1 (1985). In the tax context, see also, K.C. BORDER & J SOBEL, *Samurai accountant: A theory of auditing and plunder*, 54 *Review of Economic Studies* 525 (1987); D. MOOKHERJEE & I. PNG, *Optimal auditing, insurance, and redistribution*, 104 *Quarterly Journal of Economics* 399 (1989); H. CREMER & F GAHVARI, *Tax evasion and the optimum general income tax*, 60 *Journal of Public Economics* 235(1996); P. CHANDER & L. WILDE, *A general characterization of optimal income tax enforcement*, 65 *Review of Economic Studies* 165(1998); and SUSAN SCOTCHMER, *Audit classes and tax enforcement policy*, 77 *American Economic Review: Papers and Proceedings* 229 (1987). In the torts context, see LOUIS KAPLOW & STEVEN SHAPELL, *Optimal Law Enforcement with Self-Reporting of Behavior*, 102 *Journal of Political Economy* 583 (1994). Auditing in the environmental context has been studied by ARUN S. MALIK,

is assumed to know the capabilities of the auditing bureau. Individuals, for example, are assumed to know the ability of the tax administrator to catch cheats. Criminals deciding whether to confess are assumed to know what information the government has against them, and the likelihood of a successful prosecution.

The world would be a simpler place, and law and economics of much less interest, if these information conditions were widely found. We suspect, however, that in many cases, the agent is unsure about the capabilities of the bureau because the agent knows neither the auditing technology that the bureau possesses, nor the information it already has.

In such cases, there is not just one information asymmetry, but two. Thus, we drop the assumption that the agent knows what the bureau knows, and consider the enriched auditing problem. The agent is assumed to have private information about its behavior or type, but to have at best imperfect knowledge of the quality of the bureau's auditing capability, which is private information to the bureau.² For example, an individual seeking to hide assets in a foreign bank account has only a rough estimate of how likely the tax administrator is to find them. A polluter required to report environmental emissions is not certain whether the bureau can detect its emissions. Criminals deciding whether to confess may not know what evidence the government has against them.

How should the bureau set an SRA strategy when its auditing capabilities are private information, which agents can only infer? This additional asymmetry changes the game between the parties. Bureaus will act strategically to convey or

Self-Reporting and the Design of Policies for Regulating Stochastic Pollution, 24 *Journal of Environmental Economics and Management* (1993). For a general review of the auditing literature, see JEAN-JACQUES LAFFONT & DAVID MARTIMORT, *The Theory of Incentives* (Princeton University Press, 2002), p. 121-125.

² A very similar environment is studied by Mark B. Cronshaw and James Alm, *Tax Compliance with Two-Sided Uncertainty*, 23 *Public Finance Quarterly* 139-166 (1995). In their model, both the agent and the bureau have private information. However, the bureau in their model cannot commit to an auditing policy. Hence, their analysis does not encompass the signaling aspects that form the core of our analysis. I. MACHO-STADLER & J.D. PEREZ-CASTRILLO, *Auditing with signals*, 69 *Economica* 1(2002) presents a model where the tax authority receives a private signal of the taxpayer's income, so they have two-sided private information similar to ours. In our structure, unlike theirs, the bureau's private information need not be correlated with the taxpayer's income and may reflect general features of the environment. Moreover, in their model, the bureau has to declare an audit strategy before it receives the private signal whereas in ours, the bureau knows its auditing capabilities before setting a strategy. Other authors have considered the possibility of imperfect auditing. See, e.g., H.C. CHEN & S.M. LIU, *Incentive contracts under imperfect auditing*, 76 *The Manchester School Working Paper Series* 131 (2008); D.P. BARON & D. BESANKO, *Regulation, asymmetric information, and auditing*, 15 *RAND Journal of Economics* 447 (1984) and ARUN S. MALIK, *Self-Reporting and the Design of Policies for Regulating Stochastic Pollution*, 24 *Journal of Environmental Economics and Management* (1993).

avoid conveying information about their capabilities. A bureau with good auditing capabilities might engage in costly signaling to convince agents of this fact. Absent private information about bureaus, such signaling would be wasteful. A bureau with weak capabilities might mimic its stronger peers to enhance its deterrent capability. In both cases, signaling and mimicking strategies have to consider how both agents and other bureau types will react. The strategies must operate in an equilibrium where bureaus are strategic, and agents try to infer information about their quality and then send in reports given the inferences they draw.

Policymakers may have a strategy option as well. Sometimes they will want to encourage mimicking by weak bureaus to allow them to better enforce laws where auditing is difficult, but at other times they will want to encourage strong bureaus to differentiate themselves to aid their enforcement. Given that agents draw information about one bureau from the behavior of others, however, there will be cross-bureau externalities. Policymakers will have to consider overall strategies and appropriately balance the costs and benefits of mimicking versus signaling, essentially of pooling and separating equilibria.

We provide core intuitions and legal applications of such a model. A formal model and proofs of our results appear elsewhere.³ We begin with motivating examples, describe the core features of our model, and then turn to applications.

1. Motivating examples

Bureaus often use self-reporting to enforce laws or regulations. There are numerous straightforward examples, such as the self-reporting system used by most countries for taxation or a requirement to report environmental spills.⁴ Banks are required to report their levels of capital to bank regulators.⁵ Drivers are required to report traffic accidents to the police. Companies are required to report financial information to various regulators.⁶ Drug companies are required to report adverse reactions and device makers must submit declarations of conformity to the Food and Drug Administration.⁷ OSHA requires employers to report incidents within 8 hours.⁸

³ Kotowski, Weisbach, and Zeckhauser, working paper, cite.

⁴ 40 CFR 110 (requirement to report discharges of oil) and 40 CFR 302 (reporting requirements for hazardous substances)

⁵ Basle II.5, implemented at 77 Fed Reg. No. 169 (August 30, 2012).

⁶ Section 13(a) of the Securities Exchange Act of 1934.

⁷ 21 CFR 803.10

⁸ 29 CFR 1904.39(a).

Self-reporting can also arise in contexts where the actions are not conventional reports. Any time one party asks another for information to enforce a stricture, they are effectively using the self-reporting strategy. In criminal law, asking for a confession or just interviewing a suspect is effectively asking for a self-report. The police or prosecutors may encourage self-reporting by offering to reduce penalties in exchange for a confession or for turning yourself in. They may “audit” self-reports by deciding if and when to seek further evidence. Contracting parties may ask about the progress of performance, effectively asking the other party for a report. A misreport can lead to the loss of future business or a lawsuit.

The recent Supreme Court decision, *Arizona v. Inter Tribal Council of Arizona*,⁹ concerned a self-reporting strategy. The National Voter Registration Act, a federal law, requires that applicants self-declare their eligibility rather than provide documentary evidence. This is a self-reporting system. Arizona instead wanted a system where people had to prove their eligibility. Although the Court decided the case on preemption grounds, an important ongoing dispute about voter identification revolves around the effectiveness of a self-reporting strategy.

Because of its prominence, the SRA strategy has received attention from both legal scholars and economists.¹⁰ A basic result is that the strategy often makes sense. In a setting where the goal is deterrence, setting the penalty for bad behavior that is self-reported slightly lower than the expected penalty for the behavior when it is not self-reported, creates an incentive for truthful reports without changing the first-order effects of the underlying law.¹¹ To illustrate, consider a risk-neutral agent who engages in a sanctionable activity. If the agent does not self-report a violation, the fine is \$1,000, and the probability that the bureau detects the violation is 10%, implying that the expected sanction is \$100. If the sanction on an agent who self-reports is \$99, the agent is better off reporting, but there is no first-order change in the sanction. Enforcement costs, however, are reduced, which enables this self-reporting system to out perform a system that relies on direct monitoring.

⁹ 570 U.S. __ (2013).

¹⁰ See notes 1 and 2 *supra*. For a summary of the legal literature, see MITCHELL POLINSKY & STEVEN SHAVELL, *The Theory of Public Enforcement of Law*, in *Handbook of Law and Economics* (Mitchell Polinsky & Steven Shavell eds., 2007).

¹¹ See KAPLOW & SHAVELL, note 1. This example is taken from POLINSKY & SHAVELL, *id.* p. 437-438. Note that Kaplow and Shavell do not include the costs of self-reporting in their model. These costs may be significant. They conclude only that the strategy of requiring self-reports plus audits saves enforcement costs, not that it saves the sum of enforcement and compliance costs.

Most of the existing models have a similar structure: the agent has private information about his situation which he reports to the bureau. The bureau then audits some of the reports according to a policy that depends on what is reported.

The novel element of our analysis is that bureaus differ in their capabilities. Moreover, though bureaus know their capabilities, agents do not. Agents only have a subjective probability distribution. Capabilities differ because some bureaus are better able to detect the truth or have more audit resources. For example, the IRS can easily detect hidden income when it has information returns from payers. A taxpayer may not know how effectively the IRS matches information returns with individuals' returns, but has some estimate of the probability. In other cases, the bureau may not be able to detect the truth or may be able to do so only at significant cost. The IRS has a difficult time finding income that is well-hidden in foreign jurisdictions. It has no easy tracing technology, but it may have secret sharing arrangements with foreign banks. A taxpayer with assets stashed overseas may not know what behind-the-scenes contacts the IRS has established with the foreign government or foreign payers (e.g., Swiss banks). He can only estimate what the IRS knows.

This two-sided asymmetric information problem describes many, but by no means all, auditing situations. With the IRS, for example, audits are not publicized; they are considered private information between the IRS and the taxpayer, unless an audit dispute ends up in court. This means that individuals are unlikely to know the true auditing capabilities of the IRS as this information is revealed coarsely and sporadically. The IRS, understanding this dynamic, puffs its capabilities just prior to the April 15 filing deadline by publicizing multiple tax-fraud cases.¹²

Criminal investigations also likely involve two-sided private information. The police asking a suspect for a self-report—Professor Plum, did you have the revolver in the conservatory? —may purposefully keep the extent of their knowledge secret believing that they get better revelation by doing so.¹³

In other cases, most or nearly all information about the bureau's auditing capabilities are public. The bureau may have to publish its examination procedures which may be purely mechanical. Or a large entity that is audited frequently may have institutional knowledge of the quality of audits, as may

¹² JOSHUA BLANK & DANIEL LEVIN, *When is Tax Enforcement Publicized*, 30 *Virginia Tax Review* 1(2010).

¹³ They may even forego revealing information in one case where it would be helpful, if they think it better to keep suspects guessing in cases where they do not have information.

professional advisors, such as lawyers and accountants. Nevertheless, the real world throws up a variety of cases where two-sided private information is present and important. In them, new questions get posed; new results emerge.

2. Basic structure of the model

Our formal model, like most, simplifies for clarity and tractability. We describe the basic structure of the model using nontechnical terminology.

There is a single, risk-neutral agent who must comply with a particular stricture, such as paying tax liability, using a mandated pollution control technology, providing a safe workplace, or complying with a contract. There are only two types of agents, High and Low. (A more complex model would allow for multiple types.) For example, a taxpayer may earn high or low income, a polluter may have high levels or low levels of emissions, a criminal may be guilty or innocent, and so forth. The agent's type—High or Low—is private information, known initially only to the agent, although the bureau knows the probability that the agent is High or Low. The agent must report his type to the bureau, possibly accurately, possibly not. For example, a high-earning taxpayer might report that he earned a high amount and pay the associated tax liability, or he might underreport and pay a lower amount. A polluter might report that it is using the mandated technology (equivalent to a low report) or that it is not (a high report). A crime suspect may confess or claim innocence. In each case, the misreport precipitates a punishment if discovered during an audit.

The risk-neutral bureau receives the report and decides whether to audit the agent. As with agents, there are two types of bureaus, strong and weak. A strong bureau will discover the agent's type if it chooses to audit. A weak bureau will not. (We assume the extreme case where strong bureaus are perfect auditors and weak bureaus completely hopeless. Realistic cases will lie in between.) The bureau knows its type; the agent has only a subjective probability on those types. In all cases, each audit costs the bureau a fixed amount money.¹⁴

If a bureau audits the agent and finds that a High agent falsely claimed to be a Low agent, the agent will be penalized. A third party, such as Congress, determines the maximum penalty that the bureau can impose. Within these preset bounds, however, the bureau may impose any penalty that it finds justified.¹⁵ A truthful report never gets penalized. That is, there are no type I errors in which the

¹⁴ For simplicity, we do not include the agent's cost of audit.

¹⁵ As we argue below, the bounds set by Congress on the bureau's policies are a key factor behind the effectiveness of its enforcement actions. Perhaps surprisingly, leaving the bureau unconstrained may not be the best policy.

agent truthfully reports being Low but the audit concludes (incorrectly) that he is High.¹⁶

Three critical assumptions define the game. First, objectives: Agents seek to minimize their expected costs; bureaus seek to maximize their expected revenue net of costs. In the tax case, the IRS chooses its audit and penalty structure to maximize the sum of tax payments plus penalties less audit costs. If it is using effluent charges, the EPA maximizes the charge plus the penalties for misreporting less audit costs.

If a bureau imposes mandates, the bureau uses the shadow value of the mandate, (i.e., the behavioral change produced by the mandate multiplied by the shadow price on that change), instead of receipts in the maximand. For example, if the EPA imposes a pollution control mandate, such as a best available control technology rule, it maximizes the reduction in pollution times the shadow price of a unit reduction, plus penalties for misreporting, less audit costs. Prosecutors maximize the shadow value of imprisoning a guilty individual times convictions less the costs of investigating.

An alternative would have the bureau set the audit and penalty rates to maximize compliance with the law. If compliance were the goal, penalties would be a means to an end, not an end in themselves. Penalties would not enter directly into the bureau's maximand.

Many bureaus likely come closer to maximizing revenue than compliance. They may do so implicitly in response to the internal incentives of their employees. Thus, an individual policeman might increase his chances for promotion by maximizing arrests and fines rather than adopting a strategy that reduces crime and produces few arrests. Without arrests, he may not be able to show to his superiors that he is doing his job. Prosecutors may maximize convictions rather than compliance for similar reasons. Police seeking forfeitures of property may prefer to maximize total revenue rather than just compliance because they are often allowed to keep the forfeited items. Bureaus may also maximize revenue because their overall performance is evaluated on this basis. For example, a tax bureau may be evaluated based on the revenue it brings in. While maximizing revenue may not be the goal of all agencies, it is likely an important objective for many.

¹⁶ There is no penalty for over-paying: if a low-type agent claims to be a high type agent, he pays the fee associated with his declaration. This, however, does not happen in our model.

Second, our formulation posits that the underlying legal rule that is being enforced is set separately from the audit and enforcement strategy. For example, we assume that the tax schedule and allowable penalties are set by Congress while the audit and enforcement strategy is set by the IRS. The same separation holds for criminal law (crimes and punishments are specified by the legislature, but enforcement is left to the police and prosecutors), for environmental law, and most other contexts where bureaus use SRA strategies to enforce the law.

Such separation of rule and enforcement procedure can be costly. Ideally, a policymaker would consider the legal rule and its enforcement mechanism simultaneously, thereby optimizing the net effect.¹⁷ One way to view our approach is to posit that the underlying legal rules are specified, and that bureaus then address the enforcement problem. Given this formulation, legislatures could design legal rules taking the enforcement solution as a constraint on this problem. The overall optimization would then be a two-stage game with different players controlling the two stages.¹⁸ The restriction is invoked not primarily to simplify the problem, but rather to reflect reality. In many cases it reflects how policies are actually set, with Congress setting the substantive rules but delegating enforcement to an agency.

Third, a bureau can commit to an audit strategy. It announces that strategy, and the agent sends in a report. If the audit strategy elicits truthful reports, the bureau has no incentive to audit, and would prefer not to given that audits cost money. However, today's actions serve as tomorrow's announced audit strategy, which reduces any temptation to break commitments.¹⁹ If the bureau has a continuing existence, as virtually all do, the commitment problem vanishes.

3. Results and applications

If bureau capabilities are private information, agents must guess whether they are reporting to a strong bureau or a weak bureau. If agents believe that the bureau is weak, they can report a low amount with impunity. If they believe that the bureau is strong, they have to expect the possibility of audits and penalties if they send in a low report.

¹⁷ Some of the auditing literature allows both the underlying legal rule and the audit mechanism to be set simultaneously. See REINGANUM & WILDE, note 1.

¹⁸ This approach is taken in I. SANCHEZ & J. SOBEL, *Hierarchical design and enforcement of income tax policies*, 50 *Journal of Public Economics* 345 (1993).

¹⁹ For examples of a model without commitment, see F. KAHIL, *Auditing without commitment*, 28 *RAND Journal of Economics* 629(1997), and MARK B CRONSHAW & JAMES ALM, *Tax Compliance with Two-Sided Uncertainty*, 23 *Public Finance Quarterly* 139(1995).

Because agents will report based on their beliefs about the bureau’s auditing capability, bureaus have an incentive to act so that agents will believe they are strong and make truthful reports. Weak bureaus thus have an incentive to mimic strong bureaus; strong bureaus have an incentive to deter mimicking by “signaling:” taking actions that weak bureaus would find costly to follow. A strong bureau that is able to ensure that agents know it is strong may be able to save on auditing costs. These mimicking and signaling behaviors drive our conclusions.

The interplay between agents trying to infer bureau types and bureaus trying to mimic and differentiate produces three types of equilibria for bureau strategies: separating (strong and weak bureaus pursue different audit strategies, and thus reveal their types), pooling (strong and weak bureaus adopt the same audit strategy), and semi-separating (some weak bureaus announce the same strategy as strong bureaus (mimic) and some weak bureaus announce a different strategy (reveal)). If there is a pooling or semi-separating equilibrium, agents will only have a probabilistic estimate of a bureau’s type.

The table below summarizes the possibilities. The columns represent the three equilibria for bureaus: separating, semi-separating, and pooling. The rows represent the behavior of High agents who may always report their true type (all Highs honest), sometimes report their true type, or always misreport. The payoffs to the bureaus are represented by the payoff to strong bureaus, S , to weak bureaus which mimic the strong bureaus’ strategy, W_M , and weak bureaus which do not mimic strong bureaus and therefore reveal their type, W_R .

Agent Behavior	Bureau Behavior		
	Separating	Semi-Separating	Pooling
All Highs Honest	Not possible	Not possible	$W_R \leq W_M = S$
Some Highs Misreport	$W_M = W_R = S$	$W_R = W_M < S$	$W_R \leq W_M < S$
All Highs Misreport	Not possible	Not possible	$W = S$

Below we highlight some of the important cases, focusing in particular on the two highlighted cases. Before moving to the details, note that in a separating equilibrium—the first column—agents will always misreport to weak bureaus because they know which bureaus are weak. Agents may, however, report accurately to strong bureaus because agents know that they are strong. The table lists this as “Some Highs Misreport” but it is important to keep in mind that this

means that if there are some weak bureaus and some strong bureaus, all Highs are likely report honestly to strong bureaus and will misreport to weak bureaus. This characterization is based on interpreting the model as involving many bureaus, some strong and some weak. In this case, Highs will sometimes misreport (to weak bureaus) and sometimes report honestly (to strong bureaus). In the semi-separating and pooling cases, however, an agent will not be certain of a bureau's capability and may decide that a mixed reporting strategy is optimal (see below).

The bottom right corner—pooling, all Highs misreport—describes the case where audits are too expensive to be worthwhile, even for strong bureaus. If there are no audits, all Highs report being Low because there is no sanction. Weak bureaus also do not audit, so they receive the same reports and their revenue is the same as the revenue of strong bureaus. We use W in this case rather than W_M because although the weak bureau is doing the same thing as the strong bureau, it is doing just what it would do if its type were revealed rather than mimicking.

3.1 Maximum penalties

A standard result in law and economics is that optimal enforcement involves a very low audit rate and very high punishments.²⁰ Parodying this conclusion, once a decade someone should be executed for double parking.

This approach to law enforcement is rarely observed and commentators have offered a variety of reasons why it may not be optimal. For example, if individuals are risk averse (and liability is strict, not fault-based), the strategy of exorbitant fines and low audit probabilities imposes undue risk-bearing costs.²¹ Similarly, under a theory known as “general enforcement,” if a single enforcement activity detects more than one kind of sanctionable activity, the probability of detection will be the same for those activities. If the levels of harm they impose differ notably, the optimal fine will correspondingly vary, and in many cases be below the maximum allowed.²² Thus, if a highway patrolman observes both reckless driving and driving without a seatbelt, the vastly different

²⁰ GARY BECKER, *Crime and Punishment: An economic approach*, 72 *Journal of Political Economy* 169 (1968).

²¹ MITCHELL POLINSKY & STEVEN SHAVELL, *The Optimal Tradeoff between the Probability and Magnitude of Fines*, 69 *American Economic Review* 880 (1979). See MITCHELL POLINSKY & STEVEN SHAVELL, *A Note on Optimal Fines when Wealth Varies Among Individuals*, *American Economic Review: Papers and Proceedings* (1991). MITCHELL POLINSKY & STEVEN SHAVELL, *Enforcement Costs and the Optimal Magnitude and Probability of Fines*, 35 *Journal of Law and Economics* 133 (1992).

²² STEVEN SHAVELL, *Specific v. General Enforcement of Law*, 99 *Journal of Political Economy* 1088 (1992).

levels of expected harm caused by these violations implies that there penalties should differ.²³

Our model identifies an additional reason why a policymaker may wish to limit the penalties that a bureau is able to impose. By constraining a bureau's abilities to differentiate itself by using high penalties, the policymaker can lend credence to the signaling actions taken by a bureau or can ensure that a pooling outcome remains viable. If signaling or mimicking is desirable – i.e., policymakers want bureaus to be in one of the highlighted boxes – a cap on penalties may be desirable.

We use a numerical example to illustrate why this is the case in a separating equilibrium. (We discuss caps on penalties in pooling equilibria in Part 3.3.) The basic idea is to identify what it takes to be in one of the highlighted boxes and to rule out the possibility that a bureau can deviate from that strategy. The cap on penalties enables this across a range of contexts; it rules out profitable deviations, particularly by strong bureaus.

Suppose that 20% of the people have high income, produce high pollution, or a high amount of whatever the underlying variable is, and 80% have a low amount. The statutory payment or shadow value for High is 11; for Low it is 5. Audits cost 2.5.

Consider the highlighted separating equilibrium (the first column in the table) where agents report accurately to strong bureaus but not to weak bureaus (middle row). Suppose that for this to occur the bureau must audit 50% of low reports.

For agents to report accurately, the probability of being caught times the penalty from being caught has to outweigh the benefits of misreporting. In particular, if a High agent reports 5, half the time he is not audited and only pays 5. The other half of the time, he is audited and pays $11+P$ where P is the penalty for inaccurate reports. To convince the agent to report accurately, this outcome must be worse than reporting High and paying 11:

²³ Another explanation is that sanctions may need to be set to create progressively increasing deterrence for progressively worse activities. If we set the highest possible sanction for double parking, we cannot impose yet a higher sanction for stealing and a higher one yet for murder. This explanation is similar to (and may be identical to) the general enforcement explanation as it only holds if that the probability of enforcement cannot be fully adjusted across activities. Note also that the declarations setup creates substitution possibilities across under reports. If truthful reporting is not feasible, it may be desirable to reduce the penalty on mild under reports to induce agents to make them in lieu of severe under reports, for example, to report 80% of income rather than 60% of income.

$$0.5 \times 5 + 0.5 \times (11 + P) \geq 11.$$

The penalty, therefore, must be at least 6 to induce the agent to report accurately.

This principle is well known: the expected sanction must be sufficiently high if inaccurate reporting is to be unwise. Where there are two types of bureaus and a separating equilibrium, however, a second bound comes into play. In a separating equilibrium, a weak bureau cannot gain by mimicking a strong bureau.

Agents have no incentive to report more than 5 to a bureau known to be weak, since they know that the bureau cannot audit effectively. Therefore, absent mimicking, the most that a weak bureau can earn is 5. If a strong bureau had an audit strategy that earned more than 5 and induced *all* agents to report honestly, a weak bureau would mimic the strong bureau by adopting the identical strategy and, therefore earn that same greater than 5 amount. The fact that a weak bureau cannot enforce penalties would matter not at all because agents are reporting truthfully. There are no penalties to collect. This means that to prevent mimicking when Highs report honestly, a strong bureau cannot have a strategy that produces net revenue after audit costs of more than 5. We need to rule out all such counterfactual strategies.

Consider a strategy that yields more than 5 by inducing High agents to report Low and then imposing penalties. The strategy will involve a penalty P and an audit rate of low reports $\alpha > 0$. The bureau's revenue is made up of payments from (1) the 80% of the agents who truthfully report Low less the wasted audit costs ($\alpha \times 2.5$) for these agents, plus (2) the 20% who inaccurately report Low, a fraction $(1-\alpha)$ of whom are not audited plus (3) the 20% who inaccurately report Low, a fraction α of whom are audited and pay High plus penalties. This sum must be at most 5:

Since $\alpha > 0$, the only way for this equation to be satisfied is if $P \leq 6.5$. To maintain the equilibrium, a strong bureau must not have the ability to impose a penalty greater than 6.5.

When allowable penalties exceed this limit, a semi-separating equilibrium results. Strong bureaus lower their audit rate and collect more penalties relative to when the penalty is less than 6.5. Weak bureaus will mix it up: they will sometimes mimic the strategy used by strong bureaus and sometimes reveal

themselves by announcing a “no audit” strategy. Agents seeing a strategy that involves auditing will no longer be sure what type of bureau they are dealing with and they too will mix it up, sometimes reporting accurately and sometimes not. In particular, to decide how often to report accurately, High agents will consider the audit rate and penalties, and their estimate of the probability that the bureau they face is strong or weak. In the end, some High agents will comply, some will not comply and get away with their transgression, and some noncompliers will get caught and pay the mandated penalty.²⁴

Compared to the case where penalties are below the bound, compliance is lower because High agents sometimes report Low rather than always reporting truthfully. They are no longer sure what type of bureau they are dealing with. That dilutes their incentives to report accurately. Higher penalties increase the likelihood of mimicking and, therefore, can actually reduce compliance.

This conclusion clashes with a simplistic view that higher penalties lead to greater compliance. Someone who is “tough on crime,” for example, might want to increase penalties. A claim that higher penalties increases compliance, however, requires holding all else equal, particularly the audit rates bureaus announce, and the inferences that agents make about a bureau’s capabilities given its chosen behavior. Higher penalties may well lead to lower compliance as these factors may shift.

3.2 Monitoring of bureaus

Suppose the ultimate principal, such as the legislature, the executive, or a citizen, wishes to determine whether a bureau’s SRA strategy is being implemented effectively. The most straightforward approach would be to observe whether agents comply with the law, but if the principal cannot directly observe compliance, it may have to turn to other indicators of effectiveness. One superficially appealing possibility is audit hit rates: the principal might ask whether the bureau’s effectively marshals its resources by asking whether the bureau is targeting its audits to regularly find noncompliance. For example, the chair of the Ways and Means Committee, which oversees the IRS, might expect to see the IRS use its audit resources to frequently find tax cheating. Another

²⁴ Although it is tempting to interpret the mixed strategy of a High agent literally, we recognize that only a few people actually flip a game-theoretic coin when deciding on a course of action. Instead, our preferred interpretation of this arrangement is to view the mixed strategy of a High agent as capturing the aggregate behavior of a large population of High agents. The action taken by a particular agent may be driven by another (unmodeled) variable—such as his predisposition to embarrassment or his moral rectitude—that becomes pivotal when bureau strategies equate or nearly equate the monetary returns to the two actions.

possibility is that the principal might look to see whether the bureau is wasting money, such as by spending it on fancy buildings or conferences.

Much as with penalties, where failure to consider the equilibrium effects can lead to misguided intuitions, an assessment of bureau behavior that fails to consider the potential equilibria from an SRA strategy may be misleading. We cannot determine from the audit hit rate whether the bureau is using a good SRA strategy: audit hit rates of any level are consistent with optimal strategies. And we may very well see bureaus engaging in what looks like wasteful activity even when they are acting optimally. Auditing the auditors is a complex task when agents must infer bureau capabilities. Both conclusions—audit hit rates are not reliably informative and bureaus may engage in what looks like wasteful activity—follow immediately from the analysis above.

Start with apparently wasteful activity. Strong bureaus have an incentive to engage in what looks like wasteful activity to prevent mimicking. Consider again the highlighted separating equilibrium box in the table. In the numerical example illustrating this case, the strong bureau's revenue will be 5.2, made up of 5 from the 80% of reports that are low less the costs of auditing half of these plus 11 from the 20% of reports that are high:

If a strong bureau earns 5.2, however, a mimicking weak bureau would also earn 5.2. (If the weak bureau is able to mimic, penalties are never imposed so its inability to audit effectively is mute.) To prevent mimicking, the weak bureau cannot earn more than 5. This means that a strong bureau must adopt a strategy that would reduce the revenue collected by a mimicking weak bureau to below 5. (That is, in the notation we use above, $W_M = W_R = S$.) Oftentimes, this ancillary activity also costs the strong bureau dearly.

A strong bureau has several strategies for discouraging mimicry by a weak counterpart. Typically, a strong bureau must distort its behavior in a seemingly wasteful manner. For example, it can increase the frequency of auditing low reports beyond 50%. Holding the penalty fixed at 6.5 and increasing the audit rate does not alter agents' behavior. High agents continue to report truthfully. For example, if the bureau audited 60% of low reports, then its expected profits would equal 5. This extra 10% of audits is "wasted" because it neither deters misreporting (there was none at 50% auditing) nor collects any fines, since there is no misreporting.

Alternatively, the bureau can “burn money” by auditing high reports. While these audits would be useless in the sense that they will never find noncompliance, they may indicate the bureau’s auditing strategy is fair in that all agents can get audited.

And it can spend the 0.2 of revenue on fancy architecture or conferences. While these expenditures seem on a quick examination to be purely wasteful, they may not be. If High agents believe that a bureau that does not burn money is weak, they will not report accurately. For example, a bureau that has an office in a run-down building may appear incapable of conducting effective audits. These inferences will affect agent behavior and possibly lower compliance. Trying to save money may be self-defeating.

Above we have identified but three possible actions a strong bureau can take to reduce the attractiveness of mimicking to the weak bureau. Many more are possible. Relative to allowing mimicking, however, strong bureaus only gain when the costs for a weak bureau to do the same exceed those of the strong bureau.²⁵

Unfortunately, while “burning money” may be wise, it may instead be wasteful. The possibility of signaling does not rule out the possibility of incompetence. Simply observing the potential waste is not enough to determine whether the activity is signaling or genuine waste.

Observing audit hit rates is no more helpful. Rates of zero—audits fail to ever turn up noncompliance—arise in the separating equilibrium just analyzed. If a strong bureau is able to differentiate itself from a weak bureau, agents will want to report truthfully to that bureau. If agents will report accurately, audits will never find under reports, and audit hit rates will be zero. We do not expect such an outcome in practice very often, but it is instructive as a polar case. Imagine a police chief bragging that there were zero arrests after a major public event or an accounting firm finding that a company’s financial statements are correct. Failure to find noncompliance does not mean that the strategy is either flaccid or inappropriate. The same argument applies as well to the case of a pooling equilibrium, where all agents are honest, as we discuss below.

²⁵ Thus, if a bureau were strong because its personnel were capable, it might pay for them to get graduate degrees even if those degrees were of no value in their work. A weak bureau saddled with less capable personnel would find it too costly to educate its employees similarly. The situation is analogous to that examined by Michael Spence, *Job Market as Signaling*, 87 *The Quarterly Journal of Economics* 355 (1973).

Positive audit hit rates are also compatible with optimal strategies. If the penalty rate is above the 6.5 bound in the above example, agents, inferring mimicking, will sometimes report inaccurately. Strong bureaus will discover these inaccuracies when these agents are selected for audit. Moreover, the expected positive hit rate will depend on important parameters, such as the percentage of High and Low agents and audit costs, and could be at almost any level.

Unfortunately, both zero and positive hit rates are also compatible with negligent bureaus. A bureau that is entirely wasteful might have a very low audit hit rate simply because it is wasteful. A bureau with a high audit hit rate may not be properly implementing an SRA strategy which would induce more, or fully, truthful reporting. More information is required to know whether a particular audit hit rate is appropriate.

The lesson is that when there is two-sided private information, it is perilous to look at a bureau's auditing record and naively draw inferences about its effectiveness. A zero hit rate, any positive hit rate, and seemingly wasteful audits or other expenditures are compatible with effective audit strategies. These behaviors are also compatible with an incompetent bureau. A superficial examination cannot tell the difference. Effectively monitoring a bureau may require direct information on compliance.

3.3 Mimicry by Weak Bureaus

The possibility that weak bureaus may seek to mimic strong bureaus drove the discussion above. We turn now to examine when mimicking may occur in equilibrium, and what the effects may be. In this section, we consider a single bureau that may be either weak or strong. In the next section, we consider the possibility that there are many bureaus. In the latter case, agents make inferences across bureaus, which means that the SRA strategies of bureaus interact.

Mimicry may greatly expand the capacity for socially desirable laws to be effective. If auditing capabilities are weak, say because the law regulates in an area where auditing is difficult, laws that are otherwise socially desirable may be less effective or not even enacted in the first place. If, however, a weak bureau can masquerade as a strong bureau, it might be able to get agents to send in accurate reports.

Mimicry only arises when strong bureaus do not fully differentiate themselves. The key that allows such an equilibrium is that the maximum allowable penalty is not too large to induce a strong bureau to have the incentive to lower audit rates and cash in on penalties on under-reporting. A weak bureau

cannot follow such a strategy profitably (since its audits are ineffective). A sufficiently low cap on penalties produces this outcome.

As noted, a cap on penalties is necessary to support both separating and pooling outcomes. In both cases the cap serves to constrain the behavior of strong bureaus by eliminating profitable alternative actions that would lead the equilibria to unravel. Whether pooling instead of separation emerges depends on the costs of audits and the agent's reasoned assessment of the auditing bureau's capability. If the cost of audits is high, a weak bureau can more easily mimic because a strong bureau will be more reluctant to audit (the cost is higher). That is, as audit costs increase, the effective difference between bureau types shrinks. If the agent believes that the bureau is likely bad at auditing, mimicking will be harder. If these two factors work in the right direction—penalties are modest and agents believe that there is a reasonable possibility that the audits are effective—weak bureaus may be able to mimic strong bureaus.

One of the consequences of a pooling equilibrium is that audits will have to be more frequent to induce accurate reporting. The reason is that agents will suspect that the bureau may be weak, reducing the incentive to report accurately for any given audit rate and penalty.

To illustrate, consider a pooling equilibrium where High agents always report honestly (the highlighted pooling equilibrium in the table). Assume the same numbers as in the example above and suppose additionally that 20% of bureaus are weak and 80% are strong (and the maximum penalty is 6.5). If both types of bureaus adopt the same auditing strategy where a fraction $\alpha > 0$ of low reports are audited, then a High agent reports truthfully if and only if the expected costs of a low report are worse than of a high report:

Hence, the audit rate must be 60% (or greater) for a High agent to report truthfully. The profit level of a typical bureau in this case is 5 because,

$$0.8(5 - 0.6 \times 2.5) + 0.2 \times 11 = 5.$$

This result, with a bounded penalty and much mimicry, audit rates must go up, means that an outcome with mimicking is costly, a point we return to in the next section.

The possibility of mimicry opens a new avenue for the use of SRA strategies, namely in areas of the law where agents will be unsure about the capabilities of a regulatory bureau. For example, financial regulators may not be able to monitor banks and other financial entities (which we generically term banks) so as to control the risk externalities they impose, e.g., by taking on excessive effective leverage. Banks may be one step ahead of the regulator who cannot pay its employees to investigate anywhere near the amounts that banks can pay theirs to camouflage their risk levels. This lack of regulator capabilities is arguably at the center of the design of modern financial regulation, including the Dodd-Frank rules, the bank capital rules, and so forth. How can we regulate if the regulators are systematically outmanned? Even if they could pay the same, but had far too few resources to monitor all banks, the same problem would apply.

Suppose that we require banks to report compliance with some underlying goal and announce an audit rule based on those reports. For example, we could ask banks to report on their capital levels or what they expect their capital levels would be under various levels of stress or various economic scenarios. The bureau would then decide whether to audit the bank and its report. The risk of audit would be based on the report that the bank submits, and would go up if the bank reported higher levels of capital, the strategic equivalent of a low report in the income tax example.

Similarly, issuers of securities apparently get each offering graded by a rating agency. An alternative to this system of direct monitoring would have issuers grade their own securities, and then submit the grade (and presumably background materials) to a rating bureau. The bureau would audit some fraction of the reports. Issuers who report a high grade (which corresponds to what we called a low-income report in the tax example) would have a higher risk of audit, and would suffer a significant downgrade or other penalty if they were found to have over graded.

To work, the design of this audit mechanism must induce the bank to send in truthful reports even if the bank thinks there is a possibility that the bureau cannot effectively audit.²⁶ If, for example, a bureau with weak auditing capabilities can mimic one with strong capabilities, banks may send in truthful reports to a weak agency. If banks believe that audit bureaus are weak or audits are costly for bureaus, the SRA strategy may be ineffective. But the converse is

²⁶ Self-reports also have the virtue that banks may face sanctions from the public if they submit reports that downplay risk and there is a subsequent failure. They will be seen as not only failing but also as lying.

also true. The SRA strategy may achieve regulatory leverage in arenas where effective regulation was thought not possible. This suggests that strategies that change agents' guesses about auditing capacities may be important. The greater the likelihood that a bureau is strong, the greater the temptation to mimic. For example, the IRS strategy of publicizing tax fraud prosecutions just prior to April 15 may induce truthful reporting if such accounts change agents' beliefs about the IRS' capabilities.

This strategy could apply beyond the regulatory arena, for example, in the grading of any product. Thus, Consumer Reports could apply it to grading products, and universities could apply it to grading exams for at least some massive open online courses (MOOCS). Any time that agents can assess their own performance, they can be asked to grade themselves, with penalties—possibly just pure information—if the oversight bureau has the potential to audit them and penalize misreports.

3.4 Externalities across bureaus.

Our model of a bureau is of an entity enforcing a single stricture on an agent, such as mandating a single type of pollution control equipment or imposing a tax on a single type of income. Real bureaus enforce many strictures. The IRS must enforce taxes on wage income, dividends, gains from domestically held investments, income hidden in tax havens, and numerous other sources. The EPA, even when considering a single-type of pollution, may have a variety of mandates or fees to deal with differently-situated agents. Stepping up one level in authority, a single department in the government may encompass many complex bureaus. The executive oversees many departments.

If policies must cover many bureaus (in the narrow sense of our model), they must be set to consider the interaction of SRA strategies across bureaus. The possibility of both mimicry and differentiation (signaling) make this a complex problem. The reason is that agents observing the behavior of one bureau may make inferences about other bureaus.

Weak bureaus can impose negative externalities on strong bureaus. Consider a pooling equilibrium, where weak bureaus mimic strong bureaus. As illustrated by our example, if agents cannot tell what type of bureau they are facing, it will take more audits to convince agents that it is desirable to report accurately. The weak bureau forces the strong bureau to incur greater auditing costs, thus creating a negative externality.

Perhaps surprisingly, weak bureaus can also impose positive externalities on strong bureaus. If allowable penalties are large and agents think they may be facing a weak bureau, they may sometimes underreport, in a semi-separating equilibrium. Strong bureaus may benefit because they will collect penalties when they catch the underreporting.

The net effect, a positive or negative externality, will depend on the parameters of the problem. In general, each type of bureau will prefer that there are more of the other type. When almost all bureaus are strong, mimicry becomes attractive. A weak bureau can get lost in the crowd of its strong cousins. When almost all bureaus are weak, misreports will be abundant, and strong bureaus will catch and penalize a lot of misreporters.

Acknowledging trade-offs across bureaus, the best policy may be complex, and policies that initially seem misguided may in fact be making this trade-off correctly. For example, it is often observed that the audit and penalty rate for inaccurate tax returns is too low to induce tax compliance, because underreporting has a lower expected cost than honest reporting. If, however, a higher penalty rate would allow agents to infer in which areas the IRS is strong and which areas it is weak, overall tax compliance might even go down. A low penalty and audit rate may be desirable given the externalities across areas of tax compliance even though if we look at a single area, it looks suboptimal. We are only speculating on the possibility, but it is clear that once one considers the complexity of the setting, casual intuitions that penalties or audits need to be increased may be incorrect.

4. Conclusion

We conclude by suggesting further lines of research on SRA strategies. Our model includes only two types of agents and two types of bureaus. In reality, there are many types, and extending the model to many times would be worthwhile, and could lead to qualitatively different results. In addition, our model is of a single bureau. Formally modeling multiple bureaus operating simultaneously is likely a difficult task but may yield insights.

Another important extension would allow for probabilistic rather than certain detection of misreports by strong bureaus. People presumably would vary in their ability to avoid detection. For example, high income taxpayers might be more capable of hiding monies than low-income taxpayers, and within an income class, some, e.g., the self-employed, would be better hidiers than others, e.g., salaried employees. This possibility may lead to different, perhaps dramatically different, results.

Given constraints on government resources and investigative capabilities, SRA strategies are inevitable. Indeed, many are already in place. Their operation creates a subtle game where agents withhold information from bureaus, some bureaus signal to reveal information, and others mimic to hide it. Casual interpretation of bureau behavior may be incorrect. For example, higher penalties may not lead to greater compliance and bureaus may not want to employ SRA strategies that yield high audit hit rates. In addition, our results suggest that there may be many critical areas where legal rules can be fruitfully enforced through SRA mechanisms. For example, we suggested the possibility that bank regulation may be a good area for relying on an SRA mechanism. Future work should explore the broad potential for SRA mechanisms in fostering cost/effective regulation.