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Vertical relations in cartel theory: managerial incentives, buyer groups & antitrust damages

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2 Monitoring Managers Through Corporate Compliance Programs

Abstract. Compliance programs entail monitoring of employees' behavior with the objective of fighting corporate crime. (Competition) Authorities encourage such intra-firm monitoring. In a three-tier hierarchy model, *authority-shareholder-manager*, we study the impact of managerial monitoring through a compliance program on contracting within the firm and the authority's optimal sanctions and leniency policy. We find that compliance programs are beneficial in the fight against corporate crime if and only if the managerial sanction is low. Moreover, when the shareholder blows the whistle, the authority optimally grants *partial* corporate leniency, while *not* granting individual leniency to the involved employees. Conversely, when the employee blows the whistle, the authority grants individual leniency if and only if the expected managerial sanction is either particularly high or particularly low. Finally, we find that the authority does not apply a discount on the corporate sanction for the mere fact of having adopted a compliance program. We discuss our results in light of the U.S. and E.U. corporate leniency programs, the U.S. individual leniency program, and the U.S. Federal Sentencing Guidelines.

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2.1 Introduction

A compliance program (CP) is a corporate scheme to educate employees about illegal activities, to monitor their behavior, and to discipline them in case of illegal conduct.²⁷ When well-designed, legal scholars advocate such schemes as an effective means to deter corporate crime.²⁸ However, we argue that, depending on the extent to which the judicial system targets involved employees, CPs can indeed be helpful to deter corporate crime, but can also entail a perverse feature that actually encourages violations of the law. Moreover, we show that in both the U.S. and E.U., the current sanctions and leniency practice toward corporations and involved individuals may be suboptimal when taking into account the existence of CPs.

This chapter focuses on the monitoring and disciplining dimensions of CPs.²⁹ Examples of monitoring employees are unannounced inspections of documents, email messages and telephone records, as well as lawyers accompanying managers to business meetings (Stephan, 2009). Authorities may regard such monitoring as an effective means to rely on the firm to prevent employees from engaging in corporate crime. However, a credibility issue arises when the illegal act not only benefits the involved employees, but also the firm to which they belong, i.e., the shareholders. In such cases, the (board of) shareholders may not take (serious) measures against the involved employees when an illegal act is uncovered. They may even use the obtained information to reward employees for engaging in illegal acts, while hiding the evidence from the authority.

To address this credibility issue, we build a three-tier hierarchy, *authority-shareholder-manager* and define a CP as a monitoring technology. The shareholder owns the firm and pays the manager to run it. The manager can unobservably breach the law, resulting in a personal benefit while stochastically increasing the shareholder's profit; this gives rise to the credibility issue of relying on the shareholder to control her manager. The shareholder can adopt a CP to monitor whether the manager breaches the law, which brings about hard evidence of the violation with some probability. The shareholder and the manager both have the opportunity to blow the whistle by reporting evidence to the authority, whose objective is to deter breaches at the lowest possible cost. After a report, the authority imposes sanctions on the shareholder and the manager; otherwise, the authority investigates the firm with some costly probability and imposes sanctions if it uncovers a breach. Sanctions are contingent on (i) whether the shareholder or the

²⁷ See Section 8B2.1 of the 2010 U.S. Federal Sentencing Guidelines.

²⁸ See, for example, Webb and Molo (1993), Calkins (1997), Langevoort (2002), and Wils (2006). If a CP deters illegal conduct, it allows corporations to avoid being exposed to lengthy litigation and costly sanctions. In addition, detection of a violation through a CP allows the corporation to apply for leniency.

²⁹ We do not consider the educational aspect of CPs. For many serious corporate crimes, such as price-fixing by cartels or tax evasion, employees know that such behavior is illegal and need not be educated.

manager blew the whistle—thus allowing for corporate and individual leniency—and (ii) whether a CP was adopted—thus allowing for a reduction of the sanction for having implemented a CP.

Our work applies to the field of antitrust law enforcement. We explicitly comment on the impact of CPs on (i) the sanction policy in the U.S. (the Federal Sentencing Guidelines) and Europe; (ii) the effectiveness of the U.S. and E.U. corporate leniency programs; and (iii) the U.S. individual leniency program. Our analysis, however, applies more broadly to any type of corporate crime, or non-compliance with a binding standard, that benefits both the organization and the involved individuals; examples include tax evasion, cooking the books, environmental fraud, and misselling of a product.³⁰

In the U.S., employees involved in antitrust violations are criminally prosecuted, while European competition law does not target individuals.³¹ Since our model allows for varying the size of the maximum managerial fine prescribed by the law and endogenously solves for the optimal fine and leniency policy, we are able to derive policy implications for both the U.S. and Europe. Below, we summarize our findings from a more general economics perspective, while we discuss the implications for competition policy for both jurisdictions in Section 2.6.

Desirability of compliance programs. Monitoring managers through a CP reduces information asymmetries within the firm.³² The shareholder can then at lower cost prevent the manager to breach the law (beneficial for social welfare), but potentially also at lower cost induce managerial violations (detrimental for social welfare). We find that the adoption of a CP is beneficial for social welfare if and only if the managerial sanction is low. The reason is that if the expected managerial sanction imposed by the authority is lower than the individual gain from breaching the law, then the shareholder pays a *positive* information rent to prevent a breach, but *no* information rent to induce it. A CP would then reduce the salary to prevent a breach without affecting the salary to induce it, thereby making a breach relatively less profitable for the shareholder. A symmetric reasoning suggests that if the managerial sanction is high, a CP can make corporate crime actually relatively more profitable for the shareholder. We do not want to make the claim that firms adopt CPs with only the objective to reduce information asymmetries so as to

³⁰Different interpretations of our three-tier hierarchy are *authority-seller of a product-salesman* (Inderst and Ottaviani, 2009), *authority-seller of a financial product-broker*, or *society-lender-entrepreneur*.

³¹Some E.U. Member States have however enacted laws to criminally prosecute involved employees on the national level, such as the United Kingdom, Ireland and Estonia. See Wils (2005), p. 130, for an overview of criminalization of competition law in E.U. Member States.

³²In Price Waterhouse Coopers' (2009) *Global Economic Crime Survey*, the share of firms responding that they have "suffered" from an economic crime committed by an employee increases with firm size. This may indicate that information asymmetries indeed matter when controlling employees' behavior.

encourage employees to misbehave; the result does, however, suggest a potential perverse effect of increasing the monitoring of harmful activities.

Corporate leniency program. The E.U. corporate leniency program allows firms to blow the whistle in exchange for full immunity from legal sanctions aimed at the corporation; the U.S. corporate leniency program also fully protects involved employees from individual legal sanctions.³³ Such a “blanket” covering the entire corporation as well as its employees has the objective to incentivize employees to report illegal acts to superiors, so as to file for leniency together (Hammond, 2004). In our model, however, we find that the authority optimally grants *partial* leniency to the shareholder when she blows the whistle, while *not* granting leniency to the manager. Three arguments drive this result.

First, corporate leniency increases the effectiveness of CPs to fight corporate crime. A reduction in the corporate sanction incentivizes the shareholder to report evidence uncovered through a CP to the authority, resulting in a managerial sanction. Thus, the *combination* of corporate leniency and the adoption of a CP increases the expected managerial sanction, which, in turn, disincentivizes the manager to breach the law, thereby reducing the salary cost to prevent managerial violations, while increasing the salary cost to induce such violations. Hence, in the presence of a CP, corporate leniency increases (reduces) the salary cost of inducing (preventing) a breach, thereby making it relatively more profitable for the firm to prevent corporate crime.

Second, although corporate leniency increases the effectiveness of CPs to fight corporate crime, the reduction in the corporate fine also makes a breach less costly to the shareholder. The authority optimally balances this tradeoff by providing *just enough* leniency to incentivize the shareholder to blow the whistle whenever she possesses evidence. Hence, the authority grants *partial* corporate leniency.

Third, the authority does not grant leniency to the manager when the shareholder blows the whistle. The reason is that such leniency would reduce the *ex ante* managerial fine, thereby incentivizing the manager to breach the law and, thus, aligning the manager’s incentives with those of a shareholder that wants an infringement to occur.

Individual leniency program. Under the U.S. individual leniency program, the involved employee receives full immunity from legal sanctions when blowing the whistle.³⁴ In our model, however, the authority finds it not always optimal to grant individual leniency. The reason is that individual leniency makes a violation less costly for the manager, because the managerial fine is reduced. Granting individual leniency then entails

³³ See *Commission Notice on Immunity from fines and reduction of fines in cartel cases*, Official Journal C298/17 (2006); and the U.S. Department of Justice’s *Corporate Leniency Policy* (10 August 1993).

³⁴ See the U.S. Department of Justice’s *Leniency Policy for Individuals* (10 August 1994).

the tradeoff that (i) it requires a high salary to induce a breach, because the shareholder must compensate (bribe) the manager not to file for leniency, but (ii) it also requires a high salary to prevent a breach, because the shareholder must reward the manager for not “breaching and blowing the whistle” instead of “not breaching.” We find that the authority optimally grants individual leniency if and only if the expected managerial fine is either particularly high or particularly low. In addition, whenever individual leniency is granted, the authority fully sanctions the firm.

CP and fine reduction. In *Electrical and mechanical carbon and graphite products*, “the [European] Commission considers that it is not appropriate to take the existence of a compliance programme into account as an attenuating circumstance for a cartel infringement.”³⁵ In contrast, according to the U.S. Federal Sentencing Guidelines, a firm engaged in illegal activities is legible to receive a reduced sanction if a well-designed CP was in place at the time of the infringement; in some cases the reduction is up to 95% of the original fine.³⁶ In our model, however, such a policy has a perverse effect. As outlined above, we find that the shareholder optimally receives a reduced sanction for having adopted a CP *and* blowing the whistle, not for the mere act of adopting a CP. The reason is that a CP can be used to more effectively prevent a breach, but also to induce a breach (see above): the mere act of implementing a CP is, therefore, not informative of the shareholder’s intentions. Thus, our results confirm the European Commission’s view.

We proceed by discussing related literature in Section 2.2. Section 2.3 presents the model. Section 2.4 derives conditions under which CPs are helpful in the fight against corporate crime by solving for (i) the impact of a CP on salary costs; (ii) optimal sanctions and corporate leniency policy; and (iii) the authority’s equilibrium investigation probability. Section 2.5 extends the model to study the U.S. individual leniency policy. In Section 2.6, we discuss the policy implications of our model for both the U.S. and the E.U. Section 2.7 concludes.

³⁵See the European Commission’s decision of 3 December 2003 in Case COMP/E-2/38.359, paragraph 313. The Court of First Instance agrees with this view in its decision on 9 July 2003 in *Archer Daniels Midland v. Commission*, Case T-224/00, paragraph 280. For a detailed legal analysis, see Wils (2006), pp. 200–201, and Wils (2007), fn. 119.

³⁶Having implemented an “effective compliance and ethics program” reduces the so-called Culpability Score on which the fine is based—see Section 8C2.5(f) of the U.S. Federal Sentencing Guidelines and U.S. Sentencing Commission (2010). However, according to Section 8C2.5(f)(3)(B)(2), the discount does not apply if the involved individual has price-setting power. See also Wils (2006), pp. 200–201.

2.2 Related Literature

Our work relates to three strands of literature: (i) managerial incentives with harmful activities, (ii) leniency programs, and (iii) optimal liability rules. Most papers in these literatures consider two-tier hierarchy games: either (i) the authority and the black boxed corporation are strategic players, abstracting away from games within the firm, or (ii) the firm owner (principal or shareholder) and the employee (agent or manager) are strategic players, with the authority assumed to be an exogenous technology.³⁷ We take a step beyond these models by considering a three-tier hierarchy game: the authority, principal, and agent are all strategic players.

Managerial incentives with harmful activities. In any model opening the black box of the firm, the nature of the employment contract is central to the analysis. Scharfstein (1988) and Schmidt (1997) study the manager's incentives to exert effort, taking into account the degree of competition in the industry. In Fershtman and Judd (1987), Sklivas (1987), and Spagnolo (2000), an owner offers the manager a publicly observable and binding contract as a commitment device to soften competition or even to sustain tacit collusion. Hiring a manager with strong preferences for income smoothing serves a similar purpose in Spagnolo (2005). These models show how an employment contract might be deliberately used by an employer to reach a socially sub-optimal outcome.³⁸

From a different perspective, Inderst and Ottaviani (2009) model a seller of a good contracting with an agent to prospect for consumers as well as to provide advice concerning the suitability of the product to the consumer's needs. The consumer is taken to be a fully rational and strategic player. The employment contract, which is soft private information as in our model, determines the degree of misselling in equilibrium.

These models do not consider the authority as a fully-fledged strategic player. Aubert (2009) does take into account a strategic authority: she investigates the impact of employment contracts on the incentives for managers to unobservably substitute productive effort with price fixing. In her model, as in ours, the bonus scheme (i) is soft private information to insiders and can be deliberately used by the principal to induce an illegal activity, and (ii) takes into account that cartelization leads to evidence being created, possibly resulting in public intervention by the authority. In our model, unlike Aubert's, in addition to the authority's intervention, internal contracting is potentially also affected

³⁷ A notable exception being Inderst and Ottaviani (2009).

³⁸ Empirical anecdotes hint in the same direction. Price Waterhouse Coopers' (2009) *Global Economic Crime Survey* states that the main motivation driving employees to commit fraud is "incentives and pressure," such as bonuses, financial targets and fear of losing jobs. Also, Khanna (1996) notes that "shareholders can influence the behavior of corporation managers and employees in a number of ways, such as by modifying employment contracts."

by the presence of a CP: the principal contracts on profits, evidence generated by the CP and, potentially, evidence brought forward by the employee himself.

Leniency programs. In our model, we allow both the employer as well as the employee breaching the law to file for (endogenous) leniency from legal sanctions,³⁹ where the employer can come into possession of evidence either through a CP, or through a report by the employee. Thus, our work relates to the literature that studies mechanisms incentivizing wrongdoers to self report. To our knowledge, most work considering such leniency programs focuses on antitrust and, in particular, on cartels. Motta and Polo (2003) and Chen and Rey (2007), for instance, show that leniency programs can have two opposing effects: they destabilize existing collusion by increasing the incentives to deviate from the collusive agreement, but also make collusion *ex ante* more profitable by reducing the expected sanction.⁴⁰

In contrast to these papers, we study leniency programs that potentially jeopardize a conspiracy vertically *within* the firm, rather than horizontally *between* firms. The resulting effects are different. On the one hand, granting leniency to an employer reduces the expected corporate sanction, which incentivizes the employer to blow the whistle. This, in turn, increases the expected managerial sanction, which allows for a reduction in salary costs necessary to prevent corporate crime, while increasing salary costs necessary to induce it. On the other hand, granting leniency to an employee reduces the expected managerial sanction, thereby increasing salary costs to ensure that the manager does not blow the whistle. This leads to *vertical* destabilization, which parallels *horizontal* destabilization in, for example, Spagnolo (2004) who shows that the authority should grant leniency only to the first horizontal party coming forward with evidence. Similarly, we argue that leniency should apply only to the first vertical party blowing the whistle, that is, either the employer or the employee.

Aubert, Rey and Kovacic (2006) (ARK) consider a set-up in which the firm (principal) itself commits the crime, but employees have information about the crime. They argue that it might be optimal to reward employees for blowing the whistle in order to worsen firms' internal incentives.⁴¹ In contrast, in our model the employee (agent) is the individual possibly breaching the law. The force identified by ARK is then present, that is, an employer wishing her employee to breach the law must commit to a higher wage to keep him silent. However, there is another side of the coin: granting leniency to an em-

³⁹See Miller (2009) for recent empirical results concerning the efficacy of leniency programs in the U.S.

⁴⁰Harrington (2008) shows that a third force is present when a time varying probability of conviction is considered: as all players rush to apply for leniency, but only one comes first, overall sanctions may end up being higher compared to the case in which no leniency is available.

⁴¹Such individual rewards also provide incentives to individuals to retain evidence.

ployee increases his incentives to breach the law in the first place, making it more difficult for a firm to deter misconduct.⁴² Thus, we find that individual leniency (or: individual rewards) is not always the optimal policy and depends on the manager's private benefit resulting from the crime.

Optimal liability rules. Our work also relates to the literature investigating to which extent firms and individuals should be liable for corporate crime.⁴³ Sykes (1984) and Segerson and Tietenberg (1992), for instance, consider types of corporate crime that hurt the firm; they argue that, in the presence of agency costs, the authority targeting individuals directly is more effective than targeting the firm. We find that if the authority offers corporate leniency, targeting individuals generally works better at reducing public enforcement costs than targeting the firm, regardless of agency costs. However, since we consider types of corporate crime that actually benefit the corporation, some degree of corporate liability is always needed, which contrasts Segerson and Tietenberg (1992).⁴⁴

Polinsky and Shavell (1993) and Shavell (1997) call for managerial legal sanctions as the firm itself might be limited in its capacity to punish its employees. In our model, where the employer can actually punish its employees in the form of foregone bonuses, it is preferable to have managerial legal sanctions for an additional reason: the employer cannot be trusted to take appropriate measures as the illegal act itself benefits the employer. Focusing on managerial incentives to form cartels, Stephan (2009) argues that CPs may be ineffective if employees bear no liability, because then employees commit the crime anyway. Our results differ; we find that CPs are actually most useful when employees bear no liability, because then employers can use the information obtained through the CP to internally punish employees.

When the probability of conviction increases with the amount of internal monitoring, Arlen (1994) identifies a potentially perverse effect of holding firms liable: improved internal monitoring would expose the firm to heavy sanctions. As a result, the firm might be reluctant to disclose evidence or to choose the right level of monitoring. Our model eliminates this effect by allowing for corporate leniency, which reduces the expected corporate sanction when the firm monitors *and* reports when evidence is found. In equilibrium, the authority grants *partial* corporate leniency so as to take away Arlen's perverse effect, while not reducing the fine by too much. Thus, such a corporate leniency policy incentivizes firms to fight corporate crime by monitoring employees through a CP.

⁴²Aubert (2009), also considering individual leniency programs, identifies this tradeoff as well.

⁴³See Khanna (1996) for an exposition of the various liability regimes.

⁴⁴The threat of corporate sanctions effectively forces firms to internalize the potential social harm caused by their employees, thereby (at least partially) delegating the task of fighting corporate crime to the firm. Thus, firms may choose to monitor employees by adopting a CP.

2.3 Set-up of the Model

In this section, we present the set-up of the model, assuming that the manager cannot apply for leniency. We relax this assumption in Section 2.5.

Outline & players. Consider the following three-tier hierarchy: an owner or shareholder of the firm (principal) contracts with a manager (agent) who runs the firm and possibly breaches the law. An authority aims at deterring breaches of the law. The manager does not (Section 2.4) or does (Section 2.5) possess evidence of the violation, while the shareholder may receive hard evidence, either directly through the manager, or through monitoring the manager with a CP. The manager and/or the shareholder can blow the whistle and report evidence to the authority, which then imposes corporate and managerial fines. If neither the shareholder nor the manager blows the whistle, the authority investigates the firm with costly probability β and imposes fines when a breach of the law is uncovered. Figure 2.1 illustrates this set-up. All players are risk neutral. We refer to the manager in the male form (he/his), the shareholder in the female form (she/her), and the authority in the neutral form (it/its).

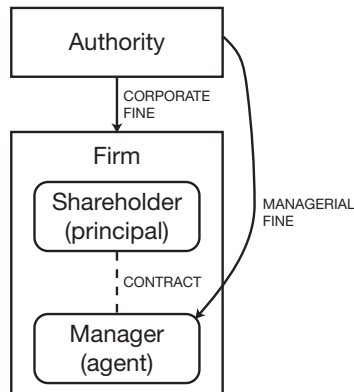


FIGURE 2.1 *The players: authority, shareholder (principal), and manager (agent).*

Actions

Manager. The manager unobservably takes action $a \in \{b, n\}$, where b is breaching the law and n is not breaching the law. The manager's action stochastically affects the realization of firm profit $\pi \in \{0, 1\}$. The following table contains the probability distribution over firm profit π given action a , where $\rho_\pi > \frac{1}{2}$, that is, breaching the law increases the firm's expected profit.

	$a = b$	$a = n$
$\pi = 1$	ρ_π	$1 - \rho_\pi$
$\pi = 0$	$1 - \rho_\pi$	ρ_π

In Section 2.4, we consider the case in which the manager does *not* possess evidence when he breached the law. Section 2.5 solves the case when the manager *does* possess evidence, which he may report to her shareholder and/or the authority. This allows to study the interaction of CPs with the U.S. individual leniency program; details about this adapted set-up are outlined in Section 2.5.

Shareholder. The shareholder takes three possible actions: (i) she offers the manager a take-it-or-leave-it employment contract; (ii) she chooses whether or not to adopt a CP;⁴⁵ and (iii) she chooses whether or not to report evidence to the authority if she comes into possession of such evidence. Regarding the latter two actions, the shareholder has the following three *reporting strategies*: she either does not adopt a CP and has nothing to report ($i = N$); adopts a CP and reports whenever possible ($i = R$); or adopts a CP and never blows the whistle ($i = C$).

Adopting a CP allows the shareholder to uncover perfectly informative hard evidence of a breach with probability $\rho_\sigma > 0$. Whether she indeed finds evidence is indicated by signal $\sigma \in \{0, 1\}$, where $\sigma = 1$ means evidence and $\sigma = 0$ means no evidence. The next table contains the probability distribution over signal σ , given managerial action a .⁴⁶

	$a = b$	$a = n$
$\sigma = 1$	ρ_σ	0
$\sigma = 0$	$1 - \rho_\sigma$	1

Consider now the employment contract. The shareholder offers the manager a take-it-or-leave-it contract, which defines transfers $t_{\pi,\sigma}$ contingent on the realization of profit $\pi \in \{0, 1\}$, as well as the signal $\sigma \in \{0, 1\}$ (if a CP is in place).⁴⁷ The shareholder may use the contract to either induce or to prevent her manager to breach the law.

⁴⁵For simplicity, we assume that a CP is costless to implement. Based on an earlier version of the model, we discuss in the concluding remarks that the results remain qualitatively unchanged when a CP is costly.

⁴⁶For simplification, we assume that a CP possibly gives rise to hard information. If the shareholder were to possess soft information and transmit it to the authority, then an investigation would still be needed as judges and courts are reluctant to rely on testimonies which are not backed by factual evidence. The possibility of soft information is left for future work.

⁴⁷We assume that the shareholder cannot contract on the outcome of the authority's investigation. This contracting incompleteness yields the same results that we would obtain in a frictionless contracting environment in which the authority commits (not too frequent) type I/II errors. If completeness is restored in the current framework, most results qualitatively hold but less economic forces are at play.

The employment contract is assumed to be soft private information. The shareholder can credibly commit to making the transfers as stated in the employment contract, while she cannot credibly commit to a specific reporting strategy, though she would prefer to.⁴⁸

The transfers $t_{\pi,\sigma}$ are associated with four possible states of nature $\{\pi, \sigma\}$. The following table states the probabilities $p_{\pi,\sigma}^{a,i}$ of these states of nature occurring, given the manager's action $a \in \{b, n\}$ and the shareholder's choice $i \in \{N, C, R\}$, where $\rho_{\sigma}^i = \rho_{\sigma}$ if $i \in \{C, R\}$, and $\rho_{\sigma}^i = 0$ if $i = N$.

STATE OF NATURE $\{\pi, \sigma\}$ AND ASSOCIATED TRANSFER $t_{\pi,\sigma}$	PROBABILITY IF $a = b$	PROBABILITY IF $a = n$
$\{\pi = 1, \sigma = 1\}, t_{11}$	$p_{11}^{b,i} = \rho_{\pi}\rho_{\sigma}^i$	$p_{11}^{n,i} = 0$
$\{\pi = 1, \sigma = 0\}, t_{10}$	$p_{10}^{b,i} = \rho_{\pi}(1 - \rho_{\sigma}^i)$	$p_{10}^{n,i} = 1 - \rho_{\pi}$
$\{\pi = 0, \sigma = 1\}, t_{01}$	$p_{01}^{b,i} = (1 - \rho_{\pi})\rho_{\sigma}^i$	$p_{01}^{n,i} = 0$
$\{\pi = 0, \sigma = 0\}, t_{00}$	$p_{00}^{b,i} = (1 - \rho_{\pi})(1 - \rho_{\sigma}^i)$	$p_{00}^{n,i} = \rho_{\pi}$

Authority. The authority imposes corporate fine F^i on the shareholder and individual fine f^i on the manager, subject to legal caps \bar{F} and \bar{f} , respectively. Varying the legal cap \bar{f} allows to interpret the results in light of U.S. policy (positive managerial sanctions, i.e., $\bar{f} > 0$) and E.U. policy (no managerial sanctions, i.e., $\bar{f} = 0$).

If the shareholder blows the whistle, the authority imposes sanctions F^R and f^R (in Section 2.5, we extend the analysis by also allowing the manager to blow the whistle). If instead no report is made, the authority commits to investigate the firm with probability β ,⁴⁹ in which case it always uncovers the breach if it occurred.⁵⁰ The authority then imposes sanctions F^C and f^C when a CP was in place, or sanctions F^N and f^N when a CP was not in place.

Information. All actions are observable to all players, except (i) whether the manager breaches the law or not, which is unobservable to the shareholder as well as the authority, and (ii) whether the shareholder has adopted a CP, which is observed by the manager, but not by the authority.⁵¹

⁴⁸We adopt the conventional wisdom that the logic behind bonuses is opaque to outsiders, but perfectly understandable to insiders. We also assume that such bonuses are credible as they involve relatively small amounts of money. Committing whether or not to report, however, may involve colossal amounts of money and is only credible if it is *ex post* rational to do so.

⁴⁹If the authority cannot credibly commit to a probability of investigation, the equilibrium is in mixed strategies—see for instance Khalil (1997).

⁵⁰Aubert, Rey and Kovacic (2006) and Aubert (2009) also make the assumption that an investigation always leads to conviction if a breach occurred.

⁵¹We do not consider signaling games in which the authority tries to separate the behavior of a shareholder preventing a breach from that of a shareholder inducing a breach. Equivalently, we could have assumed

Whether the shareholder uncovers evidence through the adoption of a CP is observable to the manager, but unobservable to the authority; only if the shareholder blows the whistle then the authority knows that the shareholder has found evidence. The nature of the employment contract is unobservable to the authority, even in case of an investigation.⁵²

Payoffs

Shareholder. The shareholder receives realized profit $\pi \in \{0, 1\}$ and pays managerial salary $t_{\pi, \sigma}$. If the manager breaches the law, the firm faces expected corporate fine

$$E_i [F] = \begin{cases} \beta F^N & \text{if } i = N \\ \beta F^C & \text{if } i = C \\ \underbrace{\rho_\sigma F^R}_A + \underbrace{(1 - \rho_\sigma) \beta F^C}_B & \text{if } i = R, \end{cases} \quad (2.1)$$

where the expected corporate fine when the shareholder adopts a CP and reports evidence ($i = R$) consists of two parts: (A) with probability ρ_σ the shareholder finds evidence and blows the whistle in which case the authority imposes fine F^R , and (B) with probability $1 - \rho_\sigma$ the shareholder finds no evidence in which case the authority investigates the firm with probability β and imposes fine F^C . Given the expected corporate fine $E_i [F]$ and the expected transfer $E_i [t^a] = \sum_{\pi=0}^1 \sum_{\rho=0}^1 p_{\pi, \sigma}^{a, i} t_{\pi, \sigma}$, the shareholder's expected payoff Π_i^a is then

$$\Pi_i^a = \begin{cases} 1 - \rho_\pi - E_i [t^n] & \text{if } a = n \\ \rho_\pi - E_i [t^b] - E_i [F] & \text{if } a = b. \end{cases} \quad (2.2)$$

Manager. The manager receives his salary $t_{\pi, \sigma}$. When breaching the law, he also receives private gain $G \geq 0$, which can be interpreted as a benefit either directly or indirectly resulting from the breach, such as the possibility to work less hard.⁵³ Moreover, the manager then faces expected managerial fine

$$E_i [f] = \begin{cases} \beta f^N & \text{if } i = N \\ \beta f^C & \text{if } i = C \\ \rho_\sigma f^R + (1 - \rho_\sigma) \beta f^C & \text{if } i = R. \end{cases} \quad (2.3)$$

that the authority *does* observe whether the shareholder has implemented a CP, but does not *ex ante* act on that by adapting its investigation probability.

⁵²This captures the idea that in many cases it is difficult for the judicial system to observe the set of incentives in place at the time of the infringement. Thus, whenever we find that the optimal policy is to sanction the shareholder, this is not based on factual evidence of culpability, but on efficiency grounds. We thank Michael Riordan for pointing this out.

⁵³In Aubert (2009), for example, managerial effort and cartelization are strategic substitutes: forming a cartel allows the manager to exert less costly effort, which is an indirect benefit.

Given this expected managerial fine $E_i [f]$ and the expected transfer $E_i [t^a]$, the manager's expected payoff M_i^a then boils down to

$$M_i^a = \begin{cases} E_i [t^n] & \text{if } a = n \\ E_i [t^b] - E_i [f] + G & \text{if } a = b. \end{cases}$$

The manager has a zero outside option and is protected by limited liability with respect to salary, but not with respect to the managerial fine.

Authority. The authority's cost of investigating firms $K(\beta)$ is increasing in the investigation probability, i.e., $K'(\beta) > 0$. Fines are costless to impose and collect. We assume that breaches are so detrimental to society that the authority's objective is to minimize investigation cost $K(\beta)$ subject to breaches being deterred,⁵⁴

$$\begin{aligned} \min_{\beta, \{F^N, F^C, F^R\}, \{f^N, f^C, f^R\}} & K(\beta) & \text{s.t.} \\ & F^i \leq \bar{F}, & \forall i, \\ & f^i \leq \bar{f}, & \forall i, \\ \max \{\Pi_N^n, \Pi_C^n, \Pi_R^n\} & \geq \max \{\Pi_N^b, \Pi_C^b, \Pi_R^b\}, & (2.4) \end{aligned}$$

where constraint (2.4) ensures that the shareholder writes an employment contract that prevents her manager to breach, that is, the shareholder's expected payoff when inducing a breach (RHS) must not be higher than her payoff when preventing a breach (LHS). Another interpretation of this minimization problem is that the authority executes a pre-written law at the least possible costs.

Timing. The timing of the game is as follows and schematically depicted in Figure 2.2:

1. The authority sets its policy parameters $\beta, \{F^N, F^C, F^R\}, \{f^N, f^C, f^R\}$.
2. The shareholder chooses her reporting strategy, $i \in \{N, C, R\}$.
3. The shareholder offers a take-it-or-leave-it contract to the manager, which the manager accepts or rejects.
4. The manager breaches the law or not, $a \in \{b, n\}$.
5. Firm profit $\pi \in \{0, 1\}$ and signal $\sigma \in \{0, 1\}$ are realized.

⁵⁴This assumption allows for a mathematically clean analysis; when some breaches are not so detrimental to society we expect the same qualitative results.

6. If evidence of a breach becomes available through the CP ($\sigma = 1$), the shareholder blows the whistle if and only if $i = R$.⁵⁵
7. If the authority receives a report, the authority imposes sanctions. If the authority receives no report, the authority investigates the firm with probability β and imposes sanctions when a violation indeed occurred.
8. The employment contract is executed.⁵⁶

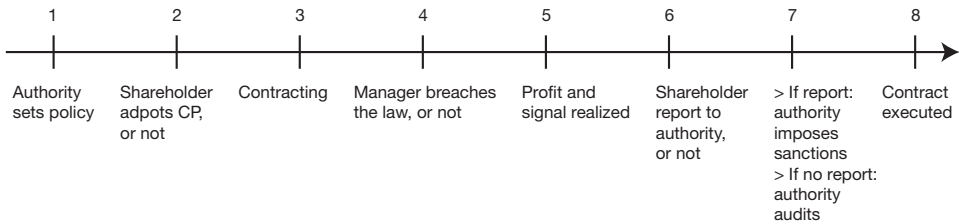


FIGURE 2.2 *Timing of the game.*

2.4 The Impact of Compliance Programs on Optimal Policy

This section solves the model for the case in which the manager does *not* possess evidence when he breached the law, as outlined in the previous section. In Subsection 2.4.1, we solve for the expected transfers associated with the optimal employment contracts. Subsection 2.4.2 determines the authority's optimal sanctions and leniency policy. Subsection 2.4.3 derives the impact of CPs on the optimal level of investigations necessary to deter corporate crime.

2.4.1 Optimal Expected Transfers

In this subsection, we present the expected transfers associated with the manager's employment contract when the shareholder either induces or prevents the manager to breach the law. We define $\gamma^N = \frac{\rho_\pi}{2\rho_\pi - 1} > 1$ and $\gamma^C = \frac{\rho_\pi}{\rho_\pi - (1 - \rho_\pi)(1 - \rho_\sigma)} > 1$ as measures of information asymmetries, where $\gamma^N > \gamma^C$, because $\rho_\pi > \frac{1}{2}$.

⁵⁵We consider reporting to (possibly) happen *before* the authority's investigation so as to study the impact of leniency programs on practices that are not yet under investigation. Motta and Polo (2003) show that it can be efficient to reduce fines even when the authority has already started an investigation, but has not yet obtained evidence of misbehavior.

⁵⁶While the employment contract is executed *after* the possible investigation, the contract is not contingent on the outcome of the investigation. This assumption is similar in effect to Aubert (2009) who instead assumes that the contract is executed *before* a possible investigation, but managerial whistle blowing (see Section 2.5) cannot take place after the contract is executed.

Lemma 2.1 (No compliance program) *If a compliance program is not adopted ($i = N$), the expected transfer to induce or to prevent a breach, respectively, is*

$$\begin{aligned} E_N [t^b] &= \max \{ \gamma^N (\beta f^N - G), 0 \}, \\ E_N [t^n] &= \max \{ \gamma^N (G - \beta f^N), 0 \}. \end{aligned}$$

Proof. See Appendix A.1.1. □

When the shareholder wants to prevent (induce) a breach, she pays a positive expected transfer if and only if the manager's gain G from breaching is higher (lower) than the expected managerial fine βf^N —that is, if and only if the incentives of the shareholder and the manager are not aligned. The resulting expected transfer is the difference between G and βf^N , inflated by the measure of information asymmetries γ^N , caused by the fact that the only (imperfect) information that the shareholder has about managerial behavior is the realization of profit.

Lemma 2.2 (Compliance program) *If a compliance program is adopted ($i \in \{C, R\}$), the expected transfer to induce or to prevent a breach, respectively, is*

$$\begin{aligned} E_i [t^b] &= \max \{ E_i [f] - G, 0 \}, \\ E_i [t^n] &= \max \{ \gamma^C (G - E_i [f]), 0 \}. \end{aligned}$$

Proof. See Appendix A.1.1. □

The adoption of a CP reduces the moral hazard problem, because the shareholder receives informative signal σ . As a result, the measure of information asymmetries decreases from γ^N to γ^C when the shareholder prevents her manager to breach, while information rents disappear altogether when the shareholder induces her manager to breach as evidence ($\sigma = 1$) is a perfectly informative signal about a breach having occurred.

We again have that the shareholder pays a positive expected transfer if and only if the incentives of the shareholder and the manager are not aligned. This expected transfer is the difference between G and $E_i [f]$, which is inflated by the measure of information asymmetries γ^C when the shareholder prevents a breach.

2.4.2 Optimal Sanctions and Leniency Policy

The authority's objective is to implement a policy that deters breaches at the lowest possible cost, i.e., with the lowest possible investigation probability β . Before determining

this optimal β in the next subsection, we solve for the optimal schedule of fines and determine whether and when the authority optimally grants leniency to the shareholder and/or the manager.

Recall that constraint (2.4) ensures that the shareholder does not find it profitable to induce a managerial violation. Substituting for the shareholder's expected payoffs (equation (2.2)) and subsequently for the expected corporate fines (equation (2.1)) yields

$$1 - \rho_\pi - \min \{E_N [t^n], E_C [t^n], E_R [t^n]\} \geq \rho_\pi - \min \left\{ E_N [t^b] + \beta F^N, E_C [t^b] + \beta F^C, E_R [t^b] + \rho_\sigma F^R + (1 - \rho_\sigma) \beta F^C \right\}, \quad (2.5)$$

which allows to determine the schedule of fines $\{F^N, F^C, F^R\}$ and $\{f^N, f^C, f^R\}$ that ensures that (2.4) is satisfied for the lowest possible investigation probability β .

Proposition 2.1 *The authority's optimal policy is to set all fines to their legal maximum, but to provide partial corporate leniency when the shareholder blows the whistle, that is,*

1. $f^N = \bar{f}, F^N = \bar{F}$;
2. $f^C = \bar{f}, F^C = \bar{F}$; and
3. $f^R = \bar{f}, F^R = \beta \bar{F} - |\epsilon|$,

where ϵ is arbitrarily small.⁵⁷

The manager receives no individual leniency when the shareholder blows the whistle and there is no reduction on the corporate fine for having adopted a compliance program.

Proof. See Appendix A.1.2. □

The authority optimally sets all managerial fines to their legal maximum and provides no individual leniency when the shareholder blows the whistle. The intuition is that increasing the managerial fines leads to (i) a better alignment of the manager's incentives with those of the shareholder aiming to prevent a breach, resulting in a weakly lower expected transfer, and (ii) more misalignment between the manager's incentives and those of the shareholder aiming to induce a breach, resulting in a weakly higher expected transfer. Setting all managerial fines to their legal maximum optimally relaxes (2.5): it becomes cheaper for the shareholder to prevent a breach, but more expensive to induce a breach.

⁵⁷We realize that "ε is arbitrarily small" violates the equilibrium concept, because all variables are continuous.

The same results would however be obtained when rewriting the proofs with corporate fines defined in a discrete grid. This makes practical sense as monetary values cannot be split infinitely.

The authority sets corporate fines to their legal maximum, but grants partial leniency to the shareholder when she blows the whistle. Consider first the case in which the shareholder does not adopt a CP and, thus, never receives evidence. We then have the Beckerian result that the authority sets the corporate fine to its legal maximum so as to maximally deter the shareholder from inducing her manager to breach, i.e., $f^N = \bar{F}$.

Suppose now the shareholder adopts a CP, which possibly provides her with evidence of a breach. Substituting the optimal managerial fines $f^N = f^C = f^R = \bar{f}$ into $E_C[f]$ and $E_R[f]$, gives expected managerial fines

$$E_R[f] = [\rho_\sigma + (1 - \rho_\sigma) \beta] \bar{f} > E_C[f] = \beta \bar{f},$$

that is, the expected managerial fine is higher when the shareholder blows the whistle than if she does not blow the whistle, because the manager is convicted for sure after a report by the shareholder. Thus, blowing the whistle weakly reduces the expected salary cost to prevent a breach, but weakly increases the expected salary cost to induce a breach. Therefore, a shareholder aiming to prevent a breach would like to commit *vis-à-vis* her manager to blow the whistle whenever she finds evidence, while a shareholder aiming to induce a breach would like to commit not to blow the whistle.

Whether such commitments are credible depends on the relative sizes of the corporate fines: blowing the whistle is *ex post* rational for the shareholder if and only if reporting leads to a lower corporate fine than not reporting, i.e., if and only if $F^R < \beta F^C$. To maximally deter the shareholder from inducing a breach, the authority sets F^C and F^R as high as possible, with the restriction that $F^R < \beta F^C$ so as to (i) provide the breach-preventing shareholder with the commitment to report, while (ii) destroying the breach-inducing shareholder's commitment to not report. When the shareholder implements a CP, the authority, thus, optimally sets the corporate fine when no report is made to the legal maximum, i.e., $F^C = \bar{F}$, while granting partial leniency to the shareholder when she reports, i.e., $F^R = \beta \bar{F} - |\epsilon|$, where ϵ is arbitrarily small. Hence, the authority does not reduce the corporate fine for the mere fact of having adopted a CP.

Combining the results regarding optimal transfers (Lemmas 2.1 and 2.2) with the authority's optimal sanctions and leniency policy (Proposition 2.1), we state the impact of the adoption of a CP on expected transfers in the following corollary.

Corollary 2.1 *Provided the implementation of the authority's optimal policy, monitoring managers through a compliance program*

1. *reduces information asymmetries within the firm (by assumption); and*
2. *increases the expected managerial fine.*

The former effect entails a downward pressure both on the transfer to prevent breaches and on the transfer to induce breaches. The latter effect entails a downward pressure on the transfer to prevent breaches and an upward pressure on the transfer to induce breaches.

Proof. The former effect directly follows from Lemmas 2.1 and 2.2. The latter effect follows from Lemmas 2.1 and 2.2 and Proposition 2.1 by noting that the managerial fine is (i) $E_N[f] = \beta\bar{f}$ when no CP is adopted, and (ii) $E_R[f] = \rho_\sigma\bar{f} + (1 - \rho_\sigma)\beta\bar{f} > E_N[f]$ when a CP is adopted, because the authority's optimal policy makes it *ex post* rational for the shareholder to report whenever she finds evidence through the CP. \square

Adopting a CP affects expected transfers through two channels. First, since a CP reduces information asymmetries within the firm, it decreases information rents (if any), thereby weakly reducing expected salary costs. This effect is beneficial in the fight against corporate crime when the shareholder aims to prevent managerial violations, but entails a perverse effect when the shareholder uses the information obtained through the CP to promote such violations. Second, given the authority's optimal sanctions and leniency policy, adopting a CP increases the expected managerial fine from $E_N[f] = \beta\bar{f}$ to $E_R[f] = \rho_\sigma\bar{f} + (1 - \rho_\sigma)\beta\bar{f}$, because the shareholder finds it *ex post* rational to blow the whistle whenever she finds evidence, which results in a sure conviction of the manager. This effect helps to deter violations as it increases the manager's expected cost of breaching, thereby reducing the expected transfer to prevent a breach and increasing the expected transfer to induce a breach. We then arrive at the following corollary.

Corollary 2.2 *A shareholder that prevents breaches optimally adopts a compliance program. A shareholder that induces breaches not always adopts a compliance program, because it reduces information asymmetries, but increases the expected managerial fine.*

Proof. The first result follows directly by noting that both effects stated in Corollary 2.1 entail a downward pressure on the expected transfer to prevent breaches. The second result follows by Corollary 2.1 and the proof of Proposition 2.1. \square

Adopting a CP unambiguously helps the shareholder to prevent managerial violations: a CP reduces information asymmetries and increases the expected managerial fine, which both entail a downward pressure on the optimal expected transfer to prevent a breach. In contrast, when the shareholder aims to induce a breach she faces a tradeoff: a CP entails a downward pressure on the expected transfer through reducing information asymmetries, but an upward pressure through increasing the expected managerial fine.

2.4.3 Social Desirability of Compliance Programs

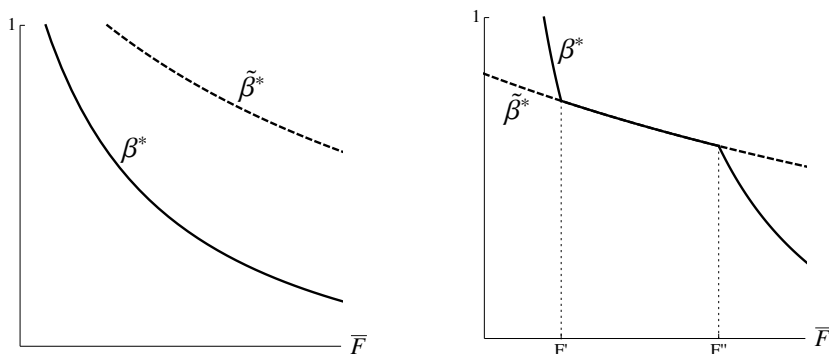
Given the authority's optimal sanctions and leniency policy, we now determine the net impact of the CP, i.e., the monitoring technology, on the authority's costly investigation probability. We do so by comparing the minimum investigation probability β^* that satisfies constraint (2.5) with the minimum investigation probability $\tilde{\beta}^*$ in a hypothetical scenario in which the monitoring technology is *not* available.⁵⁸ Proposition 2.2 then states the conditions under which monitoring managers through CPs is socially desirable ($\beta^* < \tilde{\beta}^*$) or undesirable ($\beta^* > \tilde{\beta}^*$); we graphically illustrate the results in Figures 2.3AB. Denote by F' and F'' thresholds on the corporate fine, where $F' < F''$. We assume that the corporate fine \bar{F} is high enough for $\beta^* < 1$ to exist.

Proposition 2.2 *If the managerial fine is lower than the manager's private benefit from the breach ($\bar{f} \leq G$), monitoring him through a compliance program is welfare enhancing.*

If the managerial fine is higher than the manager's private benefit from the breach ($\bar{f} > G$), monitoring him through a compliance program is

1. *detrimental for welfare if the corporate fine is low ($\bar{F} < F'$);*
2. *welfare neutral if the corporate fine is intermediate ($F' \leq \bar{F} < F''$); and*
3. *welfare enhancing if the corporate fine is high ($\bar{F} > F''$).*

Proof. See Appendix A.1.3. □



FIGURES 2.3AB *Optimal investigation probability when CPs are available (β^*), or not available ($\tilde{\beta}^*$); with (2.3A) a low managerial fine ($\bar{f} \leq G$), or (2.3B) a high managerial fine ($\bar{f} > G$).*

⁵⁸Such a situation could be due to very high implementation costs, but also to cultural or legal reasons.

When the managerial fine is lower than the manager's private benefit from the breach ($\bar{f} < G$), the manager has private incentives to breach the law when a CP is *not* adopted. The shareholder then pays a zero salary to induce a breach, but a positive expected salary, including an information rent, to prevent a breach. As discussed in the previous two subsections, adopting a CP has two effects: it decreases information rents, while increasing the expected managerial fine. Thus, the former effect decreases the expected transfer to prevent a breach, while not affecting the zero transfer to induce a breach. The latter effect has a disincentivizing effect on the manager to breach, thereby reducing the positive transfer to prevent a breach and (weakly) increasing the zero transfer to induce a breach. Altogether, the adoption of a CP reduces the salary cost of preventing a breach, while (weakly) increasing the salary cost of inducing a breach. This makes a breach of the law relatively less profitable for the shareholder, thereby allowing the authority to reduce its costly investigation probability.

Consider now the case in which the managerial fine is higher than the manager's private benefit from the breach ($\bar{f} \geq G$). In such cases, the manager has private incentives to breach if $\beta\bar{f} < G$, but has no private incentives to breach if $\beta\bar{f} \geq G$. For the following argumentation, we note that the corporate fine \bar{F} and the investigation probability β are substitutes in deterring corporate crime, that is, a high \bar{F} allows for a low β , while a low \bar{F} requires a high β .

Suppose the corporate fine is high ($\bar{F} \geq F''$). By substitutability of \bar{F} and β , the authority can set the investigation probability β relatively low. In particular, the investigation probability is so low that $\beta\bar{f} < G$, that is, the manager has private incentives to breach. Without a CP, the shareholder then pays a zero salary to induce a breach, but a positive expected salary, including an information rent, to prevent a breach. By the same arguments as above ("low managerial fine"), a CP reduces the salary cost of preventing a breach, while (weakly) increasing the salary cost of inducing a breach. This makes corporate crime relatively less profitable for the shareholder, which allows the authority to reduce its costly investigation probability.

Suppose now the corporate fine is not so high ($\bar{F} < F''$). By substitutability of \bar{F} and β , the authority needs to set the investigation probability β relatively high, resulting in $\beta\bar{f} > G$, that is, the manager has no private incentives to breach. Without a CP, the shareholder then pays a zero salary to prevent a breach, but a positive expected salary, including an information rent, to induce a breach. Then, adopting a CP by the shareholder that aims to prevent a breach has no effect on the expected transfer as it is zero anyway.

However, the shareholder inducing a breach faces a tradeoff: adopting a CP (i) reduces the information rent, which gives a *downward pressure* on the expected transfer, but (ii) if the shareholder finds evidence she cannot help reporting it to the authority so as to receive partial leniency, which gives an *upward pressure* on the expected transfer. When

the corporate fine is low ($\bar{F} < F'$), the former effect outweighs the latter:⁵⁹ adopting a CP then allows the shareholder to reduce the salary cost of inducing breach, which pushes the authority to increase its costly investigation probability to be able to deter corporate crime. Conversely, when the corporate fine is intermediate ($F' \leq \bar{F} < F''$), the latter effect outweighs the former: the shareholder inducing a breach would not adopt a CP. The availability of CPs then has no impact on the authority's investigation probability.

2.5 Individual Leniency

In this section, we study how managerial leniency interacts with the effects of a CP. To that end, we extend our set-up by assuming that if the manager breaches the law he comes into possession of a piece of verifiable evidence, which he can (i) report to the shareholder ($r_p = 1$) or not ($r_p = 0$), and (ii) report to the authority ($r_a = 1$) or not ($r_a = 0$), where a report to the authority is observed by the shareholder. This set-up allows the shareholder to condition transfers on such reports. Similarly, the authority conditions fines on the manager blowing the whistle, which we denote by F^r and f^r .

The timing of the game is adapted by taking into account that the manager can make reports either immediately after breaching the law, or after (possibly) payoff-relevant information comes available. Figure 2.4 indicates those stages by 4' and 5', respectively, which we refer to as the “ex-ante (reporting) stage” and “interim (reporting) stage.”

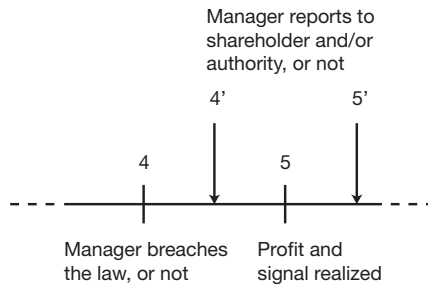


FIGURE 2.4 *Revised timing of the game. The manager can report immediately after he breaches (ex-ante stage 4'), or after the realization of payoff-relevant information (interim stage 5').*

⁵⁹The intuition runs as follows. The latter effect (i.e., the difference in the expected managerial fine with and without a CP, $\rho_\sigma \bar{f} + (1 - \rho_\sigma) \beta \bar{f} - \beta \bar{f}$) is less pronounced the higher the investigation probability is. The reason is that with a high investigation probability, the expected managerial fine is relatively high already *without* a CP. Now, if the corporate fine is low ($\bar{F} < F'$), then the investigation probability β needs to be relatively high by substitutability of the corporate fine and the investigation probability. This reduces the scope of the latter effect.

As the derivation of the equilibrium is tedious and replicates many of the steps taken in the previous section, we focus on the results that differ from the previous section. Subsection 2.5.1 deals with the impact of the adapted set-up on optimal transfers, Subsection 2.5.2 discusses the optimal individual leniency policy, and Subsection 2.5.3 states the impact of the individual leniency policy on the effectiveness of CPs.

2.5.1 Optimal Expected Transfers: Reporting Constraints

Since the manager now holds verifiable evidence of his breach, the shareholder faces an additional incentive compatibility constraint when offering the employment contract. She must ensure that her manager does not blow the whistle by reporting evidence to the authority so as to receive managerial leniency. We coin this constraint the *reporting constraint* and show how it affects the expected transfers.⁶⁰

By the same reasoning as in the previous section, the authority optimally (i) sets the managerial fines f^N , f^C and f^R to their legal maximum \bar{f} ; (ii) sets the corporate fines F^N and F^C to their legal maximum \bar{F} ; and (iii) grants partial corporate leniency when the shareholder reports evidence to the authority, i.e., $F^R = \beta\bar{F} - |\epsilon|$, thereby ensuring that the shareholder always reports when she has evidence of a breach. The formal proof is delegated to Appendix A.2 and is simultaneously derived with the optimal transfers.

If the authority grants managerial leniency, the reporting constraint turns up in the contracting problem of the shareholder inducing a breach, but also in the contracting problem of the shareholder preventing a breach, thus introducing a tradeoff. The following lemmas state the optimal expected transfers.

Lemma 2.3 (Preventing a breach) *If the shareholder prevents a breach, she adopts a compliance program, resulting in expected transfer*

$$E_R [t^n] = \max \{ \gamma^C (G - E_R [f]), G - f^r, 0 \} .$$

Proof. See Appendix A.2.1. □

If the shareholder prevents a breach she adopts a CP, because that (i) decreases the information asymmetry, while (ii) increasing the expected managerial fine. The shareholder now faces two ICs: she must not only make sure that the manager does not breach, but also that he does not “breach and blow the whistle” so as to possibly receive individual

⁶⁰Technically, there are several reporting constraints, because the manager may report to the authority at several points in time during the game. However, these reporting constraints boil down to one relevant constraint that dominates all others—see Appendix A.2.

leniency.⁶¹ This introduces the additional restriction $E_R[t^n] \geq G - f^r$, that is, the expected payment when the manager does not breach must be at least as large as the managerial gain G when he breaches, minus the managerial fine f^r when he reports.

Lemma 2.4 (Inducing a breach) *If the shareholder induces a breach without adopting a compliance program, the expected transfer is*

$$E_N[t^b] = \underbrace{\max\{\gamma^N(\beta\bar{f} - G), 0\}}_A + \underbrace{\max\{\beta\bar{f} - f^r, 0\}}_B,$$

while if she instead adopts a compliance program and respectively requests or does not request evidence from the manager, the expected transfer is

$$E_R[t^b] = \max\left\{ \underbrace{\bar{f} - G}_E, \underbrace{(1 - \rho_\sigma)(1 - \beta)\bar{f}}_F, \underbrace{\bar{f} - f^r}_H, 0 \right\},$$

$$E_R[t^b] = \max\left\{ \underbrace{E_R[f] - G + \max\{\beta\bar{f} - f^r, 0\}}_C, \underbrace{E_R[f] - f^r}_D, 0 \right\}.$$

Proof. See Appendix A.2.2. □

If the shareholder induces a breach, she must ensure that the manager (i) breaches the law; (ii) does not report evidence immediately after having breached; and (iii) does not report after the realization of payoff-relevant information, i.e., profit π or signal σ .

Suppose the shareholder does not adopt a CP. She then induces a breach by rewarding the manager if profit is high ($\pi = 1$), resulting in payment A . She must also reward the manager for not blowing the whistle at any time, resulting in additional payment B . Payment B comes *in addition* to payment A as it is paid for being silent, that is, it is being paid to the manager if he breaches the law and stays silent, but also if he does not breach the law as he then has nothing to confess and, thus, stays silent automatically.⁶²

Suppose now the shareholder adopts a CP. If she does *not* request evidence from the manager, payment C ensures that the manager breaches the law and does not blow the whistle immediately, while payment D ensures that the manager does not blow the whistle after the realization of signal $\sigma = 0$. If the shareholder *does* request to see evidence, she

⁶¹ Managerial strategy “breach and report to the shareholder” is irrelevant as it is weakly dominated by the strategy “breach and report to the authority,” because $f^r \leq f^R = \bar{f}$.

⁶² The strategy “adopt no CP and request evidence” is irrelevant as it entails a weakly higher expected transfer than the strategy “adopt a CP and request evidence”—see Appendix A.2.2.5.

rewards the manager if and only if he hands in evidence and does not blow the whistle. Noting that the shareholder cannot help to blow the whistle when she possesses evidence, the expected transfer must ensure that the manager does not (i) “not breach” (E); (ii) “breach and report no evidence to the shareholder” (F); and (iii) “breach and blow the whistle” (H). The following corollary qualitatively summarizes Lemmas 2.3 and 2.4.

Corollary 2.3 *Individual leniency weakly increases both the expected transfer to induce a breach and the expected transfer to prevent a breach.*

Proof. Comparing Lemmas 2.1–2.4 straightforwardly shows that the introduction of the reporting constraints weakly increases the expected transfers. \square

The authority faces a tradeoff when granting leniency to the manager: the reporting constraint weakly increases the expected transfer both to induce and to prevent a breach. Indeed, by Lemmas 2.3 and 2.4, individual leniency (i) weakly increases the expected transfer to induce a breach as the manager must be compensated for staying silent in stages 4' and 5', but (ii) also weakly increases the expected transfer to prevent a breach as she must compensate the manager for not “breaching the law and blow the whistle.”

2.5.2 Optimal Individual Leniency Policy

Provided the tradeoff faced by the authority, the following Proposition states the optimal individual leniency policy. We consider the authority granting either full individual leniency or no leniency. For the sake of brevity, we focus on the case in which monitoring through a CP is relatively precise, i.e., $\rho_\sigma > (1 - \rho_\pi) / \rho_\pi$. Denote by \tilde{f} and \tilde{F} thresholds on the managerial and corporate fine, respectively.

Proposition 2.3 *When the manager blows the whistle, the authority grants individual leniency if and only if either*

1. *the managerial fine is low ($\bar{f} \leq \tilde{f}$); or*
2. *the managerial fine is high ($\bar{f} > \tilde{f}$) and the corporate fine is low ($\bar{F} \leq \tilde{F}$).*

The authority does not grant corporate leniency when the manager blows the whistle.

Proof. See Appendix A.3. \square

The reason that the authority does not grant corporate leniency when the manager blows the whistle is that the shareholder failed to prevent her manager from breaching

the law and should optimally be punished for that. The intuition behind the authority's optimal individual leniency policy is explained in the next two paragraphs.

Suppose that the cap on the managerial fine is relatively low ($\bar{f} \leq \tilde{f}$). The manager's private incentive to breach the law is then relatively large, regardless of other parameters. Absent individual leniency, it is then relatively costly for the shareholder to prevent a breach, while costless to induce a breach. As a result, introducing the reporting constraint through individual leniency (i) has either no or a small upward impact on the expected transfer to prevent a breach, while (ii) substantially increasing the expected transfer to induce a breach due to the bribe necessary to keep the manager silent. Therefore, the authority optimally grants individual leniency when the manager blows the whistle.

Suppose now that the cap on the managerial fine is relatively high ($\bar{f} > \tilde{f}$). The manager's incentive to breach the law is then relatively low. Introducing the reporting constraint through individual leniency (i) increases the expected transfer to prevent a breach by G , and (ii) increases the expected transfer to induce a breach by $\beta\bar{f}$. Recall that the corporate fine \bar{F} and the investigation probability β are substitute instruments to deter corporate crime. Therefore, when the corporate fine is relatively low ($\bar{F} \leq \tilde{F}$), the authority sets a relatively high investigation probability β , resulting in $\beta\bar{f} > G$. Thus, the reporting constraint increases the expected transfer to induce a breach by more than the expected transfer to prevent a breach: the authority optimally grants individual leniency when the manager blows the whistle. By a symmetric reasoning, when the corporate fine is relatively high ($\bar{F} > \tilde{F}$), the authority sets a relatively low investigation probability β , resulting in $\beta\bar{f} \leq G$ in which case no individual leniency is optimal.

2.5.3 Individual Leniency and Compliance Programs

The following Proposition states the interaction between individual leniency and CPs.

Proposition 2.4 *Individual leniency reduces the scope of both the welfare detrimental and the welfare enhancing effect of compliance programs.*

Proof. By Lemmas 2.3 and 2.4 and their proofs in Appendix A.2, granting individual leniency introduces reporting constraints. If such a reporting constraint becomes binding, CPs are ineffective at reducing the expected transfer, because information asymmetries have become irrelevant. \square

The intuition is straightforward. If the authority grants individual leniency, then the reporting constraint may become binding, thereby determining the expected transfer. As a result, adopting a CP would not decrease the expected transfer, since it does not affect the reporting constraint. That is, adopting a CP does not affect the shareholder's

employment cost whenever the reporting constraint binds. Therefore, both the welfare detrimental and welfare enhancing effect of CPs are reduced.

The finding that the welfare enhancing effect of CP is reduced by individual leniency does *not* mean that individual leniency has a perverse effect on deterring corporate crime. After all, the authority chooses whether or not to grant individual leniency and would, therefore, only do so if it helps the authority to deter illegal activities. The result rather implies that individual leniency and CPs are substitute tools to decrease the shareholder's relative profitability of inducing a breach. Without individual leniency, a CP would be used by the shareholder to reduce the expected transfer needed to prevent corporate crime, thereby reducing the (costly) investigation probability. However, implementing an optimal individual leniency policy reduces the investigation probability by more through changing the shareholder's contracting problem.

2.6 Policy Implications and Discussion

The set-up of our model accommodates for a discussion of the U.S. as well as the E.U. practice. Under E.U. competition law, individuals are not sanctioned and, thus, individual leniency policy is non-existent: the model of Section 2.4 applies with a zero cap on the managerial fine ($\bar{f} = 0$). In contrast, U.S. antitrust law targets individuals and encompasses individual leniency policy: the models of both Sections 2.4 and 2.5 apply with a positive cap on the managerial fine ($\bar{f} > 0$).

U.S. and E.U. corporate leniency program. In both the U.S. and the E.U., the corporate leniency program (CLP) allows firms to blow the whistle in exchange for *full* immunity from corporate legal sanctions. Our results suggest that *partial* corporate leniency is more effective, because that would still incentivize the corporation to come forward, while not reducing the corporate sanction to zero. However, in practice it may be extremely difficult to determine the optimal amount of leniency, because the authority needs to estimate the corporation's benefit from the breach, which is different for each (type of) breach. The danger is then that the authority implements a policy granting too little leniency, which makes the CLP ineffective altogether. Therefore, although we find partial leniency to be optimal in theory, full leniency may be a practical second-best solution.⁶³ Also, we note that for violations involving horizontal strategic interaction, optimal policy should weigh our "partial leniency result" against *ex ante* strategic deterrence considerations of full leniency.

⁶³Spagnolo (2008) states that the number of leniency applications increased twentyfold after the introduction of *automatic* full immunity for the first corporation to self-report. This may suggest that an inappropriate level of partial immunity does not have the desired reporting and deterrence effect.

U.S. corporate leniency program. The U.S. CLP not only protects the corporation, but also provides involved employees with full immunity from legal sanctions. Hammond (2004) argues that such a “blanket” covering the entire corporation and its employees has the objective to incentivize employees to report illegal acts to their superiors so as to file for leniency together. However, we show that such a policy has a perverse effect: breaching the law becomes cheaper for the economic agent executing the illegal act, i.e., the employee. This makes corporate crime more attractive to the corporation as the employee does not need to be heavily compensated (indemnified) by its superiors to breach the law.

This result is particularly relevant for types of corporate crime that do not involve strategic interaction with other conspirators. The blanket covering employees then results in a lower expected cost of breaching the law for the entire corporation. However, when the illegal act involves coordination with others, which is the case in cartels, then our result should be balanced with the impact of the blanket on strategic considerations. Co-conspirators anticipate that the blanket reduces the corporation’s expected cost of corporate crime, which results in the fear that a rival corporation files for leniency, thereby *ex ante* destabilizing the conspiracy. Thus, it is important that competition policy balances the blanket’s indirect destabilizing effect through strategic interaction with our direct corporate crime stabilizing effect through reducing the expected indemnification costs.

U.S. individual leniency program. The U.S. individual leniency program (ILP) grants the involved employee full immunity from legal sanctions when coming forward with incriminating evidence. If the breach involves strategic interaction with a co-conspirator, such a policy destabilizes criminal cooperation as each conspirator fears that the other files for individual leniency.⁶⁴ We show that individual leniency not only entails such *horizontal* destabilization, but also *vertical* destabilization. Individual leniency makes breaching the law more expensive for the employee’s superior (the corporation), as the employee needs to be bribed not to file for individual leniency. This makes breaching the law relatively more expensive for the entire cooperation as a vertical structure.

However, we also show that individual leniency entails a perverse effect. Individual leniency not only increases the cost of a breach for the corporation (through the cost of bribing the employee not to file for leniency), it also increases the cost of preventing a breach for the corporation, because the employee must be compensated not to “breach the law and file for leniency” instead of not breaching the law.

Our results suggest that authorities should only grant individual leniency if the expected managerial fine is either particularly low or particularly high. In practice, how-

⁶⁴See, for example, Motta and Polo (2003) and Chen and Rey (2007).

ever, it may be very difficult to determine the managerial fine perceived by the manager. Providing individual leniency for all types of corporate crime may then be a practical second-best solution, although it entails the perverse effect outlined above and may, thus, increase the profitability of some types of corporate crime.

Vertical race to the courthouse. The ILP has been used rarely in practice (Spagnolo, 2008). Hammond (2004) argues that this is not a sign that the ILP is ineffective: an employee considering to blow the whistle through the ILP can tell its superior who then has an incentive to file for leniency on behalf of the entire corporation as a “vertical structure” through the CLP. Therefore, it is argued that the mere existence of the ILP encourages the usage of the CLP.

However, the leniency policy as outlined in this chapter entails another effect by misaligning the incentives of the corporation and the employees. Our results suggest that it is optimal *not* to provide the employee (corporation) immunity when the corporation (employee) files for corporate (individual) leniency. Such a policy effectively introduces a “vertical race to the courthouse” between the corporation and the employee: the corporation and the employee cannot trust each other to stay silent.

Compliance programs and fine reductions. While “the [European] Commission considers that it is not appropriate to take the existence of a compliance programme into account as an attenuating circumstance for a cartel infringement,” the U.S. Sentencing Guidelines allow for a mitigation of the corporate fine when the corporation had a well-designed CP in place at the time of the infringement, in some cases up to 95%.⁶⁵ Our results suggest that it is not optimal to apply such a fine reduction. The reason is that monitoring through a CP can be used to indeed prevent corporate crime, but also to encourage it. Thus, our results confirm the European Commission’s view.

However, we do realize that our model is based on the monitoring aspect of CPs and leaves out practicalities of how exactly the CP is implemented. Therefore, the potentially perverse effect of reducing information asymmetries may not always be present. In particular, the perverse effect may be less relevant when the shareholder delegates the implementation and execution of the CP to a third party like an in-house or external lawyer that can credibly live up to its reputation.

Desirability of compliance programs. Focusing on the monitoring aspect of CPs, we argue that CPs may be beneficial in the fight against corporate crime when individual sanctions are low, but detrimental when individual sanctions are high. Although we

⁶⁵See fn. 35 and 27, respectively.

do not want to make the claim that firms adopt CPs with the only objective to reduce information asymmetries so as to promote its employees to misbehave, the result does however suggest a potential perverse effect of increasing the monitoring of harmful activities. Since individual sanctions are non-existent in the E.U. and relatively high in the U.S.,⁶⁶ our results suggest that monitoring behavior through CPs is more desirable in the E.U. than in the U.S.

2.7 Concluding Remarks

In this chapter, we examined the desirability of the firm's monitoring effort and its impact on optimal (competition) policy. We stressed that the information obtained by monitoring employees through a CP may be used to prevent corporate crime, but also to encourage corporate crime. Thus, we argued that corporations having adopted a CP should not automatically qualify for a discount on the corporate fine, which contradicts the U.S. Federal Sentencing Guidelines. Also, we provided arguments that the corporate leniency program may be improved upon by granting partial immunity instead of full immunity to the corporation, while granting no immunity to the involved individuals. Finally, we showed that for some types of corporate crime an individual leniency program entails the perverse effect of actually encouraging breaches of the law.

We assumed that a CP is costless to implement so as to not complicate the analysis with exogenous fixed costs. If the adoption of a CP entails a fixed cost, then the qualitative results remain unchanged; the only difference would be that, in equilibrium, a CP is adopted for less parameter values, because the shareholder would compare its cost with the reduction in salary cost caused by the CP.

Our results may be reinterpreted in light of the literature on collusion between the middle and lower layer of a three-tier hierarchy—see for instance Faure-Grimaud, Laffont and Martimort (1999) for a model in an adverse selection framework. Our hierarchy can be seen as one in which the highest layer has delegated (some) authority to the middle layer that, in turn, delegates to the lower layer. Our results then imply that improving the contracting framework at the bottom, in our model through lower information asymmetries, may either reduce or increase the payoff of the highest layer. This is, to the best of our knowledge, in contrast to the existing literature in which such improvements always negatively affect the highest layer.⁶⁷

⁶⁶Some E.U. Member have however criminal laws on the national level—see fn. 31.

⁶⁷We are grateful to Yeo-Kee Cho for pointing this out.