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# Discussion paper

***OPTIMAL DETERRENCE OF ILLEGAL  
BEHAVIOR UNDER IMPERFECT CORPORATE  
GOVERNANCE***

By  
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# Optimal deterrence of illegal behavior under imperfect corporate governance\*

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December 18, 2014

## Abstract

We study the optimal design of liability schemes (at the corporate or individual level) when the objective is to deter socially harmful corporate behavior without discouraging productivity enhancements. We assume that firms face agency problems between shareholders and managers (moral hazard) and that unlimited sanctions on individuals are not available. We show that pure corporate liability rules can induce the first-best outcome only if firms can condition compensation on detection and the enforcement system is good enough. In other circumstances, unless individual sanctions can be very high, optimal mechanisms typically impose both corporate and individual liability.

*JEL Classification numbers:* D82, K21, L49

*Keywords:* illegal behavior, deterrence, agency problems, moral hazard, corporate liability, corporate crime.

## 1 Introduction

In order to maximize profits, firms may act against the public interest: pollute the environment, subject their employees or customers to health hazards, deceive consumers, take anticompetitive

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actions, etc. In order to be deterred, socially harmful actions taken by corporations or their representatives must be punished. How to best achieve deterrence without distorting incentives for improving efficiency? In particular, should legal sanctions for unlawful actions be imposed on corporations or on the corporations' officers or managers?

Different legal systems answer this question in different ways (and also treat different corporate misbehaviors differently). For example, in the United States both the firm and its managers can be punished for antitrust violations, the latter with criminal sanctions. In contrast, at the level of the European Union (EU), sanctions for violating competition law only apply to the infringing firms (as well as to a number of related corporate entities on the basis of parental liability). Hence, in the EU, the individuals who were actually instrumental in violating the law are not directly punished; sanctions apply only to firms, that is, to shareholders.<sup>1</sup>

As the governance of large firms is typically complicated by various agency problems, the ability of shareholders to control managers may be quite limited. As a result, shareholders bearing the burden could be problematic. When shareholders (or corporate boards) are unable to exercise full control on the firm's managers, they may resort to low-powered incentive schemes so as to avoid corporate liability, thereby not solving the internal inefficiencies resulting from agency. In other words, only sanctioning firms may induce productive inefficiency (higher costs), which in turn may lead to allocative inefficiency (higher prices). Hence, the efficacy of pure corporate liability systems can be called into question, and one may wonder exactly when (if at all) one would want to resort to them.

This paper studies the optimal design of deterrence schemes when there are agency problems within firms and individual sanctions are limited. On the one hand, the latter assumption allows us to investigate the effect on deterrence of having at least some individual sanctions. On the other hand, it reflects the fact that it may be impossible to subject individual managers to sanctions whose size is commensurate with the consequences of their actions.

Indeed, there are many practical, deontological or economic reasons why corporate executives may not be targeted with high sanctions in reality. For instance, prosecutors may have other priorities than pursuing complex, resource-intensive, corporate crime cases.<sup>2</sup> Besides, having

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<sup>1</sup>A number of jurisdictions within the EU provide for (administrative or criminal) sanctions on individuals in case of violation of national competition law. For instance, in the Netherlands, the involved managers can be fined; in the UK or France, jail sentences can be handed over.

<sup>2</sup>For the recent financial crisis, which did not lead to the prosecution of any high-level executive in the US, that is one of the main reasons put forward by Rakoff (2014). In France, criminal sanctions against competition law violators were introduced in 2008 (article L. 420-6 of the Code of Commerce); to this date, no case has been brought to court.

managers violating consumer law or competition law serve a 25 year-long prison term for taking advantage of consumers would look excessive to a majority of observers on ethical grounds, at least in a number of jurisdictions. Finally, marginal deterrence considerations, that is, the necessity not to induce potential violators to choose for even more serious offenses than the ones to be discouraged, may also be relevant.<sup>3</sup>

Admittedly, there are also limits to the sanctions that can be inflicted on corporations. However, those may not be binding. For example, in the EU, the maximum fine that can be imposed on a firm for a violation of competition rules cannot exceed 10 % of its total turnover in the preceding business year, a constraint that, in practice, is binding only for very few firms.<sup>4</sup> Consequently, we take it that there is a limit to the sanctions that can be imposed on individuals, while there is no such limit for firms. (When appropriate, we will comment on the implications of limits on corporate liability.)<sup>5</sup>

To assess the incentive effects of various sanctioning systems, the paper analyzes a strategic environment in which public authorities have to decide on a set of liability rules at the level of the corporation (the principal) and/or the manager (the agent). The relationship between the principal and the agent is characterized by moral hazard. Specifically, the agent may choose to slack, work at productivity improvements, or engage in an illegal but very profitable activity. One can think, for instance, about providing misleading information about the product to the buyer, leading to increased demand for the firm and a higher bonus for the sales manager. Alternatively, one can think of anticompetitive behavior, such as taking part in a price-fixing cartel. The agent's choice is not directly observed by others, but law infringement is detected with positive probability *ex post*. All actions (probabilistically) affect (observable) corporate profits, with the illegal action having higher private returns than the others, but being socially harmful (which is the reason why it is prohibited).

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<sup>3</sup>See Mookherjee and Png (1994) for a classical treatment of marginal deterrence. Even within the class of “economic” crimes, there is a wide dispersion of sanctions. For instance, in the Netherlands, managers of firms violating competition laws can be fined with at most 450,000 euros, while other economic infractions can lead to a 6-year prison term under the “Wet economische delicten”. (Prison terms are exceptional, however.)

<sup>4</sup>In the Netherlands, managers of firms violating competition law can be fined with at most 450,000 euros, while the cap for corporate fines is 10% of annual turnover; clearly, the latter is much higher in most cases. Although there is some evidence of firms strategically organizing their undercapitalization when they operate in corporate crime-prone sectors (Ringleb and Wiggins, 1990), corporations are not typically subject to sanctions that bring them to the verge of bankruptcy. To take a well-known scandal, in 2012, Glaxo-Smith-Kline agreed to pay 3 billion dollars for illegal marketing and withholding of data concerning the negative side effects of a number of its products, especially anti-diabetes drug Avandia, over the period 1994-2007. That amount represented 37% of reported corporate profit for year 2012 only.

<sup>5</sup>In the paper we abstract away from private lawsuits for damages which could arise from the conviction of a firm. That is an additional argument for taking the maximum liability to which firms can be subject as very high.

In line with free-market, capitalistic practice, we assume that public authorities are not able or not willing to dictate the kind of contract that the principal should offer to the agent, or otherwise subject the firm to full *ex ante* regulation. Instead, the State runs a liability system (whether of an administrative or criminal kind) that imposes sanctions on the principal and/or the agent when the illegal action is detected *ex post*. Hence, the State intervenes only in case misbehavior is detected. More precisely, public authorities can punish the principal and/or the agent in case of detection, but they cannot reward them in this or other circumstances. We understand that this is not an obvious requirement as a matter of pure theory. A standard regulatory (contract-theoretic) approach would assume that a designer can subject firms to any punishment-reward scheme based on all possible observables, and would proceed to maximize social welfare subject to the relevant information and participation constraints.<sup>6</sup> However, we think that most observers would agree that, say, a consumer protection agency or an antitrust authority is not in the business of subsidizing firms or running complicated or lucrative taxation schemes. We take this as a constraint on the design of incentive mechanisms, and thus restrict attention to liability schemes.<sup>7</sup>

Our third main assumption is that the principal does not have additional information that the public authorities would want to elicit. That is, in real time, shareholders do not know more about the incidence of law infringement than law enforcers do: managers have the authority to run the business on a daily basis and only intermittently report to shareholders (or their representatives). As a result, both public authorities and shareholders observe the same thing: realized profits and, in case an enforcement system is put in place (and with some probability), whether the illegal action occurred in the past. In our view, for firms where control and management are separated, this assumption is quite appropriate as a first approximation.<sup>8</sup>

Absent any other restrictions on the design of liability mechanisms, symmetric information would imply that public authorities are indifferent to the subject of liability. In the technical literature, this result is sometimes referred to as the Equivalence Principle.<sup>9</sup> Since firms and managers are in a contractual relationship, the allocation of liability does not matter, as the contracting

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<sup>6</sup>See Hiriart and Martimort (2006) for such an approach.

<sup>7</sup>Technically, in our model this restriction prevents public authorities from resorting to large (but costly) subsidies that would increase the number of cases in which the first-best can be implemented. In practice, the presence of information rents would clearly invite entry by firms. It is interesting to study which mechanisms public authorities would design if they could condition sanctions or rewards not only on detection, but also on the level of profit. One interpretation of such mechanisms is that they would correspond to the joint effects of the liability system and corporate taxation. In this paper, we study the effects of the liability system in isolation.

<sup>8</sup>If shareholders (or corporate boards) knew more than public authorities, then the latter might want to design mechanisms that facilitate the elicitation of that information. So-called leniency programs for cartel offenses belong to this category. For a recent treatment of corporate and individual leniency programs, see Angelucci and Han (2012).

<sup>9</sup>See Kornhauser (1982) and Newman and Wright (1990) for early statements.

pair internalizes any threat of external sanction. In the presence of contracting inefficiencies which weaken the ability of the principal to control the agent's behavior, sanctions should obviously be applied to the latter. In our context, one can thus expect (and indeed we will show) that individual sanctions will be used to the maximum extent; however, as managers have limited liability, even such sanctions may not be sufficient to reach the first-best outcome.

In the paper, we distinguish whether the compensation package of the manager can be conditioned on law violation or not. The issue is whether, in case of detection, firms are able to withdraw compensation (through either contractual clauses or recursive liability actions), or to indemnify managers for the individual sanctions they receive. For example, is a firm allowed to reimburse its manager's fine, or decrease his wage, or sue him for damages in case he has chosen an illegal action? Or do labor and/or liability laws prevent such moves? National legal systems, when they give clear answers, differ on these issues. For example, in France, labor law prohibits financial penalties for employees, who can only be subjected to disciplinary sanctions in case of misconduct.<sup>10</sup> In the Netherlands, lawyers are divided on the issue as to whether a firm can indemnify an employee sanctioned for wrongdoing.<sup>11</sup> Therefore, we consider it to be of interest to study both cases.

In this environment, we show the following. First, as is intuitive, high enough individual sanctions always allow society to reach the first-best outcome, while, in the absence of corporate liability, insufficient individual sanctions always lead to harmful behavior remaining un-deterred.

Second, pure corporate liability allows society to achieve the first-best outcome only when it is possible for firms to withdraw compensation in case managers violate the law *and* the quality of the enforcement system (the probability with which a violation is detected) is sufficiently high. If one of those conditions is not met, then shareholders prefer to offer managers weak effort incentives, and productive inefficiency results, leading to second-best outcomes. Hence, restrictions on the ability of firms to condition compensation on detection may stand in the way of effective deterrence. So may an enforcement system that detects violations with very low probability.

Third, in many situations, pure liability systems are suboptimal, and society may need to punish both the firm and its managers so as to induce the first-best outcome. Dual systems eliminate the worst outcome by providing corporations with sufficient incentives to prefer not infringing the law. They also enlarge the set of circumstances in which the first-best outcome can be implemented

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<sup>10</sup>See article L1331-2 of the French labor code (as enforced on January 10, 2014).

<sup>11</sup>In one case, which is still on appeal, the Dutch competition authority increased the corporate fine on the firm following its announcement that it would indemnify the sanctioned managers. See case 6888 (LHV) at <<https://www.acm.nl/en/publications/publication/6719/NMa-fines-Dutch-National-Association-of-General-Practitioners-for-illegal-establishment-recommendations/>> (January 17, 2014).

by helping firms alleviate their agency problem with managers. Indeed, individual sanctions help compliant firms incentivize managers.

Fourth, in some situations, the outside options of managers affect the ability of society to reach the first-best outcome. Under pure individual liability, when firms cannot contract on law violation, it is harder to discipline managers having high reservation wages. By contrast, under pure corporate liability or a dual system, when firms can do so, the opposite effect obtains. The documented upward trend in the compensation of top executives in the past decades may therefore have affected the level of deterrence in one direction or the other depending on the liability regime in force.<sup>12</sup>

Thus, we uncover several mechanisms at play in the deterrence of corporate misbehavior: the second-best nature of pure corporate liability regimes, the dependence of corporate liability regimes' performance on the ability to condition the agent's compensation on a violation of the law; the independent role of the quality of the enforcement system as measured by the probability of detection; the interaction between internal contracting and externally-imposed individual sanctions; and the role of managers' outside options. To our knowledge, none of these five aspects has previously been emphasized in the literature.<sup>13</sup>

This paper is organized as follows. We first go over some related literature (section 2). We then describe the model (section 3). Solving the model, we first deal with the case where the principal can only contract with the agent on the realized level of profit (section 4) and then extend the analysis to the case where public law enforcement allows the principal to contract on an additional event: detection (section 5). Section 6 concludes by giving a number of policy implications.

## 2 Literature review

This paper relates to the legal and economic literature on the prevention of torts as well as the one on the deterrence of corporate crime through public enforcement. The distinction between these two literatures is largely conventional. It is typical of the first to assume that damages can be collected with probability one without any direct social cost (as a well-identified victim is always there to sue injurers). In contrast, the second branch of the literature usually assumes that

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<sup>12</sup>See e.g. Gabaix and Landier (2008) and the references therein for a summary of the sixfold increase in US CEO compensation between 1980 and 2003, and a potential explanation for this phenomenon.

<sup>13</sup>Aubert (2009) also discusses the first aspect; see Section 2 for a brief description of how her paper differs from ours.

detection is probabilistic and costly (as public authorities have to expend resources on uncertain investigations), and that sanctions inflicted on economic agents (especially, non-pecuniary ones) are also socially costly.

The literature on optimal tort liability rules in the presence of a principal-agent relationship has developed with particular reference to environmental damages, the judgment-proofness of polluting firms, and the possibility of extending their liability to their financiers or banks. Hiriat and Martimort (2006) offer a state-of-the-art contract theory treatment of this problem. In a model where a cashless firm in a contractual relationship with a financier chooses the level of precautions that (probabilistically) determine the level of harm, they show that the inability of public authorities to directly regulate the contract between the firm and the financier motivates the extension of liability to the latter, thereby also incentivizing the financier.<sup>14</sup> As motivated in the Introduction, contrary to those authors, we do not assume that the designer can subject the firm or its financier to complete incentive regulation. As we focus on hidden violations of the law and public enforcement, we also assume that the probability of conviction is less than one.

In a frictionless world, the allocation of liability between a corporation and its representative agents does not matter (the Equivalence Principle). If one assumes that there are no insolvency concerns on either party and that, through complete compensation contracts or other indemnification schemes, stakeholders can allocate the burden of sanctions between them as they wish, then the choice between individual and corporate liability is irrelevant, as the contracting parties jointly internalize any external threat of sanction. To the best of our knowledge, Kornhauser (1982) was the first to make this argument formal in the context of tort liability.<sup>15</sup> In practice, however, these assumptions are unlikely to be satisfied.

Assuming that firms could completely control employees, early Beckerian (1968) approaches to corporate crime called for simple fines on corporations on the ground that fines are less socially costly than other kinds of punishment (see e.g. Landes, 1983). However, if firms are protected from the full power of sanctions by limited liability or other (strategic) insolvency aspects, then the optimal policy may require non-pecuniary sanctions, which therefore requires that liability be extended to the individuals who were instrumental in violating the law (Werden and Simon, 1987). This said, infinitely strong sanctions on individuals are unlikely to be optimal in the presence of

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<sup>14</sup>See also Segerson and Tietenberg (1992), Boyer and Laffont (1997), Pitchford (1995), Lewis and Sappington (1999), Lewis and Sappington (2001), and Balkenborg (2001).

<sup>15</sup>In Kornhauser's model, the level of care exerted by the agent does not affect his productivity, and the principal can condition the wage paid only on the court's decision. As a result, the principal can always write an insurance clause (under individual liability) or an indemnification clause (under corporate liability).

judicial errors (Sidak and Block, 1980). Polinsky and Shavell (1993) formalize the intuitive idea that, if the firm cannot completely control its employees, and, hence, cannot incentivize its workers to take the desired action, then individual liability may be needed to achieve deterrence. In other words, if the maximal sanction that a firm can impose on an employee is smaller than the harm his or her actions bring about, then additional external sanctions are required. In the absence of individual sanctions, agency problems between the firm and its employee may cause optimal corporate sanctions not to equal expected harm under strict liability (Shavell, 1997).

The effects of allowing firms to indemnify employees targeted with individual sanctions are of particular interest. We know of only one economic paper addressing this issue. Mullin and Snyder (2010) introduce a formal model with judicial errors, and show that targeting individuals with non-indemnifiable sanctions has the inefficient side effect of exposing employees at law-abiding firms to the risk of mistaken prosecution, thus calling for corporate sanctions and indemnification of individual sanctions.

Our model takes the firm's monitoring possibilities as given. Those could, however, be under the control of the corporation. In that case, determining the optimal deterrence scheme requires taking into account the (possibly deleterious) impact of corporate sanctions on investment in monitoring (Arlen, 1994). Similarly, we use fixed sanctions based on detection, and do not consider the cases where leniency or whistle-blowing programs, or cooperation with prosecution, could affect the level of sanctions. (See Spagnolo, 2008 for an early review of this line of literature.) Of course, a dual liability system offers the possibility of having a corporate leniency scheme and a whistle-blowing scheme operating in tandem.

In a recent paper, Motta and Fabra (2013) study the problem of optimal deterrence when firms are subject to bankruptcy risk because of both adverse market shocks and antitrust fines. They abstract away from the agency problem between principal and agent, and do not model the possibility that external enforcement may influence internal firm efficiency: it is assumed that the agent can only take two possible actions (lawful/unlawful). They show that large corporate fines might not induce optimal deterrence. Individual sanctions are therefore called for, and the optimal sanctioning scheme allows for bigger sanctions in good times than in bad times. Our paper is complementary to theirs since it shows, conversely, that limitations on the ability to punish managers typically make it optimal to sanction firms as well.

As far as the economic motivation is concerned, Aubert (2009) is the closest paper to ours, as it also looks at the interaction between enforcement and the incentives for efficient production.

Her set-up, however, is very different from ours, and the paper remains unpublished. It uses a rich and complicated model, specifically tailored to the case of price-fixing, building upon the infinite repetition of a market game between several firms. In each firm, the agent can choose both a level of effort that directly affects profit as well as the type of market activity (competition, collusion, deviation). As in our paper, it is argued that strong incentive contracts may foster collusion so that principals may prefer to weaken incentives in order to comply with the law. Because of reduced internal efficiency, welfare losses may arise even when the industry remains competitive. Individual sanctions are preferred as they foster internal efficiency in competitive firms while worsening it in colluding firms.

### 3 Model

We consider a game between three risk-neutral players: public authorities,  $S$  (for society), the principal,  $P$ , and the agent,  $A$ . One interpretation is that  $P$  stands for the shareholders of a corporation (or a governing body thereof), and  $A$  for the firm’s manager. The game proceeds in three stages.  $S$  moves first by imposing a *liability scheme* or *mechanism* on  $P$  and/or  $A$ . Next,  $P$  proposes a *wage schedule* or *contract* to  $A$ . Finally,  $A$  chooses an *action*, which determines the (possibly random) payoffs. The details on the various elements are given below. Technically, the game is a sequential-move game with perfect information, which we solve for its subgame perfect equilibria (SPE). We are mostly interested in the SPE-action that  $A$  will ultimately choose. Given perfect information, this action is generically unique and, by an abuse of language, we will often identify that action with the “outcome” of the game.

We now fill in the details.  $A$  can choose between four actions:  $\mathcal{Q}$ ,  $\mathcal{N}$ ,  $\mathcal{R}$ , and  $\mathcal{C}$ .  $\mathcal{Q}$  stands for refusing the contract (“quitting”). This yields  $A$  a reservation utility  $u \geq 0$ , results in gross profit of 0 for  $P$ , and generates the worst possible outcome for  $S$  (no economic activity). By choosing  $\mathcal{N}$ ,  $A$  does not incur any personal cost and guarantees  $P$  a gross profit of  $\pi_L \geq 0$ . ( $\mathcal{N}$  can be interpreted as the outcome of “doing nothing” or “slacking”.)  $\mathcal{R}$  consists for  $A$  in incurring (private) effort cost  $c$  so that  $P$  earns profit  $\pi_H > \pi_L$  with probability  $p \in (0, 1)$  and  $\pi_L$  otherwise. ( $\mathcal{R}$ , the “right thing”, can be interpreted as effort to reduce cost, whose outcome is uncertain.) Finally,  $\mathcal{C}$  involves (private) effort cost  $c$  for  $A$  and yields  $P$  gross profit  $\pi_H$  for sure.<sup>16</sup> ( $\mathcal{C}$  can be interpreted as participation in criminal activities such as collusion.)

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<sup>16</sup>The fact that both  $\mathcal{C}$  and  $\mathcal{R}$  have the same private cost is inessential but simplifies the exposition. All that matters is that  $\mathcal{C}$  exhibits a higher return on effort than  $\mathcal{R}$ .

The choice of  $\mathcal{C}$  is socially undesirable and is probabilistically detected through (exogenously set) enforcement activities. Here, we need to be precise about what the legal system achieves. Violations of the law may become public through the actions of prosecutors or regulators. However, detection in that sense does not automatically lead to sanctions. For example, think of the situation, as in the EU and several of its Member States, where the antitrust authority's decision is reviewed by a court, and only the court eventually decides whether sanctions are legally appropriate. From the point of view of sanctioning, only the probability of *conviction* matters. Denote by  $\lambda^A \in [0, 1]$  the probability that  $A$  is sanctioned when  $\mathcal{C}$  has been chosen by  $A$ , and by  $\lambda^P \in [0, 1]$  the probability of  $P$  being sanctioned in that case. The two conviction rates can be different; in practice, one expects  $\lambda^A \leq \lambda^P$ , as it is typically harder to convict an individual in criminal or criminal-like proceedings than to inflict an administrative sanction to a corporation.<sup>17</sup>

Next to public sanctioning, the outcome of public enforcement itself may be used as a contractible event for the private relationship between  $P$  and  $A$  under tort, contract, or labor law. However, the details of the legal environment matter here. Following the sanctioning of a firm, it may be possible for it successfully to withdraw compensation or file a liability claim against the manager in some cases, but it is not clear that the contingency on which it will be possible to act will arise with probability  $\lambda^P$ . Indeed, in many legal systems, the personal liability of the manager will involve proving intent or (gross) negligence on his part so that the likelihood of the previous actions prevailing in court is actually lower than  $\lambda^P$ . In some instances, following some substantive or evidentiary rules, no action at all will be admissible unless the manager is convicted of a criminal offense. Even in that latter case, the legal system may prohibit the indemnification of managers. Thus, the existence of a contingency on which lawfully to condition the payment scheme of the manager is essentially disconnected from sanctioning. We will thus denote this contingency by  $D$  and will assume that it arises with probability  $\lambda \in [0, 1]$ .

$A$ 's choice is unobservable and we assume that  $P$  and  $A$  can contract on profit only. We write  $L$  for the occurrence of low profit and  $H$  for the occurrence of high profit in the absence of contractible detection.  $D$  stands for the contractible detection of  $\mathcal{C}$ .<sup>18</sup> Formally, a wage contract,  $w$ , specifies a wage  $w_s$  for each of the three possible states,  $L$ ,  $H$ , or  $D$  that might come true. As

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<sup>17</sup>Indeed, the likelihood of conviction of a manager in a criminal case may not be high, as the standard of proof (e.g., beyond reasonable doubt) may be higher than the one (e.g., preponderance of evidence) applied to administrative fines on corporations. In criminal cases, procedural guarantees also typically increase with the size of sanctions (the gravity of the offense). Thus, even if the fact that a manager has chosen an unlawful course of action may become public, conviction rates may differ.

<sup>18</sup>For simplicity, the choice of  $\mathcal{C}$  leads to high profit with probability one. So, the combination of low profit and "detection" never arises in this model.

argued above, whether  $D$  arises at all depends on the context: legal requirements may restrict the subset of events on which it is possible to write an enforceable contract or in which non-contractual legal actions can be introduced. In section 4 we discuss the simpler case where the wage cannot be conditioned on  $D$ ; in section 5 we allow such conditioning, hence, in that case,  $P$  can directly stimulate or discourage unlawful behavior.

$A$  wants to maximize his expected wage net of personal costs and possible sanctions.<sup>19</sup> He faces limited liability in his relationship with  $P$  in that wages have to be non-negative.<sup>20</sup>  $A$  also faces limited liability in his relationship with  $S$  in the sense that there is a cap  $\bar{l} \geq 0$  on the sanctions that  $S$  can impose as part of a liability scheme. The main goal of the paper is to investigate the effects of this cap.

$P$  seeks to maximize expected net profit, which equals expected gross profit resulting from  $A$ 's action, minus the wage paid to him, minus the possible fines payable to  $S$  in accordance with the liability mechanism in place.  $P$  has a reservation utility of 0, which means that she will not be willing to operate if the liability scheme leaves her with losses on average. In most of the paper, we assume that she has “deep pockets”. That is, there is no upper limit to the sanctions that  $S$  can impose on her as part of a liability mechanism.

$S$  is restricted to the design of simple liability schemes, that is,  $S$  can impose sanctions on  $A$  and  $P$  only upon conviction, and is prevented from subsidizing  $P$  or  $A$  in states  $L$  and  $H$ . (Firms also cannot be paid for violations but that would never be optimal.) This restriction is motivated by the assumption that we are in a context of “light” government intervention (*ex post* liability rather than *ex ante* regulation). We write  $l^A$  and  $l^P$  (with  $l^A, l^P \geq 0$ ) for the fine imposed on  $A$  and  $P$ , respectively, in case of conviction. Thus, a liability scheme is a pair  $(l^P, l^A)$  with  $l^A \leq \bar{l}$ . We speak of *fines* or *sanctions*, but the reader should keep in mind that those stand for any action by  $S$  that brings negative utility to  $P$  or  $A$ .  $S$ 's preferences are defined with respect to the action taken by  $A$ , and we assume that  $\mathcal{R} \succ_S \mathcal{N} \succ_S \mathcal{C} \succ_S \mathcal{Q}$ . (In a possible underlying structural market model, a benevolent social planner caring about total surplus would prefer competitive pricing with low costs to competitive pricing with high costs to collusive pricing with high costs to no economic activity at all.)<sup>21</sup>

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<sup>19</sup>Real-world managers are likely to display some risk aversion but a full treatment of risk aversion does not bring a lot of insights in our limited-liability environment.

<sup>20</sup>It is well-known that under risk neutrality, there would be no real agency problem between  $P$  and  $A$  in the absence of limited liability.  $P$  could simply “sell the firm” to  $A$  against a fixed payment, thus letting the latter bear the full consequences of his action.

<sup>21</sup>We do not need to define the intensity of public authorities' preferences as we do not assign a cost to public funds.

The following table summarizes the payoffs to  $P$  and  $A$ .

Action of $A$	payoff to $A$	payoff to $P$
$\mathcal{Q}$	$u$	$0$
$\mathcal{N}$	$w_L$	$\pi_L - w_L$
$\mathcal{R}$	$pw_H + (1 - p)w_L - c$	$p(\pi_H - w_H) + (1 - p)(\pi_L - w_L)$
$\mathcal{C}$	$(1 - \lambda)w_H + \lambda w_D - c - \lambda^A l^A$	$(1 - \lambda)(\pi_H - w_H) + \lambda(\pi_H - w_D) - \lambda^P l^P$

Technically, limited contractual liability for  $A$  means that  $w_s \geq 0$  for all  $s \in \{L, H, D\}$ . Limited criminal liability for  $A$  means that  $l^A \leq \bar{l}$ , where  $\bar{l} \geq 0$  is exogenous. The prohibition of subsidies by  $S$  means that  $l^A, l^P \geq 0$ .

In order to make the game interesting, we assume throughout the paper that it is efficient for  $P$  and  $A$  to contract in the first place and that contracting on  $\mathcal{N}$  is inefficient, that is:

$$p\Delta\pi > c \text{ and } \pi_L \geq u, \quad (1)$$

where  $\Delta\pi = \pi_H - \pi_L$ .

To conclude this section, we introduce some additional terminology. We will say that, given a liability scheme  $(l^P, l^A)$ ,  $P$  can *implement* action  $a$  of  $A$  if there exists a wage schedule  $w$  such that, given  $(l^P, l^A)$  and  $w$ , it is a best response for  $A$  to choose  $a$ . Given  $(l^P, l^A)$ ,  $P$  can implement action  $a$  *without paying rents* if  $a$  can be implemented with  $A$  being indifferent between  $a$  and  $\mathcal{Q}$ , that is, if  $P$  does not have to pay  $A$  a wage in excess of what is needed to guarantee his participation. We say that  $S$  can *induce* action  $a$  of  $A$  given  $\bar{l}$  if there is an SPE of the game in which the agent chooses  $a$ . As already indicated, in this case, with some abuse of language, we will also say: the *outcome* is  $a$ .<sup>22</sup>

## 4 $P$ and $A$ cannot contract on detection

Labor or liability law may prevent  $P$  from conditioning  $A$ 's compensation on, or exercising a recursive action upon, detection. In this section, we assume that such restrictions are in place and that  $A$ 's wage can only be conditioned on the realized market profits. Hence,  $\lambda = 0$  and, for simplicity, we take it that the wage contract has to satisfy  $w_H = w_D$ . We consider three cases: (i)

<sup>22</sup>Formally, but neglecting ties, denote the best response of  $A$  given  $l$  and  $w$  by  $a^*(l, w)$ ; let  $w^*(l)$  be the best response of  $P$  to  $l$  given that  $A$  will always choose  $a^*(l, w)$ , and let  $l^*$  be the optimal liability scheme for  $S$  if  $P$  always chooses  $w^*(l)$  and  $A$  always chooses  $a^*(l, w)$ . Then the outcome is  $a^*(l^*, w^*(l^*))$ .

liability only on  $P$  (pure corporate liability); (ii) liability only on  $A$  (pure individual liability); and (iii) a dual system with liability on both  $P$  and  $A$ . In each case, we will study what action of the agent can be induced given the exogenous upper bound,  $\bar{l}$ , on the liability of  $A$ . As a benchmark, we first study what will happen in the absence of enforcement.

#### 4.1 Absence of enforcement

This case corresponds to  $\lambda^A l^A = \lambda^P l^P = 0$ . It is clear that in that case  $A$  will never choose  $\mathcal{R}$ : for any wage schedule,  $A$  prefers either  $\mathcal{N}$  or  $\mathcal{C}$ . Formally, writing  $\Delta w$  for  $w_H - w_L$ , to implement  $\mathcal{R}$ , the wage schedule needs to satisfy

$$\begin{aligned} p\Delta w &\geq c (\mathcal{R} \succ_A \mathcal{N}) \\ \Delta w &\leq 0 (\mathcal{R} \succ_A \mathcal{C}) \\ w_L + p\Delta w &\geq c + u (\mathcal{R} \succ_A \mathcal{Q}) \end{aligned}$$

as  $A$  must prefer  $\mathcal{R}$  to each of  $\mathcal{N}$ ,  $\mathcal{C}$  and  $\mathcal{Q}$ . Clearly, these conditions cannot be simultaneously satisfied. If  $P$  offers incentives to induce profit  $\pi_H$ , then  $A$  will choose  $\mathcal{C}$ ; if  $P$  offers a flat wage contract, then  $A$  will choose  $\mathcal{N}$ . Hence,  $P$  can only choose between implementing  $\mathcal{N}$  or  $\mathcal{C}$ . As each of these can be implemented without paying rents (for example,  $\mathcal{N}$  with  $w_L = w_H = u$ , and  $\mathcal{C}$  with  $w_L = 0, w_H = u + c$ ), and since  $\mathcal{C}$  is preferred to  $\mathcal{N}$  ( $\Delta\pi > c$ ),  $P$  will implement  $\mathcal{C}$ , the worst possible outcome for  $S$ . Thus, we have:

**Proposition 1.** *In the absence of enforcement, the outcome is  $\mathcal{C}$  (with  $P$  choosing an incentive contract with  $w_H = u + c$  and  $w_L \in [0, u]$ ).*

#### 4.2 Corporate liability

Suppose now that there is an enforcement system that allows for the lagged detection of  $\mathcal{C}$ :  $P$  is sanctioned with probability  $\lambda^P \in (0, 1]$ . In this subsection, we assume that there is no personal liability, that is,  $\lambda^A l^A = 0$ .

It is clear that also in that case,  $P$  cannot implement  $\mathcal{R}$ . The argument is exactly the same as in the previous subsection. Hence, the real choice for  $P$  is between  $\mathcal{N}$  and  $\mathcal{C}$ .  $S$  prefers  $\mathcal{N}$  to  $\mathcal{C}$  and also has the means to induce  $\mathcal{N}$ : if  $S$  severely punishes  $\mathcal{C}$  by setting the fine in excess of the net average gains from unlawful behavior ( $\lambda^P l^P > \Delta\pi - c$ ), then  $P$  will prefer implementing  $\mathcal{N}$  to

implementing  $\mathcal{C}$ . The result is that  $S$  avoids  $\mathcal{C}$  but does not reach the first-best outcome  $\mathcal{R}$ . We have:

**Proposition 2.** *If only  $P$  is liable, then  $S$  severely punishes  $P$  ( $\lambda^P l^P \geq \Delta\pi - c$ ),  $P$  offers a flat contract without rents ( $w_L = u$ ,  $\Delta w \leq c$ ), and the outcome is  $\mathcal{N}$ .*

This result is intuitive. In this environment with no type-1 errors (wrong conviction of innocents), law violation can be deterred simply by threatening  $P$  with a very high fine. This scheme indeed looks like the mechanisms put in place in jurisdictions resorting to pure corporate liability. Public discussions revolve around the questions as to whether the level of sanctions ( $l^P$ ) or the probability of conviction ( $\lambda^P$ ) is high enough to foster compliance. There is little recognition, however, of the fact that the scheme is second-best, in the sense that it induces firms to go for flat incentive schemes that do not elicit the best efforts ( $\mathcal{R}$ ) on the part of managers, and reduce productive efficiency.

Note that if there were a tight upper bound on corporate sanctions,  $S$  would have no other choice but to induce  $\mathcal{C}$  and, if costs were associated to enforcement, to shut down the enforcement system altogether.

### 4.3 Individual liability

We now consider the case in which only the agent is liable:  $\lambda^P l^P = 0$ ,  $\lambda^A \in (0, 1]$ ,  $0 < l^A \leq \bar{l}$ . Because of the cap on sanctions, this case is more intricate. However, some simple intuition remains available. If the maximal expected sanction on the agent,  $\lambda^A \bar{l}$ , is low, then the situation is similar to the absence of enforcement, and the outcome will be  $\mathcal{C}$ : knowing that  $A$  cannot be much punished,  $P$  will implement  $\mathcal{C}$  and compensate  $A$  for the expected sanction ( $w_H = u + c + \lambda^A l^A$ ). On the other hand, if  $\lambda^A l^A$  is high, compensation becomes too expensive to  $P$ . Furthermore, as  $P$  prefers  $\mathcal{R}$  to  $\mathcal{N}$ ,  $P$  will then try to implement  $\mathcal{R}$ . We will show that  $P$  can always do this by offering a bonus which is high enough to avoid  $\mathcal{N}$ , but low enough not to tempt  $A$  into  $\mathcal{C}$ . The main result of this subsection, therefore, is that there exists some  $\hat{l}$  such that the outcome is  $\mathcal{C}$  if  $\bar{l} < \hat{l}$ , and  $\mathcal{R}$  otherwise.

The formal development proceeds by means of a number of intermediate results. We first observe that by offering a flat wage contract that just compensates  $A$  for not taking his outside option ( $w_L = w_H = u$ ),  $P$  implements  $\mathcal{N}$  without having to pay rents. Such a contract, by not rewarding the realization of high profit, leads the agent to slack. Thus:

**Lemma 1.** For any  $l^A$ ,  $P$  can implement  $\mathcal{N}$  without paying rents.

Next, we have:

**Lemma 2.** Given  $\lambda^A$ ,  $P$  can implement  $\mathcal{R}$  if and only if  $l^A \geq \frac{(1-p)c}{p\lambda^A} \equiv l_{\mathcal{R}}^*$ . If  $\mathcal{R}$  can be implemented, it can be done without paying rents.

**Proof of Lemma 2.** For  $P$  to be able to implement  $\mathcal{R}$  it is necessary that  $A$  prefers  $\mathcal{R}$  to both  $\mathcal{N}$  and  $\mathcal{C}$ , hence:

$$\begin{aligned} (1-p)w_L + pw_H - c &\geq w_L \\ (1-p)w_L + pw_H - c &\geq w_H - c - \lambda^A l^A \end{aligned}$$

or

$$\begin{aligned} p\Delta w &\geq c \\ (1-p)\Delta w &\leq \lambda^A l^A. \end{aligned}$$

Obviously, these two inequalities can both be satisfied only if

$$c/p \leq \lambda^A l^A / (1-p).$$

This proves that the stated condition is necessary. Assume that this condition is satisfied. Consider  $w_L = u$  and  $w_H$  such that  $p\Delta w = c$ . This contract just compensates  $A$  for the cost of effort and satisfies both incentive constraints; hence, it implements  $\mathcal{R}$  without rents being paid. **End of proof.**

The case of individual liability thus brings a major novelty. Under pure corporate liability, any (meaningful) incentive given to achieve  $\pi_H$  makes choosing the illegal action  $\mathcal{C}$  a dominant strategy for  $A$ . A sanction on the agent, however, introduces a wedge in his comparison of  $\mathcal{C}$  to  $\mathcal{R}$ , which, if sufficiently large, can tilt the decision in favor of the latter. Hence, an individual liability system helps firms overcome their agency problem with managers, provided the temptation to go for collusion is not too large ( $p$  should not be too small) and the detection system is efficacious enough ( $\lambda^A l^A$  should be sufficiently large).

**Lemma 3.**  $P$  can always implement  $\mathcal{C}$ , but she can do so without paying rents only if  $l^A \leq \frac{(1-p)(c+u)}{p\lambda^A} \equiv l_{\mathcal{C}}^*$ . If  $l^A > l_{\mathcal{C}}^*$ , then the cost of implementing  $\mathcal{C}$  is  $\frac{\lambda^A l^A}{1-p}$ .

**Proof of Lemma 3.** To implement  $\mathcal{C}$ ,  $A$  should prefer  $\mathcal{C}$  to each of  $\mathcal{R}$ ,  $\mathcal{N}$ , and  $\mathcal{Q}$ . Hence:

$$\begin{aligned} w_H - c - \lambda^A l^A &\geq pw_H + (1-p)w_L - c \\ w_H - c - \lambda^A l^A &\geq w_L \\ w_H - c - \lambda^A l^A &\geq u. \end{aligned}$$

or

$$\begin{aligned} (1-p)\Delta w &\geq \lambda^A l^A \\ \Delta w &\geq c + \lambda^A l^A \\ w_H &\geq c + u + \lambda^A l^A \end{aligned}$$

Clearly, by setting  $w_H$  large enough, one can meet all constraints; hence,  $\mathcal{C}$  can always be implemented. Obviously, the easiest and cheapest way to satisfy all constraints is to set  $w_L = 0$ , hence,  $w_H = \Delta w$ . The second constraint, therefore, is redundant. Implementation without rents being paid means that the last constraint is binding. The first constraint, however, can then only hold if  $(1-p)(c + u + \lambda^A l^A) \geq \lambda^A l^A$  or  $l^A \leq (1-p)(u + c)/\lambda^A p$ . Now assume that this last constraint is violated. Then the first constraint binds, hence,  $w_H = \Delta w = \frac{\lambda^A l^A}{1-p}$ . **End of proof.**

Thus, it is always possible for  $P$  to implement  $\mathcal{C}$  by paying a very high bonus. In some cases, it is sufficient to pay a bonus that exactly offsets the cost of effort and the expected individual sanction. However, when sanctions are high (when  $\lambda^A l^A$  is sufficiently large), such a bonus might not suffice as the agent might then prefer  $\mathcal{R}$  over  $\mathcal{C}$ , that is, pocketing the bonus with some probability without running the risk of a sanction. In this case, a super-high bonus is needed to incentivize the agent to choose the unlawful action.

Comparing the constants in the previous two lemmas, we immediately see that  $l_{\mathcal{R}}^* \leq l_{\mathcal{C}}^*$ . It follows that, in the region  $[l_{\mathcal{R}}^*, l_{\mathcal{C}}^*]$  both  $\mathcal{C}$  and  $\mathcal{R}$  can be implemented without paying rents; to the left of  $l_{\mathcal{R}}^*$ ,  $\mathcal{R}$  cannot be implemented, while, to the right of  $l_{\mathcal{C}}^*$ , implementing  $\mathcal{C}$  requires leaving rents to the agent. This implies:

**Lemma 4.** *Whatever  $l^A$ ,  $P$  will not implement  $\mathcal{N}$ .*

**Proof of Lemma 4.** If  $\mathcal{R}$  can be implemented, then  $P$  obtains payoff

$$(1-p)\pi_L + p\pi_H - c - u$$

which, by (1), is larger than  $\pi_L - u$ ; hence, in that case,  $P$  will not implement  $\mathcal{N}$ . If  $\mathcal{R}$  cannot be implemented, then  $\mathcal{C}$  can be implemented without paying rents; in that case,  $P$  obtains payoff

$$\pi_H - c - \lambda^A l^A - u.$$

Furthermore, by Lemma 2 we have  $p\lambda^A l^A < (1-p)c$ , so that

$$\pi_H - c - \lambda^A l^A - u > \pi_H - c - \frac{(1-p)c}{p} - u = \pi_H - \frac{c}{p} - u > \pi_L - u$$

where the last inequality follows from (1). **End of proof.**

The principal will never implement action  $\mathcal{N}$  because she prefers  $\mathcal{R}$  or  $\mathcal{C}$  in terms of expected gross profit, and can always implement at least one of those actions without paying high compensation to the agent: indeed when  $\mathcal{R}$  cannot be implemented, then  $\mathcal{C}$  can be implemented at a low cost since we are in the case where sanctions are low. Therefore, it always pays to incentivize the agent to do “something” rather than “nothing”.

We can now take all results together and state the main result of this section:

**Proposition 3.** *Assume  $\lambda^P l^P = 0$ . There exists a cut-off level  $\hat{l}$  such that:*

(i) *If  $\bar{l} < \hat{l}$ , then the outcome is  $\mathcal{C}$  (with  $P$  offering a high-powered incentive contract that just compensates  $A$  for all costs, including expected sanctions);*

(ii) *If  $\bar{l} > \hat{l}$ , then the outcome is  $\mathcal{R}$  (with  $S$  setting  $l^A > \hat{l}$  and  $P$  offering a relatively low-powered incentive contract that just compensates  $A$  for the costs associated with  $\mathcal{R}$ ).*

*Furthermore:*

(iii) *If  $c + u \geq p\Delta\pi$ , then  $\hat{l} = \frac{(1-p)\Delta\pi}{\lambda^A} \in [l_{\mathcal{R}}^*, l_{\mathcal{C}}^*]$*

(iv) *If  $c + u < p\Delta\pi$ , then  $\hat{l} = \frac{(1-p)^2\Delta\pi + (1-p)(c+u)}{\lambda^A}$  (and  $\hat{l} > l_{\mathcal{C}}^*$ ).*

**Proof of Proposition 3.** The lemmas imply that the choice of  $S$  is between  $\mathcal{C}$  and  $\mathcal{R}$ . As  $S$  prefers  $\mathcal{R}$  best, she will induce  $\mathcal{R}$  whenever possible.

Let us first consider the case with  $u$  large, specifically  $c + u \geq p\Delta\pi$ . Lemma 2 implies that, if  $\bar{l} < l_{\mathcal{R}}^*$ , then  $P$  will implement  $\mathcal{C}$ , no matter what  $l^A$  is set by  $S$ . Let  $\hat{l}$  be defined as in part (iii) of the Proposition. Then,  $\hat{l} \geq l_{\mathcal{R}}^*$  by (1) and  $\hat{l} \leq l_{\mathcal{C}}^*$  since  $c + u \geq p\Delta\pi$  by assumption. If  $l^A = \hat{l}$ , then

$$\pi_L + p\Delta\pi - u - c = \pi_H - u - c - \lambda^A l^A,$$

and  $P$  is indifferent between implementing  $\mathcal{C}$  and  $\mathcal{R}$ , while she prefers  $\mathcal{C}$  for all lower fines and  $\mathcal{R}$

for all higher ones. This proves parts (i) and (iii).

Next, consider the case where  $u$  is small:  $c + u < p\Delta\pi$ . We now have that  $P$  strictly prefers  $\mathcal{C}$  to  $\mathcal{R}$  even for  $l^A = l_{\mathcal{C}}^*$ . From lemmas 2 and 3 it follows that  $P$  is indifferent between  $\mathcal{C}$  and  $\mathcal{R}$  for  $l^A = \hat{l}$  with  $\hat{l}$  as in (iv). It is now obvious that  $S$  can induce  $\mathcal{R}$  only if  $\bar{l} > \hat{l}$ . This proves parts (ii) and (iv). **End of proof.**

Proposition 3 shows that, if sufficiently tough sanctions are available (if  $\lambda^A \bar{l}$  is high enough), then  $S$  can induce the first-best outcome with a pure individual liability rule. In that case, the large individual fine makes it too costly for  $P$  to compensate  $A$  for taking the illegal action.  $P$  therefore offers a moderate bonus for high profit. If, however,  $\lambda^A \bar{l}$  is rather low, then  $S$  can only induce  $\mathcal{C}$ , and might as well give up enforcement altogether. The individual sanctions are so low that the firm can indirectly “insure” the manager against them (by paying a super-high bonus for high profit) and thus profitably implement the illegal action. One conclusion of this subsection is therefore that an individual liability regime is only as good as its maximal expected sanction can be.

Interestingly, the sanction threshold,  $\hat{l}$ , is not always equal the discounted gains from collusion  $((1 - p) \Delta\pi / \lambda^A)$ . As Proposition 3(iv) shows, if the agent’s outside option  $u$  is not too large, the threshold depends on this outside option. In particular, an increase in  $u$  may increase the minimal individual sanction  $\hat{l}$  needed to induce the first-best outcome. Hence, it may prove *harder* to discipline managers when their outside options improve. The reason is clear from lemmas 2 and 3 above: implementing  $\mathcal{C}$  may require leaving a rent to  $A$ , while implementing  $\mathcal{R}$ , whenever possible, can always be done without paying rents. If  $u$  increases, then  $P$ ’s net profit of implementing  $\mathcal{C}$  remains unchanged ( $A$ ’s rent is simply reduced), while for  $\mathcal{R}$  the wage cost increases; hence,  $P$ ’s net profit decreases. This may tilt the principal’s choice in favor of  $\mathcal{C}$  when  $u$  goes up.

That  $\lambda^A \bar{l}$  may be bindingly low is conceivable in practice. The sanctions that juries or judges may be prepared to inflict on individuals in the case of corporate crimes of economic nature may be low. Besides, the burden of proof for individuals is sometimes considerably higher than that for corporations ( $\lambda^A \leq \lambda^P$ ). Marginal deterrence considerations may also prevent the rise of white-collar crime sanctions above a certain level. In any case, the gains from collusion *to the firm*  $((1 - p)\Delta\pi)$  may be out of line with the average individual sanctions applied *to managers*  $(\lambda^A l^A)$ , as the latter typically do not manage to extract more than a fraction of the firm’s profits.

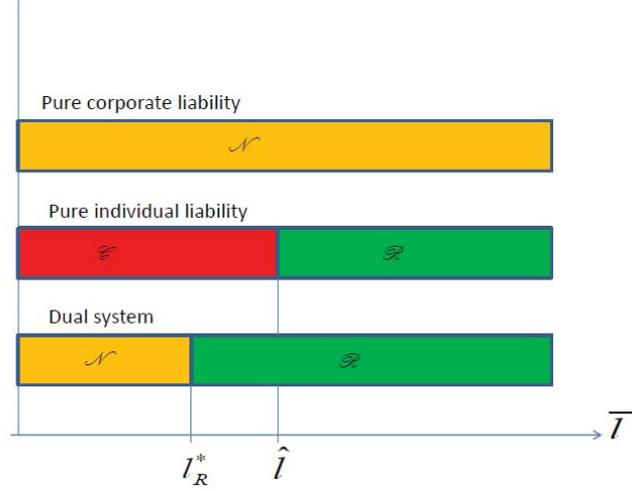


Figure 1: Outcome of the game as a function of the liability regime and  $\bar{l}$  when  $D$  is not contractible

#### 4.4 Dual system

Suppose now that  $S$  is free to design a liability mechanism with both  $l^P > 0$  and  $l^A > 0$ . Clearly, a dual system is, for  $S$ , at least as good as any of the pure systems. In particular, under a dual system,  $S$  can deter  $C$  by punishing  $P$  severely in case  $C$  is detected. Hence, the real choice for  $P$  is between  $\mathcal{R}$  or  $\mathcal{N}$ . Note that, even if  $S$  uses a dual system,  $P$  can implement  $\mathcal{R}$  if and only if the condition in Lemma 2 is satisfied. Furthermore, it follows from Lemma 4 that, if  $\mathcal{R}$  can be implemented, then  $P$  will indeed prefer to implement it. Hence, we have proved:

**Proposition 4.** *If  $S$  can impose liability on both  $P$  and  $A$ , then,  $S$  threatens to punish  $P$  severely in case of conviction, and :*

(i) *If  $\bar{l} < l_{\mathcal{R}}^* \equiv \frac{(1-p)c}{p\lambda^A}$ , outcome  $\mathcal{N}$  results, with  $P$  offering a flat wage contract:  $w_L = u$ ,  $w_H \leq u + c$ ;*

(ii) *If  $\bar{l} \geq l_{\mathcal{R}}^*$ , outcome  $\mathcal{R}$  results, with  $S$  threatening to punish  $A$  with  $l^A \geq l_{\mathcal{R}}^*$  in case of conviction, and with  $P$  offering a relatively low-powered incentive contract:  $w_L = u$ ,  $w_H = u + c$ .*

Figure 1 summarizes the outcome under the three liability regimes as a function of the maximum individual sanction,  $\bar{l}$ . Note that the dual system improves on a pure corporate liability regime, provided that  $\bar{l}$  is not too small. If it is possible sufficiently to punish the agent, then the outcome improves from second-best to first-best. On the other hand, if the agent can be harshly punished, a system of pure individual liability is already first-best, and a dual system cannot do better. In the intermediate range, the dual system is a strict improvement on both pure systems:

it results in the first-best outcome, whereas pure individual liability induces the illegal action, while corporate liability leads to slacking. Also, note that it never hurts  $S$  to impose the maximal sanction on  $A$ . Hence, there is a sense in which punishing individual managers as much as possible can never go wrong (assuming, as we do here, that it does not affect the probability of conviction).

If corporate sanctions themselves were bounded, then those results would have to be modified to account for the diminished ability of public authorities to provide adequate incentives to the principal. Indeed, she can be incentivized not to implement the illegal action only if the sum of individual and corporate sanctions is high enough to wipe out the gains from improper behavior (one needs  $\lambda^A l^A + \lambda^P l^P \geq (1-p)\Delta\pi$  to induce  $\mathcal{R}$  rather than  $\mathcal{C}$ ).

## 5 $P$ and $A$ can contract on detection

In this section, we consider the case where  $P$  and  $A$  can contract on an additional event, “detection”  $D$ , which arises with probability  $\lambda > 0$ , conditional on  $\mathcal{C}$  being chosen by  $A$ . Hence, a wage contract  $w$  now is a triplet  $(w_L, w_H, w_D)$  where  $w_H$  and  $w_D$  may differ. Such a contract is possible if law and customs allow firms to vary compensation when the legal system has adduced evidence of violation of the prohibition of  $\mathcal{C}$ . This could be achieved through *ex ante* contractual provisions regarding compensation or by means of *ex post* recursive liability actions by the principal against the agent.

In such a legal environment, both  $\mathcal{C}$  and  $\mathcal{R}$  get easier to implement for  $P$  as detection can be either punished (by setting  $w_D = 0$ ) or explicitly rewarded (by setting  $w_D > w_H$ ). A priori, it is not clear which of these effects dominates, and indeed we will show that the result can go both ways, depending on the liability regime in force. Of course, all the positive results from the previous section about implementability carry over: whatever  $P$  could implement with contracts with  $w_H = w_D$ , she can now also do with a larger set of feasible contracts.

As in the previous section, we will study each of the three different liability regimes in turn. However, we only need to focus on  $\mathcal{R}$  as, irrespectively of the regime,  $\mathcal{N}$  and  $\mathcal{C}$  can always be implemented without paying rents. For  $\mathcal{N}$ , this is immediate (set  $w_L = w_H = w_D = u$ .) For  $\mathcal{C}$ , the argument is also simple.

**Lemma 5.** *For any  $(l^A, l^P)$ ,  $P$  can always implement  $\mathcal{C}$  without paying rents; for example, by setting  $w_L = w_H = 0$  and  $w_D = [u + c + \lambda^A l^A]/\lambda$ .*

**Proof of Lemma 5.** Clearly, by setting  $w_L = w_H = 0$ ,  $P$  makes it unattractive for  $A$  to choose  $\mathcal{N}$  or  $\mathcal{R}$ . To induce  $A$  to choose  $\mathcal{C}$ ,  $P$  only has to make sure that  $A$  prefers  $\mathcal{C}$  to  $\mathcal{Q}$ , hence,

we should have:

$$\lambda w_D - c - \lambda^A l^A \geq u$$

Hence, by setting  $w_D = [\lambda^A l^A + (u + c)]/\lambda$ ,  $P$  implements  $\mathcal{C}$  without paying rents. **End of proof.**

Comparing Lemma 3 to Lemma 5, we see that the larger contract space indeed makes it easier for the principal to implement the illegal action: she can now reward it exclusively (upon detection), which makes shirking or exerting lawful efforts very unattractive to the agent.

## 5.1 Corporate liability

It has just been shown that contracting on “detection” made it easier for  $P$  to implement  $\mathcal{C}$ . In a pure corporate liability regime ( $\lambda^A l^A = 0$ ), it is always possible to implement  $\mathcal{R}$  but in some cases only by leaving rents to the agent.

**Lemma 6.** *In a regime of pure corporate liability ( $l^A = 0$ ),  $P$  can always implement  $\mathcal{R}$ . Furthermore,  $P$  can implement  $\mathcal{R}$  without paying rents if and only if  $\lambda p u \geq (1 - p - \lambda)c$ . If this condition is violated, then the smallest cost to  $P$  of implementing  $\mathcal{R}$  is equal to  $\frac{(1-p)(1-\lambda)}{p\lambda}c$ .*

**Proof of Lemma 6.** If  $P$  wants  $A$  to choose  $\mathcal{R}$ , then the following constraints have to be met:

$$\begin{aligned} (1-p)w_L + pw_H &\geq (1-\lambda)w_H + \lambda w_D & (\mathcal{R} \succ_A \mathcal{C}) \\ (1-p)w_L + pw_H - c &\geq w_L & (\mathcal{R} \succ_A \mathcal{N}) \\ (1-p)w_L + pw_H - c &\geq u & (\mathcal{R} \succ_A \mathcal{Q}) \end{aligned}$$

These constraints can be satisfied if and only if they can be satisfied with  $w_D = 0$ . Inserting this equality and rewriting the constraints yields:

$$\begin{aligned} (1-p-\lambda)\Delta w &\leq \lambda w_L \\ p\Delta w &\geq c \\ w_L + p\Delta w &\geq u + c \end{aligned}$$

It is easy to see that a solution can always be found: fix  $\Delta w$  such that  $p\Delta w = c$  and increase both  $w_L$  and  $w_H (= w_L + \Delta w)$  until the other two conditions are satisfied. This proves (i).

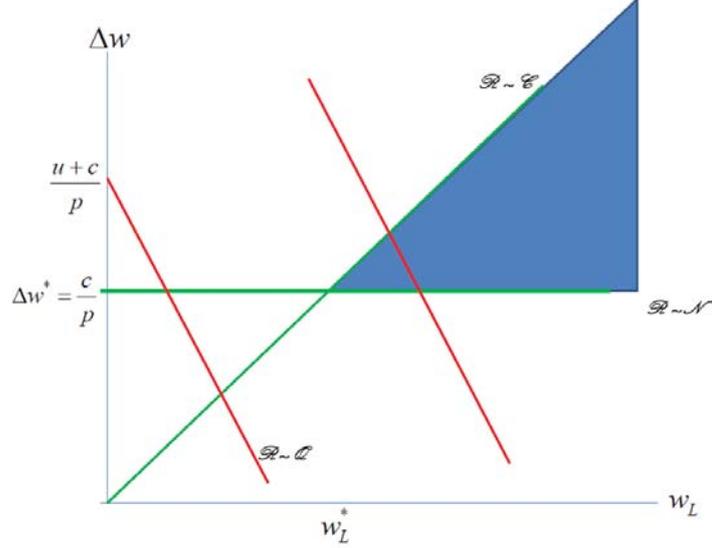


Figure 2: Implementation of  $\mathcal{R}$  in the  $(w_L, \Delta w)$  space

Clearly, if  $p + \lambda \geq 1$ , the first constraint is satisfied automatically (as  $w_L \geq 0$ ). It is then easy to find a solution that does not leave rents to the agent: take  $w_L = u$  and  $w_H = u + c/p$ .

Hence, assume  $p + \lambda < 1$ . The first two inequalities determine a cone in the  $(w_L, \Delta w)$  space. See figure 2. The two incentive constraints are represented by green lines delineating a blue area of admissible contracts. The participation constraint is given by a red downward-sloping line. Depending on  $u$ , this constraint may or may not bind; when the agent's outside option is good, it does.

The most leftward point of this cone is the point  $w_L^* = \frac{1-p-\lambda}{p\lambda}c$ ,  $\Delta w^* = c/p$ . A solution that does not involve rents exists if this “corner contract” does not, or does just meet the participation constraint, hence, if and only  $w_L^* \leq u$ . This is equivalent to the condition mentioned in the Lemma. Hence, if the outside option of the agent is good, then  $\mathcal{R}$  can be implemented without paying rents. Finally, assume that this condition is not satisfied. Then the “corner contract” is the one that minimizes the cost of implementing  $\mathcal{R}$ , which a direct computation shows is equal to:

$$w_L^* + c = \frac{(1-p)(1-\lambda)}{p\lambda}c$$

**End of Proof.**

Under pure corporate liability,  $P$  can always implement  $\mathcal{R}$  because she can always withdraw wage in case of “detection”. However, when the probability of detection,  $\lambda$ , is low, that is not enough of a punishment, and the principal must reward the occurrence of *low* profit in order to incentivize

$A$  to choose  $\mathcal{R}$ . When  $u$  is low, that leads to overcompensation of the agent. Thus, the fact that the agent is paid a high base wage (in addition to a bonus for high profit) is associated with the choice of the socially optimal action.

Clearly, in such a regime,  $S$  will set  $l^P$  so high (for example,  $l^P \geq \Delta\pi/\lambda^P$ ) that  $P$  will choose not to implement  $\mathcal{C}$ . Hence,  $P$  will be restricted to choosing between  $\mathcal{N}$  and  $\mathcal{R}$ . The previous section showed that, without contracting on detection, there was no hope of inducing outcome  $\mathcal{R}$  as the agent found  $\mathcal{R}$  to be strictly dominated by  $\mathcal{C}$  under any meaningful incentive contract. Allowing contracting on “detection” fundamentally changes this as  $A$  can now be punished by  $P$  if he chooses  $\mathcal{C}$ . Clearly, the more effective the legal system (that is, the larger  $\lambda$ ), the easier it will be for  $P$  to implement  $\mathcal{R}$ . On the other hand, if the quality of the legal system is low, then  $P$  will be unable to do this cheaply (she might be forced to leave considerable rents to the agent), and in that case she might prefer to implement  $\mathcal{N}$ . Hence, a general conclusion is that possibility for  $P$  and  $A$  to contract on “detection” improves the outcome for  $S$ , provided that this contingency arises often enough.

**Proposition 5.** *With contracting on detection, under pure corporate liability, the outcome is  $\mathcal{R}$  if  $u + p\Delta\pi \geq \frac{(1-p)(1-\lambda)}{p\lambda}c$ , and  $\mathcal{N}$  otherwise.*

**Proof of Proposition 5.** Obviously, our maintained assumption that contracting on  $\mathcal{N}$  is not first-best implies that, if  $\mathcal{R}$  can be implemented without paying rents,  $\mathcal{N}$  will not be implemented. However, by continuity,  $P$  will still prefer to implement  $\mathcal{R}$  even if she has to leave a small rent to the agent. Assume  $\lambda pu < (1-p-\lambda)c$ , so that the smallest possible cost of implementing  $\mathcal{R}$  is as in Lemma 6.  $P$  prefers  $\mathcal{R}$  to  $\mathcal{N}$  if and only if

$$(1-p)\pi_L + p\pi_H - \frac{(1-p)(1-\lambda)}{p\lambda}c \geq \pi_L - u$$

which is easily seen to be equivalent to the condition mentioned in the Proposition. **End of Proof.**

Proposition 5 shows that, in the case of pure corporate liability, society will be able to achieve the first-best outcome by threatening to punish  $P$  severely in case of law violation, provided that (i) the likelihood of contractible detection ( $\lambda$ ) is sufficiently high, (ii) slacking hurts the firm sufficiently ( $p\Delta\pi$  is high enough), and (iii) the outside option ( $u$ ) of the agent is sufficiently high. The first effect is intuitive: if  $\lambda$  is too low, the manager does not have to fear detection and the associated contractual punishment. Conversely, when  $\lambda$  tends to one, the first-best outcome can *always* be reached. Hence, we here see that shareholders can benefit from effective law enforcement

to the extent that it uncovers facts that can be used to hold managers personally responsible for their unlawful actions. The second effect is intuitive as well: if the benefit to the firm of the manager exerting effort is low, the firm will not pay a wage bonus. The role played by the outside option,  $u$ , is perhaps less intuitive. The result states that it is *easier* to implement the first-best outcome when the outside option of the agent is good. The underlying reason is the same as why, in the previous section, it became *more attractive* for the principal to implement  $\mathcal{C}$  when the agent's outside option improved: a contract at which one has to leave rents to the agent becomes more attractive when  $u$  increases, as it reduces the rent, instead of increasing the cost. In the present case, the implementation of  $\mathcal{R}$  might require leaving rents to the agent; in that case, when  $u$  increases,  $\mathcal{R}$  gets more attractive for  $P$ . (In contrast, in the previous section,  $\mathcal{C}$  sometimes required leaving rents, so that  $\mathcal{C}$  became more attractive when  $u$  increased.) More precisely, the rents that  $P$  might have to leave to  $A$  to implement  $\mathcal{R}$  are given by  $[(1-p)(1-\lambda)c]/p\lambda - u$ . The higher those are, the harder it becomes to induce  $\mathcal{R}$ . The higher  $u$ , the lower these rents and the easier it is to induce the first-best outcome.

By comparison with the previous section (where  $D$  was *not* contractible), the results show that, in regimes of pure corporate liability, the ability for firms to draft contractual provisions (or file liability claims) based on the detection of the illegal action is essential. It allows public authorities to induce the first-best outcome in a number of circumstances where they previously could only reach the second-best outcome (provided the legal system is effective enough).

## 5.2 Individual liability

As  $P$  can do at least as well with a detection-contingent contract as without it, the positive results about implementability from subsection 4.3 continue to hold. In particular,  $P$  will never implement  $\mathcal{N}$ ;  $P$ 's real choice is between  $\mathcal{R}$  and  $\mathcal{C}$ . From Lemma 5, we know that the latter can be implemented without paying rents, hence, we focus on  $\mathcal{R}$ . The next Lemma slightly generalizes Lemma 6 by taking into account the expected fine  $\lambda^A l^A$  on the agent.

**Lemma 7.**  *$P$  can implement  $\mathcal{R}$  without paying rents if and only if  $(1-p-\lambda)c \leq p(\lambda u + \lambda^A l^A)$ . If this condition does not hold, then the cheapest way of implementing  $\mathcal{R}$  involves cost  $\frac{(1-p)(1-\lambda)}{p\lambda}c - \frac{\lambda^A}{\lambda}l^A$ .*

**Proof of Lemma 7.** Lemma 6 already shows that  $\mathcal{R}$  can always be implemented. Again, implementation of  $\mathcal{R}$  is easiest when  $w_D = 0$ . The relevant constraints now are

$$\begin{aligned}
(1 - p - \lambda)\Delta w &\leq \lambda w_L + \lambda^A l^A \\
p\Delta w &\geq c \\
w_L + p\Delta w &\geq u + c
\end{aligned}$$

We can follow exactly the same line of argument as in the proof of that Lemma 6. We may restrict attention to the case where  $p + \lambda < 1$ . (If that constraint does not hold, then the first constraint is redundant, and  $\mathcal{R}$  can be implemented at minimal cost  $u + c$ .) If  $u$  is small, then the individual rationality constraint ( $\mathcal{R} \succ_A \mathcal{Q}$ ) will not be binding. Hence, it will not be possible to implement  $\mathcal{R}$  without paying rents. In this case, the least costly way of implementing  $\mathcal{R}$  is given by the "corner" of the cone defined by the first two constraints, which has coordinates

$$w_L^{**} = \frac{(1 - p - \lambda)c/p - \lambda^A l^A}{\lambda}, \Delta w^{**} = c/p.$$

The third constraint is not binding as long as  $w_L^{**} > u$ , which is equivalent to the condition stated in the Lemma. The cost associated to this corner solution is equal to  $w_L^{**} + c$ , as stated in the Lemma. If, on the other hand,  $(1 - p - \lambda)c \leq p(\lambda u + \lambda^A l^A)$ , then the third constraint is binding, and  $\mathcal{R}$  can be implemented without rents being paid. **End of proof.**

$\mathcal{R}$  can always be implemented because withdrawing wage in case of detection provides sufficient incentives. However, this may require leaving rents to the agent. In the case where minimal costs cannot be achieved, the cost of implementing  $\mathcal{R}$  decreases with every unit of liability that is imposed on  $A$ . That follows from the fact that individual sanctions are a direct substitute for the difference between  $w_H$  and  $w_D$  in the comparison by the agent of  $\mathcal{R}$  and  $\mathcal{C}$ .  $P$  therefore directly benefits from liability being imposed on  $A$  as this decreases rents: individual sanctions help firms overcome their agency problem with managers.

**Proposition 6.** *If  $P$  and  $A$  can contract on detection and only  $A$  is liable (for  $l^A > 0$ ), then the outcome is  $\mathcal{C}$  if  $\bar{l} < l^*$  and  $\mathcal{R}$  otherwise, where  $l^* \equiv (1 - p)\Delta\pi/\lambda^A$ .*

**Proof of Proposition 6.**

If both  $\mathcal{R}$  and  $\mathcal{C}$  can be implemented without paying rents, hence, if  $(1 - p - \lambda)c \leq p(\lambda u + \lambda^A l^A)$ , then  $P$  prefers to implement  $\mathcal{R}$  if and only if  $l^A \geq l^*$ . Notice that for  $l^A = l^*$ , this first inequality is indeed (strictly) satisfied. If we increase  $l^A$  from that level, then the inequality continues

to be satisfied, hence,  $P$  prefers  $\mathcal{R}$  for  $l^A \geq l^*$ . Conversely, consider the case where  $l^A < l^*$ . Then, at  $l^A$ ,  $P$  prefers  $\mathcal{C}$  to  $\mathcal{R}$  even if both can be implemented without paying rents. As the actual cost of implementing  $\mathcal{R}$  may be more expensive, clearly  $P$  prefers  $\mathcal{C}$  to  $\mathcal{R}$  in that case. **End of Proof.**

The principal will implement the socially optimal action when that is not too costly. Individual sanctions on  $A$  help her reduce the cost of implementing  $\mathcal{R}$ . Comparing Proposition 6 to Proposition 3, we see that, in the case where  $P$  and  $A$  could not contract on detection, the cut-off level was either  $l^*$  (in case  $p\Delta\pi < c + u$ ) or was *smaller* than  $l^*$  (in case  $p\Delta\pi > c + u$ ). Hence, we have proved:

**Corollary 1.** *Under pure individual liability ( $l^P = 0$ ):*

(i) *if  $p\Delta\pi > c + u$ , then contracting on detection shrinks the range for  $\bar{l}$  in which  $P$  finds it optimal to implement  $\mathcal{R}$  from  $[\hat{l}, \infty)$  to  $[l^*, \infty)$ ;*

(ii) *if  $p\Delta\pi < c + u$ , then for any  $\bar{l}$  both contracting regimes induce the same outcome (which is either  $\mathcal{C}$  (if  $\bar{l} < \hat{l}$ ) or  $\mathcal{R}$  (if  $\bar{l} > \hat{l}$ ), with  $\hat{l}$  as in Proposition 3).*

The result that contracting on detection makes matters worse in the case of pure individual liability can be explained as follows. When direct contracting on detection is not possible, it can be very costly for the principal to induce the agent to choose the illegal action. Indeed, a high profit bonus has to be paid in case the individual sanction is high, as the agent needs to be compensated for that additional expected loss. By contrast, when the wage can be conditioned on detection, direct incentives for taking the illegal action (i.e. a “bonus” in case of detection) can be given so that all rents are extracted, which facilitates the implementation of that action by the principal. It is true that direct contracting on detection makes it always possible to implement the socially preferred action, however, that may well prove costly to the principal, as she may have to leave rents to the agent. The net effect, therefore, may well be that  $\mathcal{C}$  becomes more attractive to  $P$ . Hence,  $S$  may prefer not to allow contracting on detection. In any case, one can see that  $S$  would like to prohibit rewarding  $\mathcal{C}$  directly; for example,  $S$  may impose the constraint that  $w_D \leq w_H$ . Hence, although additional contracting possibilities for  $P$  and  $A$  eased the task of society in the case of pure corporate liability (through indemnification clauses), we here see that they complicate it in the case of pure individual liability (through insurance clauses).

### 5.3 Dual system

If  $S$  can impose liability on both  $P$  and  $A$ , then  $S$  can avoid  $\mathcal{C}$  by setting  $l^P$  sufficiently high, for example,  $l^P \geq \Delta\pi/\lambda^P$ . We know that  $\mathcal{R}$  can always be implemented and that  $P$  prefers  $\mathcal{R}$  to  $\mathcal{N}$  if she can implement  $\mathcal{R}$  without paying rents. Hence, Lemma 7 implies that  $\mathcal{R}$  is the outcome if  $(1-p-\lambda)c \leq p(\lambda u + \lambda^A l^A)$ . Assume that this condition is not met. Then the cost of implementing  $\mathcal{R}$  is as given in Lemma 7, and  $P$  prefers  $\mathcal{R}$  to  $\mathcal{N}$  if and only if:

$$(1-p)\pi_L + p\pi_H - \frac{(1-p)(1-\lambda)}{p\lambda}c + \frac{\lambda^A}{\lambda}l^A \geq \pi_L - u$$

which is equivalent to

$$l^A \geq \frac{(1-p)(1-\lambda)}{p\lambda^A}c - \frac{\lambda(u + p\Delta\pi)}{\lambda^A}$$

Let  $l^{**}$  denote the right hand side of this expression. We have proved:

**Proposition 7.** *If  $S$  can impose liability on both  $P$  and  $A$ , and  $P$  and  $A$  can contract on detection, then:*

- (i) *If  $\bar{l} < l^{**}$  outcome  $\mathcal{N}$  results (with  $S$  threatening to punish  $P$  severely in case of  $\mathcal{C}$  and  $P$  reacting with a flat wage contract (for example  $w_L = w_H = u, w_D = 0$ ));*
- (ii) *If  $\bar{l} \geq l^{**}$ , outcome  $\mathcal{R}$  results (with  $S$  punishing  $A$  with at least  $l^{**}$  and  $P$  offering an incentive contract as in Lemma 7).*

This result has the same flavor as the one for the case where detection is non-contractible: the socially optimal action can be implemented provided individual sanctions are sufficiently large, while the second-best action obtains otherwise. The threshold for individual sanctions, however, could be zero: we saw that under certain conditions, pure corporate liability allow society to reach the first-best independently of the level of individual sanctions.

When those conditions are not met, additional individual sanctions allow society to do better than under pure corporate liability because they help firms solve their internal agency problem, i.e. individual sanctions make it less costly for firms to induce managers to exert effort rather than engage in illegal actions. In particular, in those situations where rents have to be paid to the agent for choosing  $\mathcal{R}$ , increasing  $l^A$  contributes to the elimination of those rents. The principal's comparison of  $\mathcal{N}$  and  $\mathcal{R}$  is therefore affected. In addition, compared to pure individual liability systems, high corporate sanctions help turn the gains from collusion into losses and deter it altogether, so that society is never left with the only option of implementing  $\mathcal{C}$ . Note again that,

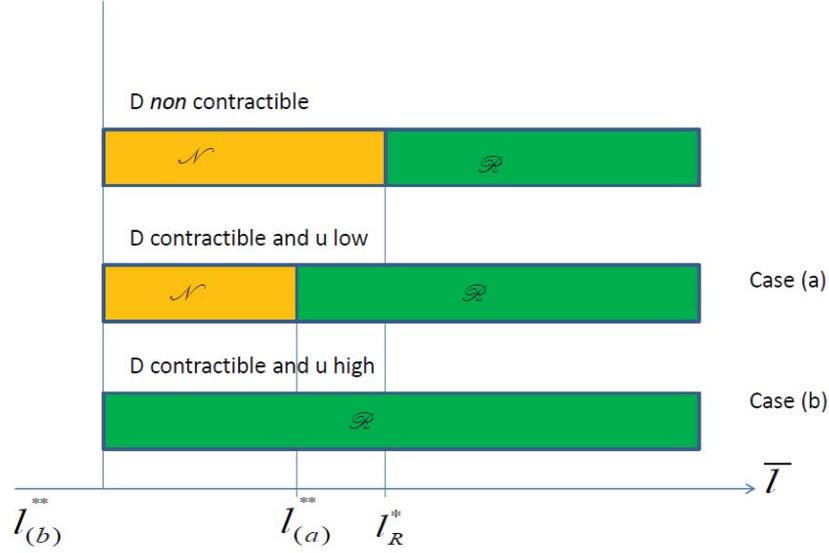


Figure 3: Comparison of the performance of the optimal dual liability scheme when  $D$  is, or is not, contractible

in our environment, it never hurts to impose maximum individual sanctions.

Note that  $l^{**} < l_{\mathcal{R}}^* = \frac{c(1-p)}{\lambda A p}$ , so that we have:

**Corollary 2.** *Contracting on detection improves the outcome for  $S$  (from  $\mathcal{C}$  to  $\mathcal{R}$ ) if  $l^{**} < \bar{l} < l_{\mathcal{R}}^*$ , but leaves it unchanged for other values of  $\bar{l}$ .*

We illustrate the effect of contractibility of  $D$  in Figure 3.

Note the contrast with Corollary 1: in the case of pure individual liability,  $S$  prefers incomplete contracting by  $P$  and  $A$ , while in the presence of corporate sanctions,  $S$  prefers complete contracting. The reason is that in the latter case, the illegal action can be avoided completely, while complete contracting makes it possible *always* to implement the socially optimal action (Lemma 6), which was not possible under incomplete contracting (Lemma 2).

## 6 Summary and policy implications

Our theoretical model attempts at capturing the various incentive properties of pure individual liability, pure corporate liability, or dual regimes in an environment where shareholders or corporate boards cannot completely control managers. Our analysis relies on four assumptions. First, corporations (or their organs) are not at an informational advantage when it comes to supervising managers. Just like public authorities, in real time they only observe the final product of managers'

actions (the bottom line in the accounts), but not whether the revenue was achieved by legal or illegal means, a fact that can become known only *ex post*, following detection. Second, corporations cannot always solve that moral hazard problem because managers face limited contractual liability: for this reason, managers cannot always be perfectly incentivized to act in the interests of shareholders. Third, the monetary equivalent of penalties that can be imposed on individual as part of an enforcement system is bounded above, while very high sanctions can be applied to firms. Fourth, full regulation of firms is not an option. Government intervention is “light” and limited to the use of *ex post* liability regimes.

Under these assumptions we have established five main results. First, pure corporate liability regimes have one big advantage: since sanctions can be very high, they make it easy to deter law infringement, at least in theory. Nevertheless, when firms are limited in their ability to penalize managers for their violations of the law, such systems cannot lead to the first-best outcome, as firms cannot cheaply incentivize managers without tempting them to choose illegal actions. In that case, illegal actions can only be deterred by paying the price of productive inefficiency (and the associated allocative inefficiency). Thus, in legal regimes relying only on corporate liability, the ability for firms to contract on detection is key. Society can reach the first-best outcome only when this feature is present. However, this requires that contractible misbehaviors are detected with sufficiently high probability (provided that some other conditions are satisfied as well). Hence, “EU-style” corporate liability systems can be expected to be sub-optimal for fighting corporate crime; corporate liability alone can work well only if the legal system is likely to detect law violations and if labor law or liability law allows firms to threaten managers with dire consequences in such cases. In our opinion, these limitations and drawbacks of pure corporate liability systems have not been sufficiently emphasized in the academic or in the policy literature.

Second, pure individual liability regimes can induce the first-best outcome, but only when expected sanctions are high enough. When those sanctions are low, law infringement is certain. Contrary to pure corporate liability regimes, the ability to contract on detection makes deterrence harder in the sense that it may require higher sanction thresholds. The reason is that contingent contracting not only makes it easier for firms to incentivize managers to choose a lawful action, but also the illegal one. The latter may be relatively easy to counter. While one may debate with legal scholars on whether or not firms should be allowed to *compensate* the sanctions imposed on managers for law violations, there do not seem to be good arguments for why managers should be explicitly *rewarded* for violating the law, hence, the law might (perhaps) allow the former, while

prohibiting the latter. The fact that frequently individuals cannot be punished heavily (low  $l^A$ ) or that there is a high burden of proof (low  $\lambda^A$ ), however, is not so easy to deal with. In some jurisdictions, such as in the EU and its Member States, it seems that companies are more easily sanctionable than individuals, and there is anecdotal evidence that judges lower conviction rates or reduce the proposed sanctions in case the investigation authority or prosecutor sets them high. Clearly, this makes pure individual liability schemes unlikely to be optimal in these jurisdictions. We think that the difference between the law as applied in practice and the rules in the books may have been insufficiently taken into account in the academic literature, in that respect.

Third, when the size of individual sanctions or the quality of the enforcement system is insufficient, dual systems that prescribe both individual and corporate liability are optimal; at least, they improve upon both pure systems. Duals systems allow society to enlarge the set of circumstances in which the first-best outcome can be implemented. They cumulate the advantages of both pure systems: corporate sanctions effectively deter collusion, while individual sanctions make it easier for firms properly to incentivize managers to take the action that is both profitable and socially beneficial.

Fourth, we have seen that dual systems work better when contracting on detection is allowed, and that, for them to work really well, it is desirable that the legal system detects the violation with sufficiently high probability; thus, the quality of the legal system should be sufficiently high. Hence, in contrast to what is assumed in the literature following Becker (1968), when it is a principal-agent pair that commits the crime, it is not just the expected sanction that matters: the probability of contractible detection plays an independent role. A higher-quality legal system generates contractible events with a larger probability, and this makes it easier for firms to discipline managers. As a side result, we have also seen that, if the conviction probability is not affected by the size of the sanction, it never hurts to set individual sanctions at their highest possible level.<sup>23</sup>

Fifth, we have shown that the managers' outside options may influence the effectiveness of the liability system. If contracting on detection is not possible, then under a pure individual system it may be *harder* to discipline managers when there outside options improve. The reason is that, in this case, the illegal action can only be implemented by leaving rents to the manager, hence, the individual rationality constraint does not bind in this case. However, this constraint is always binding when one wants to implement the social optimum. Hence, if the outside option improves,

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<sup>23</sup>This result might no longer hold if the court may decrease  $\lambda^A$  in case the proposed  $l^A$  is high. In that case, it may be optimal to maximize the expected fine (the product).

it becomes more costly to implement the social optimum, while this just reduces the manager's rent in case the illegal action is implemented. As a result, when the option increases, it may become more attractive for the firm to go for the illegal action. In contrast, if contracting on detection is possible, then under a pure corporate or a dual system, it becomes *easier* to implement the social optimum when the outside option of the agent improves. The reason is that, in this case, the social optimum can only be implemented by leaving rents to the agent. We are not aware of a literature in which this effect has been identified or indeed documented.

Notwithstanding the usual and legitimate concerns about the stylized nature of our model, our study is relevant to some of the current debates regarding the criminalization of corporate misbehavior. Pure corporate liability systems require stringent conditions to be optimal, so that in many circumstances (additional) sanctions on the individuals actually taking the decision will be more effective in deterring socially harmful actions than further increasing the corporate sanctions, and this without suppressing incentives for managers to work hard. Our study is only a first step in the direction of opening up the "black box" that firms currently constitute in the literature concerned with public enforcement. There remain many interesting issues to investigate.

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