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# Compliance Programs, Signaling and Firms' International Coordination

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# Compliance Programs, Signaling and Firms' Internal Coordination

Daniel Herold*

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**Abstract**

Fines imposed on firms for corporate infringements such as cartels reduce these infringement's profitability. When a manager knows when a violation is unprofitable he can prevent violations committed by an uninformed employee by investing in compliance programs (CPs). Investments can be interpreted as signals. The paper shows that there exists a separating equilibrium where high investments in CPs induce the employee to obey the law. However, if CPs are too expensive the signal is not credible. The manager can also show personal commitment to compliance ('tone-at-the-top'). Coordination on an efficient outcome will then be achievable if commitment is costly. Imposing high, individual sanctions on the manager disturbs a firm's internal coordination because he is unable to credibly signal that an infringement does not pay off for the firm. However, imposing sanctions on the employee unambiguously deters violation.

Keywords: Compliance, Crime, Tone-at-the-top
JEL Codes: D82, D86, L14, L22, K20, K21

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# 1 Introduction

Corporate crime is typically committed by a single individual or a small group individuals (Karpoff and Lott (1993), Harrington (2006), Ashton and Pressey (2012)). Such infringements can be quite expensive for firms. For instance, cartel fines imposed on a single firm involved in the truck cartel exceeded 1 billion Euro in 2016. Although this paper focuses on cartels in particular, the model can be applied to other types of corporate crime like cooking the books, fraud or violations of environmental laws.

One way for a firm to confine corporate misconduct is to install a compliance program (CP). According to the Competition and Markets Authority, CPs consist of four stages: risk identification, risk assessment, risk mitigation and a review step (OFT, 2010, pp. 10–11).[1] With the latter being a control device, the goal of the first three steps is to spot possible threats (risk identification), rank them according to their overall risk potential (risk assessment) and to reduce those threats (risk mitigation). Murphy and Kolasky (2012) emphasize that a major risk factor is employees' underestimation of the risk of detection by authorities. To reduce this lack of information, firms can, e.g., install training programs for their employees or issue mission statements (Stephan, 2009).

This paper addresses the credibility problem when it comes to avoiding corporate crime through CPs. Ignoring fines, violations of the law typically pay off for the firm.[2] Why should an employee who expects that a viola-

[1] This applies to antitrust-law compliance programs. Those measures are similar in general CP.

[2] For cartels see, e.g., Connor and Bolotova (2006).

tion increases firm's profits obey the law when a trainer or some document recommends him to do so? As illegal behavior cannot be contracted upon a firm might not be able ensure law obedience through simple communication. Hence, communicating law compliance is lacking credibility because officially appealing to break the law is impossible. In this paper compliance measures are thus understood signals. For instance, offering training programs can be interpreted as a more costly signal than simply publishing a code of ethics.

A violation can be profitable or not, depending on the overall level of fines and the probability of detection. Since fines are typically calculated on the basis of a whole firm or enterprise, an employee might not be aware of the actual level of expected fines, i.e., whether crime pays off. A manager informed about an infringement's profitability can make different levels of compliance-investments to send a (costly) signal in order to eliminate the information asymmetry.

Direct investments in CPs (e.g., training programs for employees) are made on a firm level and constitute costs reducing total profits. The manager can also make a personal investments in compliance. This is referred to those as an indirect investment throughout the analysis since it does not directly reduce firm's profits. This approach can be seen as an attempt to model the called *tone-at-the-top* – a firm's upper level hierarchy's dedication to and communication of law conform behavior. The tone-at-the-top is described as a crucial factor of CPs (OFT, 2010, pp. 36 – 37), International Chamber of Commerce 2013, (Schwartz et al. (2005), Paternoster and Simpson (1996), Collier and Esteban (2007), J. et al. (2010) and d'Adda et al. (2014)). To the best knowledge the author, this is the first paper to formally address the

tone-at-the-top in a game theoretical model. By analyzing their coordination function, this paper also contributes to the discussion on whether CPs are really effective. It is criticized that the main purpose of CPs and corporate codices is to promote public relation (Stevens, 2007) and to reduce fines.[3]

The signaling game proposed in this paper is technically comparable to Kreps and Wilson (1982). The paper is thus related to the literature on communication (see Riley (2001) and Farrel and Rabin (1996) for an overview of signaling and for communication in general, respectively). In the model the manager (employee) is referred to as the principal (agent) because the coordination problems resembles features of an agency problem. The manager can for example be a member of the board of directors who has an interest in maximizing firm value (Fershtman and Judd, 1987). The employee belongs to a firm's hierarchical level with sufficient responsibilities to break the law but lacking an exact overview of the enterprise and its exposure to fines, e.g., a (leading) member of the marketing or sales department. According to Ashton and Pressey (2012) marketing and sales personnel is often engaged in collusive activity.

The model shows that separating equilibria exist when (direct and/or indirect) investment costs in compliance are neither too low nor too high. In a separating equilibrium, the agent chooses the strategy that maximizes firm's profits. The tone-at-the-top approach might be a cheaper way to achieve the same goal because the manager bears all investments costs.

It is often discussed that imposing individual sanctions on managers improves cartel deterrence (Kokkinaki (2013), Buccirossi and Spagnolo (2005)).

[3]See US sentencing guidelines, Chapter 8.

In the model, if those individual sanctions are very high the manager might belief that crime never pays off for him. This can be inefficient because then only pooling equilibria exist where corporate misconduct is primarily driven by agent's believes about expected fines. However, by imposing individual fines on the employee it is less likely that an infringement occur. Punishing the employee or increasing firm-level fines thus always deters violations.

The paper is structured as follows. In section 2 basic features of CPs are described. In section 3 the model is outlined. Section 4 extends the model by allowing for individual sanctions. Section 5 concludes.

# 2 Compliance Measures

To evaluate the ability of CP investments to act as signals, their costs require some discussion. A CP can involve different levels of investments (see Götz et al. (2016) for an overview of compliance measures). A cheap CP involves a relatively vague communication whereby employees are told not to violate the law at a single meeting, via e-mail or a printed booklet or via a written code of conduct. The costs of those measures are small. On the other hand, some compliance measures can be very expensive. A firm can for example invest in regular training programs, establish compliance meetings or set up an independent compliance department. There are wages to be paid for the employees in the newly established department, potential cost for hiring external experts for the training session as well as the foregone working effort of the employees when attending the courses or the meetings. Further investments in internal screening and auditing are typically even more expensive

(Stephan, 2009; Bace et al., 2006).

The measures described above involve costs incurred by the firm. In addition to or instead of those direct costs the manager can incur (indirect) costs. He can further exert effort to actively promote compliance by, e.g., acting as a role model. This can be done for example by attending ethical training sessions for managers as described by Schwartz et al. (2005). As the daily tasks of a manager will have to be done anyway, attending the courses requires extra working time. This creates disutility for which the manager is not necessarily compensated. Other examples are that the manager is always present in the training session, communicates the compliance codices face-to-face and holds separate speeches about compliance to show his commitment. Depending on the size of the firm, this process can be very time consuming and, therefore, costly.

The difference between direct and indirect costs can be seen as an interpretation of the tone-at-the-top. In contrast to that, there is the issue of a cheap vs. an expensive signal. A simple e-Mail stressing out the importance of law-conform can be interpreted as a cheap signal; ethics training for managers or an independent compliance department are expensive signals.

# 3 The Model

Consider a Signaling game where $P$ is the sender of the information and $A$ the receiver. The receiver $A$ takes an action $s_A \in S_A = \{C, V\}$ where $C$ indicates law-abiding behavior and $V$ a violation of the law. The action $s_A$ is chosen based on the observation of a signal $s_P = (d, i)$ where $d \in \{L, H\}$

is a direct and $i \in \{l, h\}$ an indirect investment in a compliance program with $H > L$ and $h > l$ based on the concepts outlined in Section 2. Hence, $S_P = \{(L, l), (L, h), (H, l), (H, h)\}$, i.e., the principal can combine direct and indirect investments.

Firm's profits are denoted by $\Pi(s_A, s_P, \theta)$. When the receiver chooses $C$, the firm remains on a compliant course with profits $\Pi(C, s_P) = \pi_C - d$. However, when choosing $V$, profits will be $\Pi(V, s_P, \theta) = \pi_V - \rho_\theta \Phi_\theta - d$ where $\rho_\theta$ is the probability that an illegal action is detected and $\Phi_\theta$ are firm-level fines. The variable $\theta \in \{S, D\}$ indicates the firm's exposure to fines. The firm would be in a dangerous sate ($\theta = D$) when, e.g., there is a sector inquiry, or when there is a change in the law which increases fines or the threat of detection. Throughout the analysis $F_\theta \equiv \rho_\theta \Phi_\theta$ will be referred to as expected firm level fines depending on state $\theta$.

We assume that, in a safe state $\theta = S$, firm's profits are higher for corporate crime than in a law abiding regime. The reverse is true for the dangerous state $\theta = D$:

$$\begin{aligned} \Pi(V, s_P, S) &= \pi_V - F_S - d > \pi_C - d = \Pi(C, s_P) \\ \Pi(V, s_P, D) &= \pi_V - F_D - d < \pi_C - d = \Pi(C, s_P) \end{aligned} \tag{1}$$

The sender knows the state of nature $\theta$ while the receiver has a prior belief that the state is $D$ of $p = Prob(\theta = D)$. Hence, $1 - p = Prob(\theta = S)$ is the prior belief of being in a safe state.[4]

[4]Alternatively, one could think of uncertainty the profits from violation of the law. Then, $\theta \in \{\underline{V}, \overline{V}\}$ indicates that when an infringement's profits are high ($\underline{V}$), a violation is profitable in expectation, i.e., $\pi_{\overline{V}} - F - d > \pi_C - d$. For $\theta = \underline{V}$, an infringement's expected

Denote by $u_j$ utility of both players defined as follows. Both parties derive utility from wages $w_j(\Pi)$. Assume that wages increase in total profits $\Pi$ due to, e.g., a linear incentive contract. For the following results to hold it is only necessary that $\frac{\partial u_j}{\partial \Pi} > 0$, i.e., both players benefit from higher profits.[5] The utility functions of the parties can now be stated.

$$u_A(s_A, s_P) = w_A(\Pi(s_A, s_P, \theta)) \tag{2}$$

$$u_P(s_A, s_P) = w_P(\Pi(s_A, s_P, \theta)) - i \tag{3}$$

From assumption (1) it immediately follows that both parties prefer to break the law in state $S$ and to obey the law in sate $D$. Hence, if the true state was common knowledge, no coordination problem would exist.

To show that there exists a separating Perfect Bayesian Equilibrium (PBE), assume that a type-$S$ sender *never* makes additional investments in CPs, i.e., for $\theta = S$, the sender always chooses $(L, l)$.[6] Lemma 1 states the value of the prior above which the agent never prefers to commit an infringement in a pooling PBE. Proposition 1 states under which conditions a type-$S$ sender has an incentive to reveal the state of nature by investing in CPs. (Nash-) Equilibrium strategies are denoted by $\sigma_j$.

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profits are not sufficiently high to overcompensate expected fines, i.e., $\pi_{\underline{V}} - F - d < \pi_C - d$. The ordering of profits is thus as in (1) and the results of the paper apply to such a situation as well.

[5] It might also be the case that higher profits increase chances for promotion (Sappington, 1991), decrease the possibility of job-loss (Schmidt, 1997) or provide other benefits such as an increased reputation from the parties' peers because of them working for a successful firm.

[6] When this assumption is dropped there exists another separating equilibrium where a high investment induces a violation. This is shown in the Appendix.

**Lemma 1.** *There is a value of the prior belief $p_{ind}$ for which the agent is indifferent between $V$ and $C$. In a pooling equilibrium, $\sigma_P = (L, l)$ and $\sigma_A = V$ for a prior $p \in [0, p_{ind})$ and $\sigma_A = C$ for $p \in (p_{ind}, 1]$.*

*Proof.* In a pooling equilibrium, $s_P = (L, l)$ dominates all other alternatives as $u_P(s_A, l) > u_P(s_A, s'_P)$ for $s'_P \in S_P \backslash \{l\}$ (See 3). All investments are too costly and investments are not credible by definition of a pooling equilibrium.

In a pooling equilibrium, posterior beliefs $\mu$ equal prior beliefs $p$. For any prior $p$, agent's expected utility reads as follows:

$$u_A(V, s_P) = p w_A(\pi_V - F_D - d) + (1 - p) w_A(\pi_V - F_S - d) \tag{4}$$

For $s_A = C$, agent's utility is $u_A(C, s_P) = w_A(\pi_C - d)$. The agent is indifferent between $s_A = C$ and $s_A = V$ if $u_A(V, s_P) = u_A(C, s_P)$, i.e.,

$$p_{ind} \equiv \frac{w_A(\pi_V - F_S - d) - w_A(\pi_C - d)}{w_A(\pi_V - F_S - d) - w_A(\pi_V - F_D - d)} \tag{5}$$

For all $p < p_{ind}$, $u_A(V, s_P) > u_A(C, s_P)$ and for all $p > p_{ind}$ the contrary holds. The agent will thus violate the law if her prior belief is below $p_{ind}$ and comply with the law otherwise.

□

**Proposition 1.** *If either $w_P(\pi_C - H) > w_P(\pi_V - F_D - L)$ or $w_P(\pi_C - L) - h > w_P(\pi_V - F_D - L) - l$, Signaling is credible and there exists a separating PBE with $\sigma_P \neq (L, l)$.*

*Proof.* As shown in Lemma 1, $\sigma_A = V$ for all $p \in [0, p_{ind})$ and $\sigma_A = C$ for all $p \in (p_{ind}, 1]$ in a pooling equilibrium. If $\theta = D$ and for priors $p < p_{ind}$,

$s_A = V$ will not be optimal because illegal activity is not profitable (See (1)). If $\theta = S$ and $p > p_{ind}$, the agent will refrain from profitable illegal activity by choosing $s_A = C$.

It was assumed that a type-$S$ sender never makes a high investment. For $\theta = D$ and $p \in [0, p_{ind})$, the agent would engage in an unprofitable violation. Inducing $s_A = C$ by $s_P \neq (L, l)$ pays off iff at least one of the following conditions is satisfied:

$$\begin{aligned} & u_P((H,l),C,D) > u_P((L,l),V,D) \\ \Leftrightarrow\ & w_P(\pi_C - H) > w_P(\pi_V - F_D - L) \end{aligned} \tag{6}$$

$$\begin{aligned} & u_P((L,h),C,D) > u_P((L,l),V,D) \\ \Leftrightarrow\ & w_P(\pi_C - L) - h > w_P(\pi_V - F_D - L) - l \end{aligned} \tag{7}$$

$$\begin{aligned} & u_P((H,h),C,D) > u_P((L,l),V,D) \\ \Leftrightarrow\ & w_P(\pi_C - H) - h > w_P(\pi_V - F_D - L) - l \end{aligned} \tag{8}$$

Obviously, if (6) and (7) are satisfied, (8) will be satisfied as well. Hence, $s_P = (H, h)$ is dominated. Hence, if either (6) or (7) holds, there exists a separating PBE.

□

As shown in Proposition 1, there exists a separating PBE if the gains

from inducing law-abiding behavior exceed investment-costs. While firm-level fines $F_\theta$ and direct compliance investments $d$ decrease utility through lower (expected) wages, indirect investments $i$ directly decrease utility. To see this, assume a linear contract $w_j(x) = b_j x$ where $b_j \in [0, 1]$ denotes the percentage of realized profits paid to the sender $P$ or the receiver $A$ with $b_P + b_A < 1$. Furthermore, we normalize $L$ and $l$ to zero.

Given these assumptions, condition (6) reduces to $\pi_C - (\pi_V - F_D) > H$. By assumption (1), the LHS of this equation is positive because wages are higher if an unprofitable violation can be avoided. Hence, investment costs $H$ must not be too high in order for the signal to be credible. The same arguments apply for (7) and (8) as well while the latter condition is always satisfied if at least (6) or (7) is satisfied. The only difference here is that indirect investments have to be taken into account and condition (7) reduces to $b_P(\pi_C - (\pi_V - F_D)) > h$. A higher variable remuneration $b_P$ thus incentivizes the principal to take higher personal investments $h$ because he looses wages when an unprofitable infringement occurs.

It was shown that if the agent's prior is in a range such that he unprofitably violates the law, the principal's best response is to make a high investment. Hence, high CP investments can prevent an agent's underestimation of the threat of fines which is typically referred to as *hubris* (Murphy and Kolasky, 2012, p. 63). To credibly promote law-abiding behavior the principal's signal must be perceived as being high. This suggests that compliance codices alone may not effectively promote ethical behavior. Similar arguments are made in the business ethics literature (Stevens, 2007, p. 607).

Incurring high individual costs via tone-at-the-top can be an equilibrium

strategy for a rational manager without any preference for morality or behavioral assumptions. Qualitatively, the same explanation applies as for direct investments: If crime does not pay off the principal will better off by sending a costly signal by incurring high individual costs. If those individual costs are too high, signaling will not be credible and there only exists a pooling equilibrium where violations are driven by the value of agent's prior beliefs $p$. One way to promote the transmission of such a credible signal is to increase $\frac{\partial u_P}{\partial \Pi}$ by, e.g., adjusting incentive pay or a higher likelihood of promotion.

# 4 Individual Sanctions

Depending on the jurisdiction and the infringement, not only the firm but also the individual will be sanctioned in case of a detected violation of the law. For instance, in cartel cases the authority can impose monetary penalties and prison sentences on individuals (Buccirossi and Spagnolo, 2005). Assume an authority imposes sanctions $\phi_{j,\theta}$ on the agent ($j = A$) or the principal ($j = P$) in case of detection which occurs with probability $\rho_\theta$. Expected individual sanctions are denoted by $f_{j,\theta}$. The parties' expected utility can be formulated as follows.

$$u_A(s_A, s_P) = w_A(\Pi(s_A, s_P, \theta)) - f_{A,\theta} \tag{9}$$

$$u_P(s_A, s_P) = w_P(\Pi(s_A, s_P, \theta)) - i - f_{P,\theta} \tag{10}$$

As $f_{j,S} < f_{j,D}$, together with assumption (1) and $\frac{\partial u_j}{\partial \Pi} > 0$, both parties prefer

to violate the law in a safe state $\theta = S$ and to obey the law for $\theta = D$ if fines $f_{j,\theta}$ are not too high. Formally, for $j \in \{P, A\}$, this condition reads

$$w_j(\Pi(V, s_P, S)) - f_{j,S} > w_j(\Pi(C, s_P)) > w_j(\Pi(V, s_P, D)) - f_{j,D}. \tag{11}$$

holds. If (11) is violated for $j$, $j$ will always prefer either $s_A = C$ or $s_A = V$, depending on the ordering of payoffs. Proposition 2 states that if condition (11) is satisfied, there exists a separating PBE.

**Proposition 2.** *If* $w_P(\Pi(V, s_P, S)) - f_{P,S} > w_P(\Pi(C, s_P))$ *and* $w_P(\pi_C - H) > w_P(\pi_V - F_D - L) - f_{P,D}$ *or* $w_P(\pi_C - L) - h > w_P(\pi_V - F_D - L) - l - f_{P,D}$ *is satisfied there exists a separating.*

*Proof.* Including sanctions $f_{P,\theta}$ in (6) and (7), the following conditions are necessary for the existence of a separating PBE.

$$\begin{aligned} u_P((H, l), C, D) &> u_P((L, l), V, D) \\ \Leftrightarrow w_P(\pi_C - H) &> w_P(\pi_V - F_D - L) - f_{P,D} \end{aligned} \tag{12}$$

$$\begin{aligned} u_P((L, h), C, D) &> u_P((L, l), V, D) \\ \Leftrightarrow w_P(\pi_C - L) - h &> w_P(\pi_V - F_D - L) - l - f_{P,D} \end{aligned} \tag{13}$$

$$\begin{aligned} u_P((L,l),V,S) &> u_P((L,l),C,S) \\ \Leftrightarrow w_P(\pi_V - F_S - L) - f_{P,S} &> w_P(\pi_C - L) \end{aligned} \tag{14}$$

Conditions (12) or (13) ensure the sender's incentive to deter an unprofitable violation. If condition (14) is violated, signaling cannot be credible because the sender never prefers a violation. At least one of conditions (12) and (13) has to be satisfied for an investment to pay off. Condition (14) constitutes the left-hand term of (11) while the right-hand part captures either (12) or (13). Conditions (12) and (13) are less restrictive than their counterparts (6) and (7) because $f_{P,D} > 0$. However, condition (14) is more restrictive than assumption (1).

□

The threat of additional, individual sanctions *ceteris paribus* makes the existence of a separating PBE more likely because the principal's incentive to induce law conform behavior increases. However, if sanctions imposed on the principal are deterrent in state $S$, i.e., if the left inequality in (11) is violated, there will not exist a separating PBE because the sender does not have an incentive to reveal the true type $\theta$. The agent knows that the principal always prefers law obedient behavior.

Next, consider a situation where penalties are imposed on the agent. In a pooling equilibrium, the agent will break the law for beliefs $p \in [0, p_{ind})$, where $p_{ind}$ satisfies $u_A(C,d) = pu_A(V,d,D) + (1-p)u_A(V,d,S)$, i.e.,

$$p_{ind} \equiv \frac{w_A(\pi_V - F_S - d) - f_{A,S} - w_A(\pi_C - d)}{w_A(\pi_V - F_S - d) - f_{A,S} - w_A((\pi_V - F_D - d) - f_{A,D})} \tag{15}$$

The critical value of the prior (15) decreases if $f_{A,\theta}$ increases.[7] In a pooling equilibrium imposing high fines on the agent thus always promotes law-abiding behavior because the range of priors $p \in [0, p_{ind})$ shrinks.

The effectiveness of imposing individual sanctions strongly depends on whom their are imposed on as well as their magnitude. When the principal beliefs that a violation *never* pays off (condition (11) is violated) there exists no separating equilibrium and the agent takes an action based on his prior belief. Hence, punishing managers who are responsible for coordinating subordinates can be suboptimal as CP investments potentially become non-credible. Sanctions imposed on employees directly involved and responsible for an illegal action, however, seems to be more promising because they will simply refrain from violating the law even in a pooling equilibrium.

# 5 Conclusion

This paper presents an analysis of the ability of CPs to coordinate on law conform behavior. An employee deciding whether to obey or to break the law is imperfectly informed about the level of fines imposed by an authority. However, those fines determine whether a violation pays off. There is a

[7] Note that $\frac{\partial p_{ind}}{\partial f_{A,S}} < 0 \Leftrightarrow w_A(\pi_V - F_D - d) - f_{A,D} < w_A(\pi_C - d)$ and $\frac{\partial p_{ind}}{\partial f_{A,D}} < 0 \Leftrightarrow w_A(\pi_C - d) < w_A(\pi_V - F_S - d) - f_{A,S}$ which is both satisfied by assumption (1) if $f_{A,S}$ is not too high. If the latter inequality is violated for high values of $f_{A,S}$ sanctions are always deterrent.

manager who is perfectly informed about expected fines and thus knows whether the infringement pays off. To solve the arising coordination problem, the manager can invest in expensive compliance measures to signal whether crime pays off.

The model shows that there exists a separating PBE in which the manager will make a high investment in CPs in order to induce law obedient behavior of the employee. A low investment signals the employee that crime pays off. The existence of such a separating PBE is ensured if investment costs are not too high, i.e., inducing law compliance must not be too expensive. The same result holds for individual investments. Those investments are modeled as personal costs incurred by the manager. This approach helps to understand the concept of the tone-at-the-top based on a game theoretical foundation. Since the manager incurs the indirect costs of her dedication to compliance and ethics, tone-at-the-top can be cheaper for the firm as a whole. However, the manager has to be compensated for the investment-costs by, e.g., increasing incentive pay.

From a welfare perspective, if fines are deterrent separating equilibria are the preferred outcome because they ensure the 'correct' coordination on law abiding behavior. If an authority is able to provide the right incentives by setting deterrent fines violations will be rendered unprofitable. In this case, the manager will make a high investment in compliance and the result will be a law-abiding behavior. If CPs are too costly, only a pooling equilibrium exists where the manager never invests (more than necessary) in compliance. Hence, the employee is unable to draw any useful information from the investment-decisions of the manager. The employees conduct is primar-

ily driven by (prior) beliefs about the threat of punishment. Unprofitable violations can emerge which are harmful to both the firm and to society.

By incorporating individual punishment regimes into the analysis, the model shows that if individual sanctions imposed on the manager are so high that he always beliefs that crime does not pay off signaling will not be credible. The agent knows that for the manager a violation does not pay off although it possibly pays off for the firm as a whole. In that case, a firm's (non-)compliance with the law is driven by the agent's prior. The model suggests that sanctioning the employee instead of the manager is a more effective measure to deter an infringement.

# Appendix

In this section, the assumption that a state-$S$ principal always chooses $(L, l)$ is dropped. Refer to this game as $G2$. To simplify the analysis, we restrict our attention to direct investments $d \in \{L, H\}$. In the following, the strategy $s_P = (vx)$ means that for $\theta = D$, the principal chooses $v$ and for $\theta = S$, he chooses $x$. For $s_A = (yz)$ the agent chooses $y$ given he observes a low investment $L$ and he chooses $z$ given $H$ is observed. For instance, the outcome $(HL, VC)$ depicts a situation where, for $\theta = D$, the sender chooses a high investment $H$ and a low investment $L$ for $\theta = S$. The agent will break the law $V$ if she observes $L$ and she obeys the law $C$ observing a high investment $H$. The resulting $4 \times 4$ Bi-matrix contains 12 candidates for pooling equilibria, i.e., every solution that contains $s_P = (LL, HH)$ or $s_A = (CC, VV)$. Assume for simplicity that both the sender and the receiver derive utility from wages only and that the payment function is linear, i.e., $u_j = b_j(\Pi)$, $j \in \{A, P\}$, $b_j \in (0, 1)$ and $b_A + b_P < 1$.

**Proposition 3.** *The game $G2$ has four potential pooling equilbria $(LL, CC)$, $(LL, VV)$, $(LL, CV)$ and $(LL, VC)$. If wages lost from additional investments $H - L$ are lower than higher wages due to (i) avoiding an unprofitable violation or (ii) avoiding unprofitable compliance, there also exists at least one of two separating equilibria $(HL, VC)$ and $(LH, CV)$.*

*Proof.* To proof proposition (3), we first derive all potential pooling equilibria. Given the receiver chooses $CC$, the sender will always choose $LL$. The principal's payoff for $(LL, CC)$ is $pb_P(\Pi(C, L, D)) + (1 - p)b_P(\Pi(C, L, S)) = b_P(\pi_C - L)$. Hence, $(LL, CC)$ dominates $(LH, CC)$, $(HL, CC)$ and $(HH, CC)$

because $b_P(\Pi(C,H,\theta))$ is always higher than $b_P(\Pi(C,L,\theta))$. The same argument applies for $(LL,VV)$: As $u_P(LL,VV) = pb_P(\Pi(V,L,D)) + (1-p)b_P(\Pi(V,L,S))$, $(LL,VV)$ is preferred to $(LH,VV)$ because $\Pi(V,L,S) > \Pi(V,H,S)$ and to $(HL,VV)$ because $\Pi(V,L,D) > \Pi(V,H,D)$. For $(HH,VV)$ both $\Pi(V,L,S) > \Pi(V,H,S)$ and $\Pi(V,L,D) > \Pi(V,H,D)$ applies.

Given the agent chooses $CV$, $(LH,CV)$ is the only possible strategy in a separating Equilibrium provided it exists. From $\Pi(C,L,D) > \Pi(V,H,D)$ and $\Pi(V,H,S) > \Pi(C,L,S)$, $(HL,CV)$ can be ruled out. It follows that $(LH,CV)$ is strictly preferred to $(HL,CV)$. There exists a sep equilibrium if the payoff for $(LH,CV)$ is higher than for $(LL,CV)$, i.e.,

$$\begin{aligned} b_P\Pi(C,L) &< pb_P\Pi(C,L) + (1-p)(b_P\Pi(V,H,S) - f_{P,S}) \\ &\Leftrightarrow\ b_P(H-L) < b_P(\pi_V - F_S - \pi_C) - f_{P,S} \end{aligned} \tag{16}$$

Given the agent chooses $VC$, the only potential separating equilibrium is $(HL,VC)$. Payoffs for $(LH,VC)$ are strictly lower because $\Pi(V,L,S) - f_{P,S} > \Pi(C,H) > \Pi(V,L,D) - f_{P,D}$. There exists a separating equilibrium if $(HL,VC)$ is preferred to $(LL,VC)$, i.e.,

$$\begin{aligned} b_P\Pi(C,L) &< pb_P\Pi(C,H) + (1-p)(b_P\Pi(V,L,S) - f_{P,S}) \\ pb_P(H-L) &< (1-p)b_P(\pi_V - \pi_C - F_S) - f_{P,S} \end{aligned} \tag{17}$$

From the remaining 4 candidates for a separating PBE, we can rule out $(HL,CV)$ as it is dominated by $(LH,CV)$. In $(HL,CV)$ for $\theta = D$ the

principal would choose a high investment which, for $CV$, induces a violation. Inducing $V$ by choosing $H$ only pays off in the safe state, i.e., expected payoffs are always higher for $(LH, CV)$ than for $(HL, CV)$.

□

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