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**“CORPORATE CRIMINAL LIABILITY AND OPTIMAL
BEHAVIOR BY FIRMS. INTERNAL MONITORING
DEVICES *versus* MANAGERIAL INCENTIVES”**

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Corporate Criminal Liability and Optimal Behavior by Firms. Internal Monitoring Devices *versus* Managerial Incentives*

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Abstract

Corporate criminal liability legislation has been the subject of a widespread debate around the world in response to the financial scandals of the early 2000s. The existing legal regimes entail compliance requirements, such as internal monitoring mechanisms, with the aim of inducing firms to detect the wrongful conduct of their agents. We develop an analytical framework to address when and to what extent firms may find convenient to adopt these regulatory devices. We conclude that more productive firms and those operating in sectors where managers have more opportunities to undertake criminal activities are more likely to prevent such activities (through monitoring or the payment of efficiency wages). When the potential returns of illegal activities are high or when the firms are large, implementing internal monitoring devices may be optimal, while smaller firms should generally prefer the payment of efficiency wages to prevent crimes by managers.

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1 Introduction

After the financial scandals that affected the industrial and business community and weakened stock markets during 2000–2002, both in the United States and in Europe there has been a widespread debate about implementing a corporate responsibility system which could consider the use of criminal law to deter misconduct by business entities. Governments have made great efforts to improve the system of corporate criminal liability legislation with the aim of limiting financial instability and restoring investors' confidence in financial markets, by increasing their protection and establishing higher standards for corporate governance. The Sarbanes Oxley Act (SOX) represented a step forward in regulating corporate governance and it generated echoes in European legislation that adopted comparable actions in dealing with corporate fraud (Gómez and Ganuza, 2007; Alexander et al., 1999).

The doctrine of corporate crime liability appears to be quite controversial and the reason is twofold. A critical issue concerns the conceptual difficulty of imposing criminal liability on a corporation, which is an artificial and collective entity, since the requisite for attributing criminal liability is a culpable mental state or *mens rea* (Alexander, 1999; Hamdani and Klement, 2009). One of the main benefits of the criminal-law system is the possible use of imprisonment as a punishment in addition to fines, but since enterprises are not physical entities, they cannot be imprisoned so this relevant advantage is nullified.¹ This consideration leads to the other crucial question about the rationale for imposing criminal liability on a corporation, that involves the proper use of criminal law as a more effective way of influencing the conduct of corporations and deterring corporate crimes, when compared with other forms of corporate liability like civil liability or administrative sanctions (Polinsky and Shavell, 1993; Arlen, 1994; Khanna, 1996; Arlen, 2004; Bowles and Garoupa, 2008). It is argued that the choice in favor of criminalization that ensures stiff penalties, including reputational penalties like the threat to go out of business as well as a substantial increase in the severity of sentencing, represents a necessary device to contain corporate malfeasance. Criminal sanctions exhibit a potent social meaning because of their moral censure and they constitute a tool for institutionalizing a more ethical code of behavior by providing firms with powerful incentives to limit illicit conduct. However, despite the role of social stigma as a deterrent against crime, it is often observed

¹There is a famous quote about this principle: “*Did you ever expect a corporation to have a conscience, when it has no soul to be damned and no body to be kicked?*” which can be traced back to the eighteenth century and is attributed to Baron Edward Thurlow. An apocryphal version of the quote reports as an additional part: “*and, by God, it ought to have both!*”. However, long before Baron Thurlow’s time, the ecclesiastical courts had faced the dilemma of corporate punishment related to its anthropomorphic fallacy through the practice of excommunication. See on this point Coffee (1981).

that these sanctions could be disproportionate when considering the interests of third parties involved and may lead to overdeterrence.

Growing theoretical literature has analyzed optimal corporate liability regimes (Arlen and Kraakman, 1997; Shavell, 1997; Kraakman, 1999; Mullin and Snyder, 2009). The issues explored include, first, the socially optimal sanction level and, second, the question about how or whether to attribute corporation liability and optimal sanction targets to firms and their agents. A corporate liability regime may prove to be socially optimal when the sanction equals the sum of the social harm caused by the violation and the social enforcement costs, divided by the probability of detection (Becker, 1968; Polinsky and Shavell, 2000; Oded, 2009). In the literature, this principle represents a useful benchmark to further develop the analysis of socially efficient sanction schemes.

Concerning the proper structure of corporate liability and the most efficient hierarchical level to target with sanctions, it has been highlighted that corporate criminal laws exhibits a dual structure of liability, with both firms and culpable employees being held liable for corporate misconduct. In general, corporate liability can assume different forms, such as *strict corporate liability* or *duty-based liability*. The first system imposes strict liability on corporations whenever a crime occurs, while the other holds firms liable if they contravene a legal duty, i.e., they do not observe due care in preventing or reporting a violation. Moreover, it is possible to observe mixed regimes under which firms are liable but the level of sanctions depends on whether the corporation fulfilled its policing duties. The goal pursued in this case is to activate corporations so that they could prevent regulatory violations and internalize the social consequences. The choice made by governments after financial scandals in the US and Europe seems to follow this composite approach. Corporations are in fact considered strictly liable for crimes committed by their employees within the scope of their employment, but they can take advantage of a mix of complex incentives and monitoring schemes to mitigate the sanctions determined by law.

This paper does not aim to intervene in the debate on the optimal structure of corporate criminal liability. Rather, taking into account the general structure of legislation based on corporate criminal responsibility, we analyze with a theoretical model optimal behavior by firms in reducing the risk of becoming liable in case of regulatory violations, when corporations can adopt different instruments provided by law either to monitor or to incentivize activity by their employees.

The theoretical model proposed allows us to analyze when and to what extent firms will find

it convenient to implement internal devices to deter crimes. We consider a framework where firms have to delegate tasks to a number of managers. The managers can undertake illegal activities (in some states of the world) which increase their expected payoff. If found liable by the state, they are subject to a sanction. The state also imposes a sanction on firms. The criminal liability of the firm is modeled as a permanent reduction of that firm's future profits. Firms can prevent criminal activities of their managers by paying higher (efficiency) wages or through the implementation of monitoring mechanisms characterized by economies of scale. We conclude that more productive firms and those operating in sectors where managers have more opportunities to undertake criminal activities are more likely to prevent such activities (through monitoring or the payment of efficiency wages). When the returns of illegal activities are high or when the firms are large, implementing internal monitoring devices may be optimal, while smaller firms should generally prefer the payment of efficiency wages to prevent crimes by managers.

The scope of corporate criminal liability relies on the deterrence theory within a context of principal-agent relationships. The government attributes to the corporation the task of monitoring potential regulatory violations committed by their employees, so lowering the overall cost of enforcement. Firms naturally have better information and their own enforcement mechanisms are more likely to be more effective. However the law has to provide corporations with the proper incentives to induce them to control and penalize their wayward employees. Both firms and workers make rational choices as utility-maximizing agents: they decide whether to obey or to violate the law according to a cost-benefit analysis, namely by comparing their expected compliance utility with their expected violation utility (Garoupa, 2000; Kraviec, 2005; Ettner, 2005; Oded, 2009). Corporate responsibility systems are meant to provide incentives to market agents to comply with regulations by lowering the payoff expected from illicit behavior. However, a number of issues need to be addressed. The main concern is about the impact of internal control requirements on small and medium sized firms. Many compliance costs are fixed and there are economies of scale in implementing regulatory requirements so that imposing a unique compliance structure on all corporations might not prove to be optimal. In particular, smaller firms may be disadvantaged by adopting internal control systems, since they have to bear higher costs (Litvak, 2007).

There exists a wide range of empirical studies which try to evaluate the market reaction (in particular in the US) to the introduction of legislative reform. The findings are mixed, as both positive and negative effects have been highlighted.

Some authors focus on the impact of corporate regulation on the value of firms suggesting that it increased after SOX, while for some others the value decreased (Jain and Rezaee, 2006; Chhaochharia and Grinstein, 2007; Wintoki, 2007; Zhang, 2007; Boyle and Grace-Webb, 2007; Li et al., 2008). A number of studies investigate the frequency of going-dark and going-private decisions after the introduction of the new legislation (Leuz et al., 2008; Kamar et al., 2009), while others analyze the impact of regulatory burdens on audit quality and its costs (Hoitash et al., 2007; Coates, 2007; Asthana et al., 2009). In general, the new legislation seems to increase the audit fees, but it is possible to observe an improvement in the quality of auditing services as well as relevant changes in the auditor market.

Finally, as a result of the higher risk faced by company executives, a restructuring of management pay has been noted. Linck et al. (2007) look at the effect of the legislation reform on the market for top managers and, in particular, on their remuneration. Their empirical evidence suggests that managers' compensation increased after the introduction of the new legislation, particularly for smaller firms, as a consequence of supply and demand shifts for high quality managers. This result is in line with our findings.

The paper is organized as follows. Section 2 describes the analytical framework. Section 3 derives managers' optimal strategies and Section 4 presents the results on the firm's behavior. Section 5 concludes the analysis.

2 The model

We consider an infinite horizon model in discrete time. Each firm can employ a certain number of managers $n \geq 1$, which will also represent the size of the firm. For simplicity, we assume this is exogenously determined and that the managers are all equal. Each manager has a reservation utility $w_0 > 0$ representing his outside option and, in each period, he is asked to undertake a project that generates an output $y > w_0$. The firm and the manager are risk neutral and discount utility and profits at a rate $\beta = 1/(1+r) > 0$, where r is the risk free interest rate.

In realizing the project, each manager may undertake criminal activities. In particular, we denote with ξ_c the state of the world in which the manager can commit a crime, and with ξ_{nc} the state of the world in which the manager cannot undertake any illegal activity. We denote with $\alpha \in [0, 1]$ the probability that the state of the world $\xi = \xi_c$ occurs, so that $Pr(\xi = \xi_{nc}) = 1 - \alpha$. The realization of the state of the world $\xi \in \{\xi_c, \xi_{nc}\}$ is private information of the managers and is not known to the firm. This implies that the firm's strategies cannot be conditioned

on ξ . The firm has three possible strategies, $S \in \{N, E, M\}$. $S = N$ means that the firm does not prevent the managers undertaking criminal activities. $S = E$ denotes the strategy of paying higher wages to the managers and $S = M$ when there is the adoption of monitoring programs from the firm. With the last two strategies the firm is trying to prevent managers' illegal behaviors. We assume that implementing monitoring deterrence mechanisms (such as compliance programs) implies a per-period fixed cost $k \equiv k(n)$, whose average cost $k(n)/n$ is monotonically decreasing in n and tends to 0 as n tends to infinity.

In states of the world $\xi = \xi_c$, the manager may undertake illegal activities generating a benefit for him equal to $R > 0$ if not discovered. We denote with $s \in \{c, nc\}$ the strategy of the manager, where $s = c$ means that he is committing crimes and $s = nc$ that he is not.

At the end of the period, the judicial authority discover with probability $p \in (0, 1)$ whether the manager has committed a crime or not, while he is not discovered with the complementary probability, $1 - p$.² When a manager is detected, he is punished with a fixed immediate cost $C > 0$. Moreover, the judicial authority can impose additional sanctions that may reduce his future earnings by a factor $\gamma > 0$. This parameter allow us to capture the idea that the stigma linked to the penal imputation has long lasting negative effects. To simplify the analysis and without loss of generality, we assume that the manager cannot commit crimes anymore once he has found to be guilty. When the firm decides not to implement any compliance program and the manager is found to be liable of a crime, the firm incurs in a responsibility involvement that implies a monetary fixed sanction $F > 0$ in the same period, plus a sanction that reduces all future earnings by a fraction $\phi > 0$. The sanction on future earnings is intended to reflect a penal sanction that reduces the ability of the firm to get access to higher productive projects (e.g., projects with the public administration). The game described here is reported in Figure 1.

3 The manager's optimal strategy

We start determining under which conditions the manager finds optimal to undertake criminal activities when the firm pays the minimum wage w_0 —that is, the firm does not make deterrence (N). In this case, the manager finds optimal undertaking criminal activities, if this is possible (i.e., in the state ξ_c), when

$$V^m(N, \xi_c, c) \geq V^m(N, \xi_c, nc), \quad (1)$$

²We denote with $v \in \{v_d, v_{nd}\}$ the state of the world where the manager's crimes are detected and not detected respectively.

where V^m denotes the expected discounted value of the manager, and c and nc denote his strategy relatively to committing or not crimes respectively.³

When the manager gains the minimum wage and he does not commit any crime in the state ξ_c , he obtains

$$V^m(N, \xi_c, nc) = w_0 + \beta V^m(N), \quad (2)$$

where $V^m(N)$ is the manager's value at the beginning of the period (i.e., before the realization of ξ) when the manager has never been found to be liable of any crime in the past.⁴ This is equal to

$$V^m(N) = \alpha \max \{V^m(N, \xi_c, c), V^m(N, \xi_c, nc)\} + (1 - \alpha) V^m(N, \xi_{nc}), \quad (3)$$

where this expression takes into account that criminal activities are feasible only with probability α and, in this case, the manager will choose the strategy that gives him a higher payoff. The value of the manager when crimes are not possible $V^m(N, \xi_{nc}) = V^m(N, \xi_c, nc)$ and is given by (2).

When the manager undertakes criminal activities he gets

$$V^m(N, \xi_c, c) = p [w_0 - C + \beta \bar{V}^m(N)] + (1 - p) [w_0 + R + \beta V^m(N)]. \quad (4)$$

This value takes into account that the manager's crimes are discovered with probability p , and in this case the manager suffers a static punishment equal to C and obtains a value $\bar{V}^m(N)$ from the following period, while his crimes are not discovered with the complementary probability, and in this case he obtains the benefit R .⁵ The value of the manager (at the beginning of a generic period t) that he has been detected committing crimes in the past is given by

$$\bar{V}^m(N) = \sum_{t'=t}^{\infty} \beta^{t'-t} (1 - \gamma) w_0 = \frac{(1 - \gamma) w_0}{1 - \beta}, \quad (5)$$

where γ is the reduction of the salary that such manager will suffer in each future period. This expression incorporates the assumption that the manager will be unable to commit crimes in the future.

When (1) holds, (3) can be rewritten as

$$V^m(N) = \frac{(1 - \beta) + \alpha p \beta (1 - \gamma)}{(1 - \beta) [1 - \beta (1 - \alpha p)]} w_0 + \frac{\alpha}{1 - \beta (1 - \alpha p)} [(1 - p) R - pC], \quad (6)$$

³The apex m indicates that the value function refers to the manager; we shall later use f when the value function refers to the firm.

⁴It is worth noting that when the strategy of nonprevention is optimal and crimes are not committed, then this will also be optimal in the next period.

⁵We next will consider the case where there is limited liability and the maximal static punishment is the loss of wage, i.e., $w_0 = C$.

where we have used (5) and (4), and the fact that $V^m(N, \xi_{nc}) = V^m(N, \xi_c, nc)$.

Substituting (4) and (2) into (1), and taking into account (6) and (5), we obtain that the manager will find optimal to undertake criminal activities when

$$(1-p)R \geq p \left(C + \frac{\beta}{1-\beta} \gamma w_0 \right). \quad (7)$$

The left hand side of condition (7) is the expected gain of the manager from criminal activities, while the right hand side represents the expected costs. The latter is the sum of the fine C and the reduction in future wages following the discovering of the manager's misbehavior.

Let us now consider the case where the firm tries to avoid that the manager undertakes criminal activities by paying higher wages. The efficiency wage inducing the manager not committing crimes satisfies the following condition

$$V^m(E, \xi_c, nc) \geq V^m(E, \xi_c, c), \quad (8)$$

where E denotes the strategy of the firm preventing crimes.

The value of the manager when he does not commit crimes in state ξ_c and the firm pay the salary w is

$$V^m(E, \xi_c, nc) = w + \beta V^m(E), \quad (9)$$

where

$$V^m(E) = \alpha \max \{V^m(E, \xi_c, nc), V^m(E, \xi_c, c)\} + (1-\alpha) V^m(E, \xi_{nc}) \quad (10)$$

is the value of the manager when at the beginning of the period before he knows whether or not there will be opportunities for illegal behavior. $V^m(E, \xi_{nc})$ is the value of the manager in the state where he cannot commit crimes and it is equal to

$$V^m(E, \xi_{nc}) = w + \beta V^m(E). \quad (11)$$

Similarly to the previous case, the value of the manager when he undertakes criminal activities in state ξ_c is

$$V^m(E, \xi_c, c) = p [w - C + \beta \bar{V}^m(N)] + (1-p) [w + R + \beta V^m(E)] \quad (12)$$

where $\bar{V}^m(N)$ is given by (5).

Using (9) and (12), condition (8) can be rewritten as follows

$$\frac{(1-p)R - pC}{p\beta} \leq V^m(E) - \bar{V}^m(N). \quad (13)$$

Substituting (11) and (9) into (10), and taking into account that in equilibrium the firm will choose the salary w so that $V^m(E, \xi_c, nc) = V^m(E, \xi_c, c)$, we obtain

$$V^m(E) = \frac{1}{1-\beta}w. \quad (14)$$

From (13), (14) and (5) follows that the wage preventing the manager's crimes is $w \geq w_e$, where w_e is the efficiency wage given by the following expression

$$w_e = (1-\gamma)w_0 + \frac{1-\beta}{\beta p}[(1-p)R - pC]. \quad (15)$$

As expected, the efficiency wage necessary to prevent managers' illegal behaviors is negatively related to the expected payoff from these actions, and therefore on the (static and dynamic) sanctions imposed to those managers found liable. When the maximal static punishment is the loss of wage ($w_0 = C$), the efficiency wage can be rewritten as

$$w_e = \beta(1-\gamma)w_0 + (1-\beta)\frac{1-p}{p}R.$$

Finally, when the firm adopts a monitoring technology, the manager will be paid the reservation wage w_0 and will not undertake criminal activities as he will be caught with probability one in this case.

4 The firm's optimal strategy

The firm can follow three strategies. It may decide non preventing the managers' criminal activities, or preventing crimes by adopting a monitoring technology or by paying the managers an efficiency wage.

The strategy M of adopting of a monitoring technology gives a value to the firm equal to

$$V^f(M) = \frac{n(y-w_0) - k}{1-\beta}, \quad (16)$$

where $y-w_0$ is the gain of the firm from each of the n manager, and $k \equiv k(n)$ is the per period cost of the technology. Expression (16) incorporates the fact that crimes are not possible when this technology is employed. It is clear that a necessary condition for this strategy to be considered by the firm is that it gives a positive payoff, i.e., $V^f(M) \geq 0$, which in turn requires an that the average cost of monitoring lower than a certain threshold. In particular, we need that $k/n \leq y-w_0$.

If the firm follows the strategy E of preventing crimes by paying an efficiency wage w_e to the managers, it obtains

$$V^f(E) = \frac{n(y-w_e)}{1-\beta}. \quad (17)$$

Again, this strategy provides a positive payoff to the firm, $V^f(E) \geq 0$, only when the product generated by each manager is higher than the efficiency wage, i.e., $w_e \leq y$. From the expression of the efficiency wage in (15) follows that this will generally be possible only if the expected returns from criminal activities are not too high for the manager.

When the firm opts for the nonprevention strategy N , it pays the managers the minimum salary w_0 and its expected discounted value will be equal to

$$V^f(N) = \alpha V^f(N, \xi_c) + (1 - \alpha) V^f(N, \xi_{nc}), \quad (18)$$

where this expression incorporates the fact that with probability α there is a state of the world where the managers can undertake illegal activities, while crimes are not possible with the complementary probability. The value of the firm when managers cannot undertake criminal activities is

$$V^f(N, \xi_{nc}) = n(y - w_0) + \beta V^f(N), \quad (19)$$

while

$$V^f(N, \xi_c) = V^f(N, \xi_c, c) = p \left[n(y - w_0 - F) + \beta \bar{V}^f(N) \right] + (1 - p) \left[n(y - w_0) + \beta V^f(N) \right] \quad (20)$$

represents the firm's value when crimes can be made and condition (7) holds, so that it is optimal for the managers undertaking illegal activities. Expression (20) takes into account that managers are not discovered by the public authority with probability $1 - p$, and in this case the firm's payoff is the same as in (19), and that managers' crimes are detected with probability p . In this case, the firm pays a fine F and is punished in the future with a reduction of future payoffs by a factor ϕ , which implies that its value is

$$\bar{V}^f(N) = (1 - \phi) \frac{n(y - w_0)}{1 - \beta}. \quad (21)$$

Substituting (19) and (20) into (18), and using (21), we obtain that the value of the firm from the nonprevention strategy can be written as

$$V^f(N) = \frac{1 - \beta + \beta \alpha p (1 - \phi)}{(1 - \beta) [1 - \beta (1 - \alpha p)]} n(y - w_0) - \frac{\alpha p}{1 - \beta (1 - \alpha p)} nF. \quad (22)$$

As we have determined the value of the firm from each strategy, we can now move to analyze its optimal behavior.

When the firm undertakes the prevention strategy, it prefers monitoring the managers rather than paying them efficiency wages if

$$V^f(M) \geq V^f(E). \quad (23)$$

From (16) and (17) follows that this condition is satisfied when

$$\frac{k(n)}{n} \leq w_e - w_0, \quad (24)$$

i.e., when the average cost of the monitoring technology is lower than the extra-wage that has to be paid to each manager in order to avoid him committing crimes. The assumption that the monitoring cost is monotonically decreasing in the size of the firm and becomes low enough for n large ensures that there will be a level of n , call it n^* and defined as $k(n^*)/n^* = w_e - w_0$, such that (23) is satisfied for all $n \geq n^*$. In other words, large firms will prefer the adoption of a monitoring technology while smaller firms may prefer paying higher wages to managers when preventing crimes is optimal.⁶

We now compare the two strategies of crime prevention and the nonprevention strategy. In this respect, it is useful to observe that the payoffs from prevention are independent on the sanction ϕ imposed to the firm when illegal activities are discovered by the public authorities, while the nonprevention payoff is monotonically decreasing in ϕ (see Figures 2a and 2b).⁷ This implies that there exists a threshold level of $\phi = \phi_M^*$ defined as the solution of the equation $V^f(N, \phi_M^*) = V^f(M)$, i.e.,

$$\phi_M^* = \frac{[1 - \beta(1 - \alpha p)]k - (1 - \beta)\alpha p n F}{\beta \alpha p n (y - w_0)}, \quad (25)$$

such that $V^f(N) > V^f(M)$ for all $\phi \in [0, \phi_M^*)$, and $V^f(N) < V^f(M)$ for all $\phi \in (\phi_M^*, 1]$. Similarly, there will be a threshold ϕ_E^* defined as the solution of the equation $V^f(N, \phi_E^*) = V^f(E)$ and equal to

$$\phi_E^* = \frac{[1 - \beta(1 - \alpha p)](w_e - w_0) - (1 - \beta)\alpha p F}{\beta \alpha p (y - w_0)}, \quad (26)$$

such that $V^f(N) > V^f(E)$ for all $\phi \in [0, \phi_E^*)$, and $V^f(N) < V^f(E)$ for all $\phi \in (\phi_E^*, 1]$.

Both thresholds may not be interior however. $\phi_M^* < 1$ if and only if $V^f(N, \phi = 1) < V^f(M)$. Using (22) and (16), we find that this is the case when

$$\frac{k}{n} < \frac{\alpha p}{1 - \beta(1 - \alpha p)} [\beta(y - w_0) + (1 - \beta)F],$$

namely when the average cost of monitoring is lower than a certain threshold. Moreover, $\phi_M^* > 0$ if and only if $V^f(N, \phi = 0) > V^f(M)$, which requires that

$$\frac{k}{n} > \frac{\alpha p(1 - \beta)}{1 - \beta(1 - \alpha p)} F,$$

⁶We assume that the condition $w_e \leq y$ is always satisfied. This in turn means that $w_e - w_0 < y - w_0$, and that the range of parameters where monitoring is preferred to efficiency wages is non empty.

⁷It is straightforward to verify from (22) that $dV^f(N)/d\phi < 0$.

namely when the average cost of monitoring is higher than a certain threshold. In other words, the threshold ϕ_M^* is interior when the average cost of monitoring is within a certain range.

Similarly, the threshold ϕ_E^* is interior when the efficiency wage is nor too high or too low. In fact, $\phi_E^* < 1$ if and only if $V^f(N, \phi = 1) < V^f(E)$, which requires that

$$w_e < \frac{1}{1 - \beta(1 - \alpha p)} [\beta \alpha p y + (1 - \beta)(w_0 + \alpha p F)],$$

and $\phi_E^* > 0$ if and only if $V^f(N, \phi = 0) > V^f(E)$, namely when

$$w_e > w_0 + \frac{\alpha p(1 - \beta)}{1 - \beta(1 - \alpha p)} F.$$

From the above analysis, we can emphasize the following results.

1. Larger firms should prefer preventing crimes using monitoring programs rather than paying higher efficiency wages (see condition (24)). Moreover, larger firms should prefer the prevention of crimes by the adoption of monitoring technologies to nonprevention, which follows from ϕ_M^* decreasing in n .
2. More productive firms (i.e., firms with a larger surplus $y - w_0$) should prefer the strategy of preventing crimes to nonprevention. This follows from the fact that both thresholds ϕ_M^* and ϕ_E^* are decreasing in $y - w_0$ (see (25) and (26)), and therefore the regions of crime prevention, $\phi \in (\phi_M^*, 1]$ and $\phi \in (\phi_E^*, 1]$, increase as $y - w_0$ gets larger. The intuition for this result is that more productive firms have more to lose if their managers are caught by the public authorities in illegal activities.⁸
3. Firms where managers have more opportunities to undertake criminal activities, i.e., characterized by a higher α , should prefer the prevention of crimes as the thresholds ϕ_M^* and ϕ_E^* are both strictly decreasing in α .
4. When the return of the managers from illegal activities R is very high, then preventing crimes through monitoring may be preferred to the payment of efficiency wages. This is because the higher the returns from crime and the higher will be the wages to be paid to the managers in order to make optimal for them behaving honestly (see the expression of the efficiency wage in (15)). Moreover, higher level of efficiency wages necessary to prevent managers' crime may favor the adoption of a nonprevention strategy when monitoring programs are too costly.

⁸Recall that the firm suffers a reduction of future payoffs by a factor ϕ when the managers are found to be guilty.

5. A higher probability of detection of crimes, i.e. a higher p , implies that prevention is preferred to nonprevention because ϕ_M^* and ϕ_E^* are both decreasing in p . This result comes from the fact that higher levels of p reduce the value of the firm from nonprevention. Moreover, paying efficiency wages become more convenient than adopting monitoring programs because the efficiency wage is decreasing in p (see equations (15) and (17)). This means that the size of the firm above which the adoption of monitoring programs is optimal is negatively related to p —i.e., n^* is decreasing in p .

5 Concluding remarks and discussion

Corporate criminal law is particularly invoked during financial crises as a proper mean to deter illicit corporate misconduct and to establish higher standards for corporate governance, so restoring investors' confidence in financial markets. It is often argued that the choice in favor of criminalization and the stigma's role it encompasses represents a necessary tool to limit corporate crimes and institutionalize a more ethical code of corporate behavior. However the doctrine of corporate crime liability appears to be quite controversial and several questions need to be answered. Our paper tries to provide some insights on the economic theory of corporate crime enforcement. In particular, we studied the optimal firm's behavior when this is subject to criminal liability that we have modeled as a reduction of the firm's future productivity. We obtained that variables like the size of the firm or its productivity are important determinants on the decision of the firm to prevent criminal activities and affect which prevention strategy to implement, i.e. paying higher wages to managers or adopting monitoring internal devices. Other variables related to the profitability of the illegal activities and the probability to be found liable by the state also play a role.

Although the analysis developed here takes as exogenous the structure of the sanctions for illegal behaviors, it provides some insights that could be useful for the optimal design of sanctions. For example, we have obtained that small firms are unlikely to adopt monitoring internal programs when these requires relatively high fixed costs. At the same time, high returns from criminal activities may also make not viable the prevention of crimes through the payment of efficiency wages because of the high costs this implies. Under these circumstances, the firms may prefer to take the risk of sanctions due to the managers' illegal activities rather than preventing misbehaviors. Moreover, our analysis has highlighted that the activities of crime prevention of firms and state are substitute under some circumstances but are likely to be complements under other conditions. A firm adopting monitoring internal devices

discourages managers' misbehaviors and, in this sense, its action is a substitute of the state monitoring/repressive activity. However, the convenience for the firm to adopt these programs or to prevent crimes through the payment of higher wages also depends on the efficiency of the state in detecting illegal behaviors (as well as on the structure of sanctions). Recall that a high probability of detection of crimes reduces the efficiency wages that need to be paid to managers making more convenient this strategy and, in general, all strategies preventing crimes.

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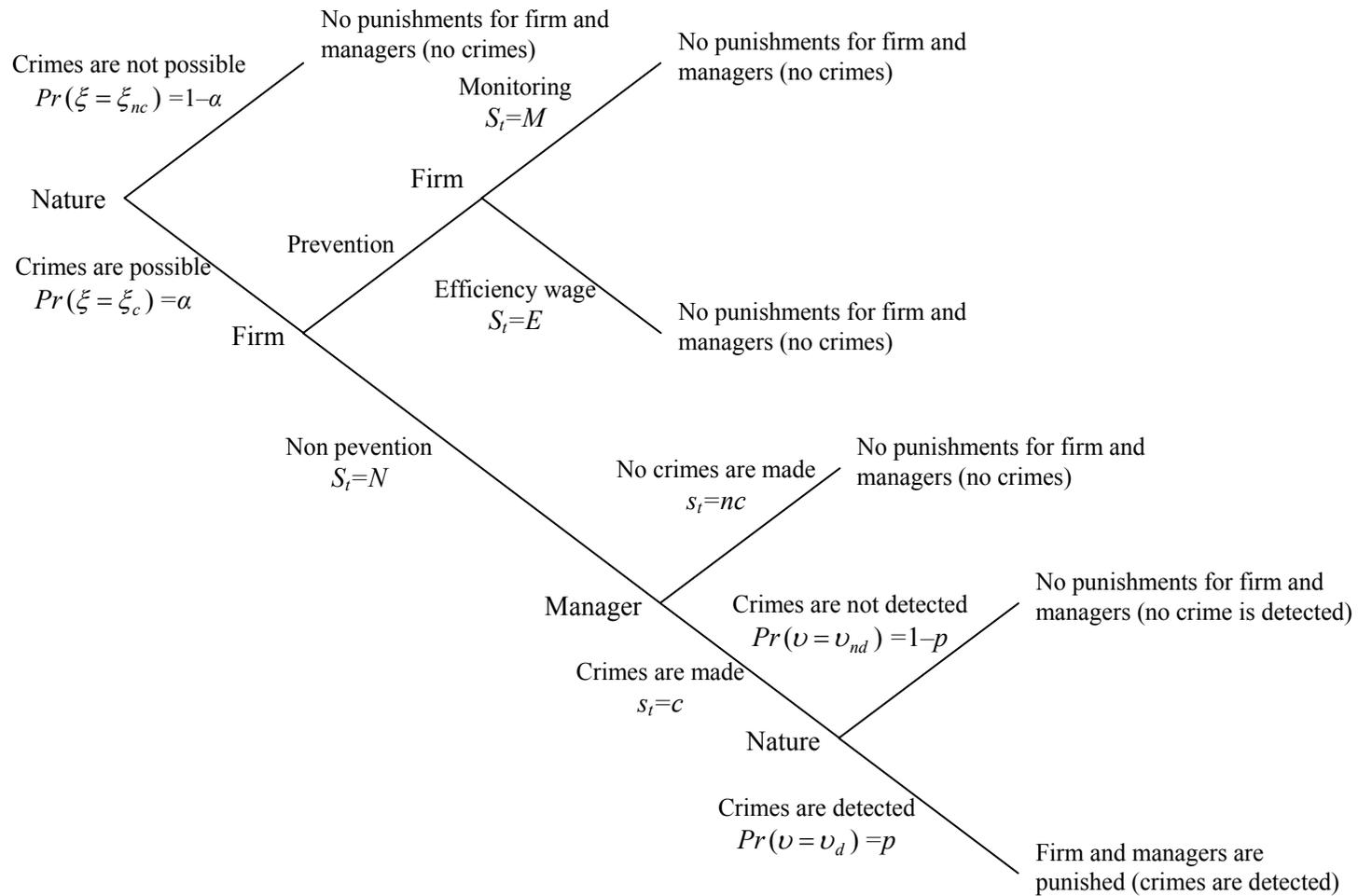


Fig. 1. The game form in period t .

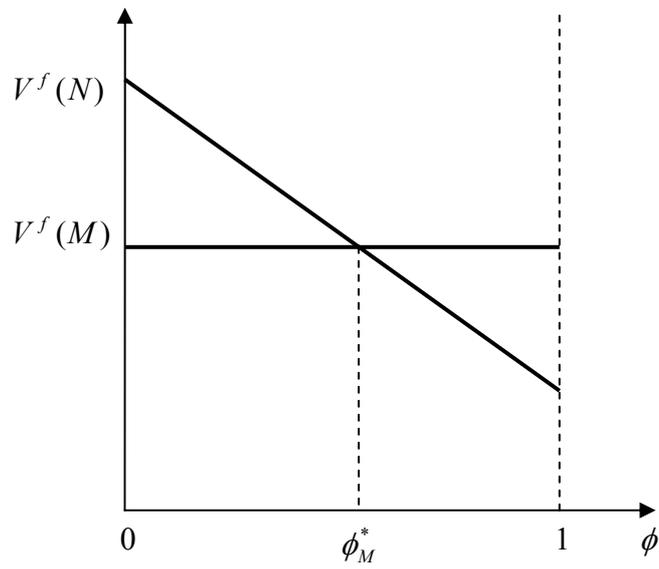


Fig. 2a. The comparison between *Nonprevention* and *Monitoring*.

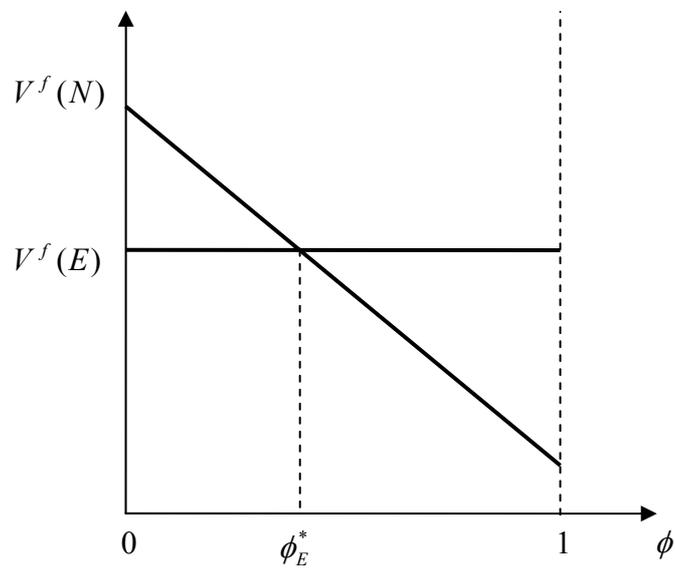


Fig. 2b. The comparison between *Nonprevention* and *Efficiency wages*.