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Corporate Fraud, Governance and Auditing

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Giovanni Immordino ♦ **and Marco Pagano** ♥

Abstract
We analyze corporate fraud in a setting in which managers have superior information but are biased against liquidation, because of their private benefits from empire building. This may induce them to misreport information and even bribe auditors when liquidation would be value-increasing. To curb fraud, shareholders optimally design internal corporate governance, by choosing audit quality and managerial compensation. Both internal governance mechanisms tend to substitute for poor shareholder protection; in contrast, audit quality tends to complement stricter auditing regulation. We also find that severance pay dominates both equity and option-based pay in improving managerial incentives.

JEL classification: G28, K22, M42.

Keywords: accounting fraud, auditing, managerial compensation, corporate governance, regulation.

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1. Introduction

The desire to keep or increase their private benefits of control often biases managers in favor of corporate expansion plans, even when these are unprofitable, and against liquidation or restructuring decisions, even when these would be desirable. But shareholders can design the internal governance of the company so as to mitigate this managerial bias toward empire building and against efficient liquidation. To this purpose, they can rely on two main mechanisms. First, they can rely on monitoring, for instance by appointing auditors and independent directors to verify the information provided by managers and oversee their decisions. Second, they can design the compensation of managers so as to induce them to provide truthful information on the firm's prospects and to deter them from inducing auditors to validate false accounting data. To this purpose, one can combine a variety of contractual schemes, ranging from equity and option-based compensation to severance pay.

The design of internal corporate governance does not occur in a void, however: its effectiveness in controlling managerial incentives depends non-trivially on external governance rules, that is, on the legal provisions that constrain the extraction of private benefits of control, and those that enhance the reliability of the information reported by managers. The purpose of this paper is to analyze how external governance rules affect the internal governance of companies, and how they jointly affect managerial incentives and corporate investment decisions.

On the whole, our analysis underscores that different external governance provisions have opposite effects on the internal governance of firms: some act as substitutes of internal governance mechanisms, while others enhance their effectiveness, and therefore complement them. Specifically, rules that directly constrain the *magnitude of the private benefits* that managers can extract, such as norms forbidding or limiting related party transactions, will tend to be partly counteracted by weaker internal governance: for instance, they may induce firms to lower the pay-performance sensitivity of managers' compensation or invest fewer resources in auditing. Conversely, rules that enhance the *monitoring mechanisms* available to shareholders, such as those that promote the loyalty of auditors or independent directors, will encourage companies to step up monitoring activities in their internal governance.

This distinction is relevant to a recent strand of empirical research that tests whether firm-level internal governance tends to substitute or complement country-level external governance. The evidence is ambiguous. Several studies suggest that internal and external governance are substitutes in their effects on company valuation (Aggarwal Erel, Stulz and Williamson, 2007; Chhaochharia

and Laeven, 2009; Durnev and Kim, 2005, Klapper and Love, 2004, and Lins, 2003). But Aggarwal, Erel, Stulz and Williamson (2009) report "evidence that investment in internal governance and investor protection are complements rather than substitutes" (p. 3167): foreign firms invest less in internal governance mechanisms to protect minority shareholders than comparable U.S. firms. This finding is consistent with that of Doidge, Karolyi and Stulz (2007), who document a positive correlation between company-level governance scores and the country-level degree of shareholder protection in financially developed countries, though not for emerging market countries. Our model suggests that the sign of this correlation may depend on the specific external governance provisions under investigation, the key distinction being between those that directly limit private benefits of control and those that enhance the effectiveness of monitoring within companies.

We study these issues in a model where managers are better informed than investors, but, due to the private benefits of empire building, may have the incentive to misreport information and even to bribe auditors when liquidation would be optimal. Poor external corporate governance strengthens their bias against liquidation and their incentive to fraudulent accounting. To explore how the company's internal governance reacts to external governance rules, initially we hold managerial compensation fixed – assuming that management has an exogenously given equity stake – and focus on the role of auditing as an internal governance mechanism. Auditing is taken to include not only checks by outside auditing firms but also verification of corporate accounts by internal auditors and independent directors. The informational basis of corporate policies can be improved by stepping up any of these activities.[1]

The optimal audit quality turns out to have a non-monotonic relationship with shareholder protection. With poor shareholder protection, auditors are ineffective and so hardly worth hiring, since managers would bribe them anyway to avoid liquidation. In an intermediate range of shareholder protection, it becomes optimal to hire auditors to deter managerial fraud. Over this range, the better is shareholder protection the less is to be invested in auditing. In the limit, when external governance is very good, auditing is again useless: if managers are very well aligned with shareholders, they can be trusted to do the right thing. Also the regulation of auditing firms affects optimal audit quality: the stricter is auditing regulation, the less likely that auditors will take bribes

[1] In the case of external auditors, audit quality can be improved by increasing the accuracy of verification, for instance by requiring external confirmation of the company's credits, performing on-site inspections of inventories and directly interviewing managers and employees at various levels. In general, this greater verification effort by auditors involves costs in terms of man-hours by qualified personnel and other costs, and so translates into steeper auditing costs for the customer company.

from managers to misreport information, so that it is worth spending more resources on auditing. Thus, audit quality has a relationship of substitutability with shareholder protection but one of complementarity with auditing regulation.

In the second part of the paper, we let shareholders choose jointly audit quality and managerial compensation. An incidental but important result is that in this model optimal compensation invariably takes the form of "paying the CEO for reporting bad news", which can be interpreted as severance pay, since bad news are followed by liquidation of the company. We find that if audit quality and severance pay are chosen optimally and jointly, an improvement in shareholder protection tends to trigger decreased reliance on both. Conversely, stricter auditing regulation has opposite effects on the two dimensions of internal governance: it calls for reduced severance pay, but for enhanced auditing intensity. In summary, while in general internal corporate governance tends to have a substitutability relationship with external governance rules, an important exception arises in the case of the relationship between audit quality and the strictness of auditing regulation, which are complements.

Another byproduct of the analysis is that equity-based and option-based compensation play no role in optimal managerial compensation. This is because the agency problem analyzed in the model arises from the "empire-building bias" of the management, rather than from the inefficiently low provision of managerial effort. This bias is effectively tempered by severance pay, in line with the results of Levitt and Snyder (1997), Inderst and Müller (2008), Eisfeldt and Rampini (2008) and Laux (2008). Equity-based compensation is a less efficient way to affect this bias, because it does so at the cost of giving the manager a rent in good states. Option-based compensation is even less appropriate: it provides no penalty for inefficient continuation, and may actually exacerbate the manager's continuation bias (if options have short vesting).

Our paper is related to recent literature on managerial fraud. While our analysis takes into account that shareholders can restrain managers' incentives to engage in fraud both via the design of their compensation and via the intensity of auditing, related papers tend to concentrate on each of these two levers separately: for instance, Goldman and Slezak (2006) focus on equity-based compensation,[2] while Povel, Singh and Winton (2008) analyze investors' monitoring effort.[3]

[2] Benmelech, Kandel and Veronesi (2007) also focus on equity-based compensation when managers can lie about the firm's growth prospects, and show that in a dynamic setting it is optimal to index managerial compensation both to the stock performance and to the company's earnings. Like Goldman and Slezak (2006), they do not consider monitoring as an additional governance tool.

Our model of auditing is related to the analysis of Dye (1993). There, however, audit quality is assumed to be unobservable, which directly generates an agency problem.[4] In contrast, in our model audit quality is observable, the agency problem arises from the manager's superior information and imperfect alignment with shareholders, and it may extend to auditors if managers bribe them. Our problem is more akin to that studied by Kofman and Lawarrée (1993), where an imperfectly informed agent – the auditor – plays a useful role in monitoring a perfectly informed one – the manager – because his incentives are better aligned with those of the principal. The key difference is that in our setting external corporate governance affects the severity of managerial moral hazard, and thereby optimal auditing intensity as well as executive compensation.[5]

Finally, a growing empirical literature has investigated how the incidence of managerial fraud responds to the internal governance of firms and to auditing quality, broadly defined to include the monitoring activity of independent directors. In accordance with our predictions, earnings restatements are less frequent in firms whose board or audit committees include an independent director with financial expertise (Agrawal and Chada, 2005) and the incidence of accounting fraud and earnings manipulation is lower in companies with more independent boards (Beasley, 1996; Dechow, Sloan and Sweeney, 1996; Klein, 2002). Another strand of the empirical literature has analyzed the relationship between managerial incentive pay and accounting fraud. Bergstresser and Philippon (2006), Burns and Kedia (2006), Kedia and Philippon (2007) and Peng and Röell (2008) document that high-powered incentive schemes (especially options) are positively correlated with proxies for accounting fraud, such as discretionary accruals, fraud accusations, accounting

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[3] These papers differ from ours in other respects as well. In Goldman and Slezak (2006), equity-based compensation elicits managerial effort but also induces managers to manipulate earnings to boost stock prices. In our model, by contrast, manager's incentive to misreport derives from an empire-building motive, and equity-based compensation mitigates managerial fraud. This is because we assume equity-based pay to be indexed to the final value of stocks, and not to a short-term stock price that managers can manipulate, as in Goldman and Slezak. Povel, Singh and Winton (2008) focus on how investors' monitoring activity varies over the business cycle. They show that in booms investors exert less effort to verify managerial information, because their beliefs about investment opportunities are more optimistic than in a slump. This implies that the incidence of corporate fraud is greater in booms than in slumps, a prediction that Wang, Winton and Yu (2008) show to be consistent with the evidence.

[4] In Dye (1993) the problem is resolved by litigation, insofar as auditors have wealth that damaged clients can seize. Immordino and Pagano (2007) show how the agency problem can be tempered by regulations imposing minimum audit standards.

[5] There are two other substantial modeling differences. First, Kofman and Lawarrée assume two auditors, a corruptible but costless internal auditor and an incorruptible but costly external one, while in our setting there is a single auditor, who is both costly and corruptible. Second, they make different assumptions regarding the state in which the manager has the incentive to bribe the auditor, so that collusion can only occur in the good state, whereas under our assumptions it may occur only in the bad state.

restatements and security class action litigation. The contribution of our paper to this line of research is to show not only that the incidence of corporate fraud is affected by auditing quality and managerial compensation, but that both of these aspects of the internal governance of firms are endogenous, being optimally chosen by shareholders in response to public policy parameters – shareholder protection and auditing regulations – as explained above.

The paper is structured as follows. Section 2 sets out the model and its assumptions, Section 3 derives the optimal choice of auditing quality for given managerial compensation, Section 4 analyzes the optimal choice of managerial compensation, and Section 5 draws it all together, deriving the optimal internal governance regime for each possible configuration of external governance parameters. Section 6 concludes.

2. The model

Consider a firm worth V_0, whose continuation requires an expenditure of size *I*. Otherwise, the company is liquidated at its status-quo value V_0.[6] If shareholders decide to invest the resources *I*, the final value of the company changes to $V_1 = V_0 + \tilde{V} - I$, where $\tilde{V}$ is a random variable that equals $V_H > I$ in a good state occurring with probability $p \in (0,1)$ or $V_L < I$ in a bad state occurring with probability 1−*p*. Thus, the investment *I* is profitable in the good state $s = H$ but not in the bad state $s = L$.

There are three players: (i) a manager (*M*), who owns a minority stake γ of the company's shares and runs the company; (ii) shareholders (*S*), who own the remaining stake $1-\gamma$ and decide whether to invest and whether to hire an auditor; and (iii) an auditor, who provides a report of quality *q* for an audit fee F.[7] We assume risk neutrality, no discounting and limited liability. Moreover, for simplicity we set the reservation utility of the manager at zero, so that it is never optimal to pay a fixed salary to the manager.

If shareholders decide not only to invest *I* but also to hire an auditor, the company disburses an audit fee, so that the required expense is $I + F$. If the company continues to operate, its manager can divert an amount of corporate resources $D > 0$ and appropriate it as private benefits, decreasing

[6] Alternatively, the choice may be interpreted as one between a *status quo* where the firm retains its existing capital stock and an expansion plan whereby it undertakes a new project costing *I*.

[7] For the definition of auditing quality *q*, see below.

the company's value by the same amount;[8] under liquidation, for simplicity private benefits are set to zero.[9] The manager has no wealth when shareholders hire him, and his private benefits cannot be seized: jointly with the limited liability assumption, this implies that his compensation is never negative.

The unconditional expectation of the firm's incremental value is assumed to exceed the investment *I*: $\bar{V} - D = pV_H + (1-p)V_L - D > I$. Therefore, managerial diversion is not so large as to prevent the firm from investing, but it can lead to a misallocation of resources, by inducing continuation even in the bad state.[10]

Since *D* is the maximum private benefit that the manager can extract without risking legal sanctions, the expected profit that management cannot appropriate, $P \equiv \bar{V} - I - D$, is a natural measure of shareholder protection, namely of the degree to which regulation and its enforcement constrain managerial opportunistic behavior, such as tunneling corporate resources via related party transactions. But shareholder protection *P* is only one of the two dimensions through which legal institutions can affect the agency problem within the firm: the other is the regulation of auditing, which sets penalties for unloyal auditors as well as for managers who attempt to bribe auditors. The stricter is auditing regulation, the larger is the fear of sanction and therefore the "reservation bribe" that auditors will require from management to engage in fraud. So this reservation bribe, that we shall denote by $\bar{B}$, can be viewed as a measure of the strictness of auditing regulation.

We shall refer to shareholder protection *P* and strictness of auditing regulation $\bar{B}$ as the two dimensions of the *external* corporate governance, as they are set by public policy and taken as given by firms. But shareholders also have two *internal* governance levers at their disposal to maximize the firm's expected continuation value: audit quality and managerial compensation. They can realign managers' incentives to their own by raising audit quality *q*, for instance by allocating spending more resources on auditing or by appointing highly skilled independent directors: better auditing enables them to check the truthfulness of managers' reports on the profitability of continuation. In the baseline model, the incentive effect of managerial compensation is held fixed,

[8] The results of the model would not be qualitatively affected by allowing for deadweight costs of managerial diversion. An increase in these deadweight costs is tantamount to a reduction in *D* within the current setting.

[9] Our results survive even if the manager's private benefits are positive with liquidation, provided they are lower than with continuation.

[10] Under the opposite assumption, the unconditional value of the firm under continuation would be negative, so that the inefficiency would be the reverse from our setting: the firm would be liquidated too often, not too seldom. But the basic logic of the model would be similar.

being captured by an exogenously given equity stake γ. However, subsequently we allow for complete flexibility in the choice of the managerial compensation scheme, our ultimate aim being to characterize the optimal design of internal governance – the joint choice of audit quality and managerial compensation – as a function of external governance parameters, that is, shareholder protection P and strictness of auditing regulation $\overline{B}$. The assumption that shareholders can design the company's internal corporate governance presupposes that ownership is not so dispersed as to prevent their ability to pursue their common interest. Otherwise, even decisions such as the choice of auditors would be captured by the manager, thereby making agency problems more severe.

In the following subsections we complete the description of the game, presenting the players' payoffs, the game's structure and the equilibrium concept to be used in its solution.

2.1 Payoffs

Under continuation the value of the company, net of the investment and audit cost, is

$$V_1^c = \begin{cases} V_0 + \tilde{V} - I - D & \text{under no audit,} \\ V_0 + \tilde{V} - F - I - D & \text{under audit,} \end{cases} \tag{1a}$$

while if the company is liquidated, its final value is

$$V_1^l = \begin{cases} V_0 & \text{under no audit,} \\ V_0 - F & \text{under audit.} \end{cases} \tag{1b}$$

For simplicity, we assume the company's initial value V_0 to be large enough that its final value is never negative.[11] Shareholders' wealth is a fraction $1-\gamma$ of this final value, so that their payoff is:

$$\Pi_S^h = (1-\gamma)V_1^h, \tag{2}$$

where $h = c, l.$ Shareholders have no private information about the company's final value. Since $\overline{V} - D > I$, lacking any other information they will always opt for continuation, even in the bad state where this is inefficient. However, they may improve their decision by using the reports of the manager and/or the auditor.

[11] The model could easily accommodate the case in which the company goes bankrupt when investment is undertaken in the bad state. In this case, due to limited liability shareholders would get a zero payoff from their holdings.

Unlike shareholders, the manager has perfect knowledge of the company's final value V_1^c under continuation. Since in this case he also gains the private benefit *D*, his final payoff is:[12]

$$\Pi_M^h = \gamma V_1^h + D \cdot 1_c, \tag{3}$$

where $h = c, l$ and 1_c is an indicator function equal to 1 under continuation and 0 under liquidation.[13] Expression (3) presupposes that the manager cannot trade his stake γ before the company's final value is publicly known ("long vesting"). Even though the manager knows whether continuation is worthwhile or not, he may not have the incentive to report V_1^c truthfully to shareholders: he may prefer continuation even when it is not value-increasing, if the private benefit *D* that he expects to realize exceeds the loss on his stake γ.

Auditing should allow shareholders to base their investment decision on reliable information that cannot be obtained from the firm's manager. Auditors have a costly technology that helps to determine whether continuation will increase or decrease the company's value, and they use it to produce a report $r_A \in \{V_L, V_H\}$.[14] An audit varies in quality, depending on the procedures that adopted (e.g., external confirmation of accounting data). We denote audit quality by $q \in [0,1]$, where higher *q* corresponds to a more precise signal about the company's final value but implies a higher cost according to a function $C(q)$ that is continuous, increasing and convex in *q*, with $C(0) = 0$ and $\lim_{q \to 0} C'(q) = 0$. The idea that audit quality is a choice variable is consistent with the evidence surveyed by Francis (2004), who documents that clients can raise the quality of auditing by picking auditing firms that are larger or more specialized in their industry.

The auditor's signal is perfectly accurate when the state is *H*, but it may be inaccurate if the state is *L*. Formally, the conditional probabilities of the auditor's report being correct are:

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[12] This private benefit is assumed to reduce the monetary benefits accruing to shareholders. However, the results would be qualitatively unchanged if private benefit had been modeled as a non-monetary gain that does not decrease the gain to shareholders.

[13] In principle, shareholders could assign to the manager a fraction of the company's value increment $\gamma(V_1^h - V_0)$ alone. However, this would imply that the manager's monetary payoff would be negative in the bad state, which would conflict with the manager's limited liability.

[14] Outside auditors assess the reliability of the historical and prospective information provided by the company's accountants and deliver this "certified" information to investors who use it to evaluate the company. As in Dye (1993), here too these two phases (data validation and valuation) are collapsed into a single step, by viewing the auditor's report as an assessment of the company's value.

$$\begin{aligned} &\Pr(r = L \mid s = L,\ q) = q, \\ &\Pr(r = H \mid s = H,\ q) = 1. \end{aligned} \tag{4}$$

This assumption is quite natural in our context, where the manager observes the true state of nature and wishes the firm to continue: in the good state the manager will convey to the auditor the evidence in his possession to show that continuation is worthwhile, and by the same token he will not caution the auditor against any mistake that he may make when the state is bad. This can be thought of as a reduced form of a communication stage between the manager and the auditor.

We assume that audit quality is contractible, so that the auditor's fee $F(q)$ can be conditioned on it.[15] To meet the participation constraint of auditors, their fee must cover their costs, that is, $F(q) \geq C(q)$. We assume competition between auditors.[16]

If the auditor has discovered that the firm's incremental value is low ($V = V_L$), the manager may attempt to bribe him into reporting V_H. As such, bribery cannot occur in the good state ($V = V_H$), where the auditor's report would be favorable to continuation anyway.[17] As already explained above, the auditor has a reservation bribe: he will not lie unless he gets at least a bribe $\overline{B}$, which reflects the fear of sanction for unloyal behavior (i.e. both the severity of sanctions and the effectiveness of their enforcement). The actual bribe is determined by a take-it-or-leave-it offer:[18] the manager pays the reservation bribe $\overline{B}$ and gains the surplus stemming from the more likely continuation. Note that the reservation bribe $\overline{B}$ may also reflect a penalty inflicted on the manager if found out attempting to corrupt the auditor – a penalty that Karpoff, Lee and Martin (2009) show to be quite sizeable for U.S. managers.[19] In any event, what matters is the total expected penalty

[15] We assume that the fee is not conditional on the ex-post accuracy of the report. If optimally designed by shareholders, such a fee could help deter bribe-taking by the auditor. However, the analysis under this more sophisticated contract yields no qualitatively new insights and is considerably more complex. Moreover, managers could take advantage of contingent auditing fees to bribe auditors more effectively, rather than to deter them from bribing. This may explain why contingent audit fees are not observed in actual practice.

[16] The model could easily allow for auditors' rents arising from market power. The only significant effect of this would be that the manager's ability to bribe auditors would be correspondingly reduced, since the danger of losing a higher fee would induce auditors to behave better.

[17] We rule out the possibility for the auditor to blackmail the manager when the signal is positive, thus obtaining a bribe in this state of nature as well.

[18] This assumption is made only for simplicity. Allowing for more general assumptions about the bargaining power of the manager and the auditor would leave the equilibrium qualitatively unaffected.

[19] They show that U.S. managers identified as responsible for financial misrepresentation by the SEC or the Department of Justice face significant disciplinary penalties: the majority of them are fired, and bear

inflicted on both parties if fraud is detected. When indifferent, the manager is assumed to prefer not to bribe. If the auditor does not accept the bribe, he will misreport the state of the world only by mistake, wrongly reporting $r_A = V_H$ in the bad state. This occurs with probability $(1-p)(1-q)$, where $1-p$ is the probability of the bad state and $1-q$ is the probability of an inaccurate report.

For auditing to play a beneficial role in the allocation of investment, its cost to the firm must not be prohibitively high, so we assume that at least in the good state the company makes a profit even after paying for the cost of auditing, that is $V_0 + V_H - I - D - F > 0$, where F is optimally chosen by shareholders. The precise parameter restrictions that are implied by this assumption will be specified below, once the optimal audit contract has been characterized.

2.2. Structure of the game

There are six stages, as shown in the time line of Figure 1. At stage 0, shareholders choose the manager's compensation contract. In the baseline version of the model, we skip this stage, and assume a given equity stake γ; in Section 4, instead, we will solve for the optimal compensation contract. At stage 1, nature (*N*) determines the incremental value of the company under continuation: V_H with probability p and V_L with probability $1-p$. At stage 2, the manager observes the state of nature and reports $r_M \in \{V_L, V_H\}$ to shareholders, either truthfully or not. At stage 3, shareholders decide whether to engage an auditor. If they opt not to audit, they must then decide whether or not to invest solely on the basis of the manager's report. In this case the game is over and its payoffs are realized; if they elect to get an auditor's opinion, the game moves to the next stage. At stage 4, the auditor observes the signal concerning the state, may or may not accept a bribe from the manager, and files a report $r_A \in \{V_L, V_H\}$. Finally, at stage 5, shareholders make their investment choice based on both the manager's and the auditor's reports, and payoffs are realized.

[Insert Figure 1]

The extensive form of the game is illustrated by the tree in Figure 2, where each node is marked by the initial of the player moving. To save space, we omit payoffs at the final nodes.

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substantial financial losses in the form of fines, restrictions on shareholdings and on subsequent employment, while 28 percent of them face criminal penalties, including jail sentences.

[Insert Figure 2]

After the stage-1 move by nature (*N*), the manager (*M*) files a report to shareholders: at stage 2 his action is $a_2 \in \{L, NL\}$, where *L* stands for "lying" and *NL* for "no lying". If indifferent, he is assumed to prefer not to lie.[20]

At stage 3, shareholders (*S*) decide whether to audit, and set the audit quality *q* by maximizing their expected payoff conditional on the manager's report, $\mathrm{E}(\Pi_S^h \mid r_M)$, where Π_S^h is defined by (2). So they choose action $a_3 \in \{A, NAI, NANI\}$, where *A* stands for "audit", *NAI* for "no audit and investment", and *NANI* for "no audit and no investment". In the figure, shareholders' uncertainty about the company's value is captured by marking the nodes that they consider as belonging to the same information set either by Γ_i (if the manager reports V_L) or by Λ_i (if the manager reports V_H), for $i = 1, 2$.

If an auditor is hired, the game moves to stage 4, where nature determines the auditor's signal about firm value: under our assumptions, this signal is always correct in the good state, while it is correct with probability *q* in the bad one. In the latter case, the manager may try to bribe the auditor to issue a positive report $r_A = V_H$ anyway.[21] Offering a bribe is denoted as action *B*, not doing so as *NB*. The manager chooses $a_4 \in \{B, NB\}$ so as to maximize his payoff Π_M^h, defined by (3).[22]

At stage 5, shareholders decide whether to invest (*I*) or not (*NI*). They take this decision, denoted by $a_5 \in \{I, NI\}$, by maximizing their expected payoff conditional on the reports $\{r_M, r_A\}$ of the manager and the auditor, $\mathrm{E}(\Pi_S^h \mid r_M, r_A)$. In this case Π_S^h is net of the audit cost *F*. But since this cost is paid irrespective of the investment decision (i.e., at this stage it is sunk), it does not affect the choice between *I* and *NI*. Now the shareholders' uncertainty about the value of the company is captured by marking the nodes that belong to the same information sets either by Θ_j (if both

[20] This tie-breaking condition can be rationalized with the presence of a small psychological cost of lying, or a reputational cost in the presence of a small probability of detection.

[21] Since the accounting information on which the auditor bases his report is provided by the manager, it is natural to assume that the latter knows whether the auditor has received a negative signal, which is the only case in which bribing him may benefit the manager.

[22] Unlike the shareholder, the manager does not maximize an expected payoff but its realized value, because he has perfect knowledge of the true state of nature.

manager and auditor report V_H) or by Ψ_j (if the manager reports V_L and the auditor report V_H), for $j = 1, 2, 3$.

2.3. Strategies and equilibrium concept

The shareholders' strategy is a couple $\sigma_S = \left(a_3(r_M), a_5(r_M, r_A)\right)$: they take the investment decision at stage 3 conditional only on the manager's report, or else at stage 5, conditional also on the auditor's report. The manager's strategy is a couple $\sigma_M = \left(a_2(\tilde{V}), a_4(V_L, a_2)\right)$, where the decision on lying, $a_2(\tilde{V})$, is conditional on the actual value of the company, while that on bribing, $a_4(V_L, a_2)$, also depends on whether the manager himself has previously lied or not.

At stages 3 and 5, shareholders choose their actions based on beliefs about the state of nature, conditional on their information: their belief of being in the good state is denoted by $\beta(r_M) = \Pr(\tilde{V} = V_H \mid r_M)$ at stage 3, and by $\beta(r_M, r_A) = \Pr(\tilde{V} = V_H \mid r_M, r_A)$ at stage 5.

In what follows, we will seek the triplet $\{\sigma_S, \sigma_M, \beta\}$ that form the pure-strategy perfect Bayesian equilibria (PBE) of the game described so far, showing that the PBE has a unique equilibrium outcome. All proofs are in the Appendix.

3. Equilibrium audit quality

Here we solve for the PBE of the game conditional on a given managerial equity stake γ. We leave the determination of the optimal contract to Section 4. We derive the equilibrium strategies separately for three regions that differ in the degree of shareholder protection *P*, which ranges from close to 0 when private benefits are maximal to $P_{\max} = \bar{V} - I$ when there are no private benefits. Shareholder protection is "strong", "intermediate" or "weak" depending on whether the private benefit is small, intermediate or large, as specified below. We will see that the shareholders' incentive to audit differs across these regions (see Figure 3, which graphs the audit quality optimally chosen by shareholders as a function of *P*, for a given managerial stake *γ*).

[Insert Figure 3]

3.1. Strong shareholder protection

This region corresponds to values of the manager's private benefit small enough that he wishes to disclose the true value of the firm under continuation. Suppose that the manager knows that shareholders will base their refinancing decision on his report. Then, if the firm's true continuation value is low and the manager files a truthful report, shareholders will not invest and the manager will realize only his fraction of the firm's liquidation value, γV_0. If instead the manager lies, he induces shareholders to invest and his payoff will be $\gamma(V_0 + V_L - I - D) + D$, that is, a fraction γ of the firm's final value plus his private benefit *D*. By lying, he makes losses on his equity stake (since $V_L - I - D < 0$) but gains the private benefit *D*. He will be indifferent between lying and not lying if *D* takes the threshold value

$$D_0 = \frac{\gamma}{1-\gamma}(I - V_L). \tag{5}$$

This corresponds to the threshold level of shareholder protection $P'' = \bar{V} - I - D_0$, which can be expressed as

$$P'' = \frac{1}{1-\gamma}(\bar{V} - I) - \frac{\gamma}{1-\gamma} p(V_H - V_L), \tag{5'}$$

For values of *P* below this threshold, the manager will lie. At the threshold or above, he will not.[23]

The region of strong shareholder protection ranges between P'' and $P_{\max}$. This region is non-empty: $P_{\max} - P'' = D_0 > 0$, since by assumption $I - V_L > 0$. Being equal to D_0, the length of the interval $[P'', P_{\max}]$ is increasing in the manager's stake γ and in the loss $I - V_L$ from undue continuation: as both raise the manager's loss from continuation, these parameter changes increase his propensity to tell the truth, unless his private benefits increase correspondingly.

If $P \in [P'', P_{\max}]$, the manager's interest is so well aligned with shareholders that in equilibrium the latter do not seek a second opinion from an auditor. Thus in Figure 3 the auditing intensity *q* in this region is zero. More precisely:

Proposition 1. *If* $P \in [P'', P_{\max}]$, *then the unique equilibrium outcome is such that shareholders do not engage an auditor and the first best is achieved.*

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[23] If $D = D_0$, our tie-breaking assumption implies that the manager prefers not to lie.

In this case, in equilibrium investment is undertaken only in the good state and no money is wasted on engaging an auditor, so the expected return to investment is the maximum $p(V_H - I)$. Since the manager diverts an amount D of this surplus, shareholders earn an expected payoff $(1-\gamma)[V_0 + p(V_H - I - D)]$. In this region, we have two equilibria that result in the same investment decision but differ in the manager's strategy. In one the manager never lies, so that shareholders invest according to his report. In the other, he always lies, and shareholders adopt a "contrarian" strategy investing when the report is negative and not when it is positive. Of course, the outcome in the latter equilibrium is the same as in the former.

3.2. Intermediate shareholder protection

If shareholder protection falls below the threshold P'', the manager will lie, so that a second opinion by an auditor may help shareholders decide whether to finance the company's continuation – but only if the manager does not bribe the auditor. This requires that the manager's private benefit fall short of another threshold, denoted by D_1, or equivalently that shareholder protection stays above the threshold $P' = \bar{V} - I - D_1$. To determine this new threshold, consider the scenario in which the manager expects shareholders to base their investment decision on the auditor's report, the state of nature is bad and the auditor has correctly evaluated the investment. Then, unless the manager bribes the auditor, the latter's report is negative, shareholders abstain from the investment and the manager gets $\gamma(V_0 - F)$. If instead the manager wishes to bribe the auditor, he must pay his opportunity cost $\bar{B}$. In this case shareholders will invest and the manager's payoff will be $\gamma(V_0 + V_L - I - D - F) + D - \bar{B}$. By bribing, the manager loses monetary benefits (since $V_L - I - D < 0$) and the bribe $\bar{B}$, but gains the private benefit D. Equating these two payoffs, the manager is seen to be indifferent when D equals the threshold

$$D_1 = D_0 + \frac{1}{1-\gamma}\bar{B}, \tag{6}$$

which corresponds to the critical shareholder protection

$$P' = P'' - \frac{1}{1-\gamma}\bar{B}. \tag{6'}$$

Below this threshold value of *P*, the manager will bribe. At the threshold and above it, he will not.[24]

The medium shareholder protection interval $(P', P'']$ is non-empty, as $P''-P' = \bar{B}/(1-\gamma) > 0$, and is increasing in $\bar{B}$ and in γ. Intuitively, if auditors are harder to bribe (higher $\bar{B}$), the region where the manager does not bribe them expands. Indeed, it may expand to the point that the threshold P' in (6') would take a non-positive value for $\bar{B} \geq (1-\gamma)P''$: since however by definition *P* must be positive, in this case the threshold must be set at zero. This has a nice interpretation: when auditing regulation is sufficiently strict, managers can never bribe auditors, even if shareholder protection is very poor. In this case, the intermediate region extends from zero to P''. The same logic applies to a larger γ: if the compensation scheme aligns the manager's incentives more closely with shareholders' interests, the no-bribe region expands, and may start at zero.

Suppose that in this region shareholders engage an auditor who refuses a bribe, and invest according to his report. (Below we will show that in this region this is the unique equilibrium outcome.) In this case, they want to choose *q* so as to maximize their expected payoff:

$$\mathrm{E}(\Pi_S^h) = (1-\gamma)\{V_0 + p(V_H - I - D) + (1-q)(1-p)(V_L - I - D) - F\}. \qquad (7)$$

In this expression, the term $p(V_H - I - D)$ is the expected after-diversion profit in the good state, when the firm always continues; $(1-p)(V_L - I - D)$ is its analogue in the bad state, when the firm invests only if the auditor makes a mistake, which occurs with probability $1-q$; and the last term is the audit cost. The shareholders' expected payoff (7) can be rewritten as:

$$\mathrm{E}(\Pi_S^h) = (1-\gamma)\{V_0 + \bar{V} - I - D + q(1-p)(I - V_L + D) - F\}. \qquad (7')$$

Without an auditor, the shareholders would always invest, since the manager would always lie (as $P < P''$). So their payoff is equal to their share of the company's expected value under continuation, net of the manager's private benefit, i.e. $(1-\gamma)(V_0 + \bar{V} - I - D)$. Subtracting this from (7'), one obtains the benefit that shareholders draw from the auditor, i.e. the "informational value" of auditing, $(1-p)q(I - V_L + D)$, minus its cost *F*. This value stems from the fact that with probability $(1-p)q$ he spares shareholders two losses: the loss $I - V_L$ from mistaken continuation, and the diversion *D* that goes with it.

[24] If $D = D_1$, our tie-breaking assumption implies that the manager prefers not to bribe the auditor.

To determine optimal audit quality, shareholders maximize their payoff $E(\Pi_S^h)$ subject to paying auditors at least their cost. Formally, dropping the terms unaffected by q and F from (7') shareholders solve the following problem:

$$\max_{q,F} \; q(1-p)(I-V_L+D)-F\,, \tag{8}$$

subject to the auditor's participation constraint

$$F \geq C(q)\,. \tag{9}$$

The solution to this problem is characterized below.

Lemma 1. *In the equilibrium with auditing, the optimal audit quality* $q^*(P)$ *is decreasing in the degree of shareholder protection* P *for* $P \in [P', P'')$.

The proof is immediate. In this interval, competition among auditors ensures that the participation constraint is binding, so that $F = C(q)$. Replacing this condition in the maximand (8) and differentiating with respect to q yields the following condition for the optimal audit quality:[25]

$$(1-p)(I-V_L+D) = C'(q^*)\,, \tag{10}$$

that is, audit quality is chosen so as to equate its marginal informational value to its marginal cost. Equation (10) can be rewritten as

$$(1-p)\big[\,p(V_H-V_L)-P\big] = C'(q^*)\,. \tag{10'}$$

Recalling that the marginal cost $C'(q)$ is increasing in q, optimal quality q^* is decreasing in the degree of shareholder protection P: intuitively, the more they are protected by the law against managerial diversion, the less willing are shareholders to spend resources on auditing in order to prevent diversion when continuation is unwarranted.

The result described so far rests on the assumption that, for $P \in [P', P'')$, there is an equilibrium with auditing. In this region, in fact, this is the unique equilibrium outcome:

[25] Under our hypotheses on $C(q)$, this optimality condition identifies a solution $q^* > 0$.

Proposition 2. *If* $P \in [P', P'')$, *then the unique equilibrium outcome is such that the manager's report is uninformative, shareholders hire an auditor and continuation occurs if and only if his report is positive.*

In this region shareholders rely on the auditor even though his information is less precise than that of the manager. This is because the manager cannot be trusted, as his incentives are insufficiently aligned with shareholders, while the auditor's imprecise information can be trusted, as in this region he will not be bribed.[26] This result is reminiscent of Kofman and Lawarrée (1993), where an imperfectly informed agent helps in monitoring a perfectly informed one because his incentives are better aligned with the principal.

3.3. Poor shareholder protection

This region corresponds to private benefits so great that the manager has the incentive for bribery, so that shareholders prefer to forgo the auditor's services. In this region, they also expect the manager to lie when the firm's value is low, and accordingly always invest irrespective of the manager's report. As a result, their expected payoff is:

$$\mathrm{E}(\Pi_S^C) = (1-\gamma)(V_0 + \bar{V} - I - D). \tag{11}$$

More specifically:

Proposition 3. *If* $P \in (0, P')$, *then the unique equilibrium outcome is such that the manager's report is uninformative, shareholders do not engage an auditor and continuation always occurs.*

Intuitively, shareholder protection is so poor that auditing is unable to counteract it. But, as already noticed above, this never occurs if auditing regulation is sufficiently strict: if $\bar{B} \geq (1-\gamma)P''$, the poor shareholder protection region vanishes, since $P' = 0$. In this case, it is always worth hiring an auditor, however poor is shareholder protection.

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[26] Note that the pure-strategy equilibrium described by Proposition 2 may not always exist. To understand why, consider that through his equity stake γ the manager also contributes to the auditors' fee *F*. Thus when his private benefit is sufficiently small, he may have no incentive to lie in the bad state if an auditor has been engaged, in which case the auditor is no longer necessary. But if no auditor were hired, the manager's profit in the bad state would increase and he would have an incentive to lie.

3.4. Effect of external governance on audit quality

In this model public policy can affect the agency problem between shareholders and managers in two ways, that we refer to as the two external dimensions of corporate governance. It sets the degree of shareholder protection against managerial abuses, *P*, but may also penalize fraudulent behavior by auditors and bribery by managers, thus raising the reservation bribe $\overline{B}$. In response to the two policy parameters *P* and $\overline{B}$, shareholders optimally determine their reliance on auditors in investment decisions, i.e. audit quality *q*.

The analysis set out in the previous sections shows how external corporate governance affects audit quality. As Figure 3 illustrates, the response of the optimal audit quality to an improvement in shareholder protection *P* is non-monotonic: q^* jumps from zero to positive as *P* crosses the threshold P', then starts declining in the intermediate region, and finally drops back to zero upon crossing the higher threshold P''. So in the regions where shareholder protection is intermediate or strong, audit quality tends to act as its substitute: shareholders have less recourse to auditors as they feel better protected from managerial expropriation. If shareholder protection is too poor, instead, auditing breaks down as an incentive mechanism: for $P < P'$, auditors are never engaged. But, as already noted, this region will vanish if the penalties for auditors' misconduct, $\overline{B}$, are sufficiently strict, so that such breakdown of auditing may never be observed, and only the intermediate and strong shareholder protection regions would exist. If so, the model predicts that reliance on auditors (as measured, for instance, by resources spent on internal auditing) should be decreasing in the quality of shareholder protection – the above-noted substitutability relationship.

It is also worth investigating how audit quality varies as a function of the severity of the penalties for auditors' misconduct, $\overline{B}$, for a given degree of shareholder protection *P*. From the above analysis, audit quality is zero for $P < P'$ and q^* if $P \geq P'$. Re-expressed in terms of $\overline{B}$, the threshold becomes:

$$\overline{B}' = (1-\gamma)(P''-P),$$

which is positive if shareholder protection is in the intermediate region ($P < P''$). In this case, which is illustrated in Figure 4, shareholders will set $q = 0$ if $\overline{B} < \overline{B}'$, and $q = q^*$ if $\overline{B} \geq \overline{B}'$: this illustrates that the audit quality chosen by shareholders is complementary with auditing regulation, since it increases from zero to q^* if the strictness of auditing regulation exceeds the threshold $\overline{B}'$. If

shareholder protection is strong ($P \geq P''$), instead, the threshold $\overline{B}'$ falls to a non-positive value, implying that an auditor will be hired ($q = q^*$) irrespective of auditing regulation.

[Insert Figure 4]

Figures 3 and 4 illustrate the comparative statics of audit quality *q* with respect to an external governance parameter, *P* and $\overline{B}$ respectively. Figure 5, instead, offers the overall picture, showing how these two parameters jointly affect the optimal audit quality, represented as a surface in tri-dimensional space. We see that moving along the *P* axis, audit quality is generally decreasing. It is non-monotonic only for low values of $\overline{B}$, as illustrated by the bold dashed line to the extreme right, which corresponds to Figure 3. For values of $\overline{B}$ larger than $(1-\gamma)P''$, audit quality is instead decreasing or constant in *P*, as show by the dashed lines more to the left. Moving instead along the $\overline{B}$ axis, we obtain the stepwise increasing function of Figure 4, which is illustrated by the other bold dashed line cutting across Figure 5.

[Insert Figure 5]

In conclusion, while shareholder protection tends to act as a substitute for audit quality, the strictness of auditing regulation tends to act as its complement. Intuitively, if the law punishes corrupt auditors more severely, shareholders will rely more on them, because they are more trustworthy as monitors of management. The empirical prediction is that where auditing regulation is stricter, companies are more likely to rely on auditors and pay higher audit fees, even if external corporate governance is weak. This is consistent with evidence in Francis and Wang (2008) that "Big 4" auditors impose higher earnings quality and more accounting conservatism on clients' financial reports in response to stricter auditing regulation, such as greater ability to sue auditors for negligence and regulatory sanctions for auditors' misconduct. Relatedly, Seetharaman, Gul and Lynn (2002) report that audit fees are higher for U.K. companies that cross-list in U.S. markets, which they interpret as a response by auditors to the higher litigation risk typical of the U.S. system.

So far, our analysis has taken the managerial equity stake γ as given. But to control managers' incentives, shareholders can fine-tune not only the resources devoted to auditing but also managerial compensation, and the latter may not be only equity-based. The extent to which they rely on each of these two internal governance variables depends on relative costs and effectiveness, which in turn depend on external regulatory environment. To address these issues, we turn to stage 0, the choice of the optimal managerial compensation scheme.

4. Optimal managerial compensation

So far, to focus on the role of auditing in internal governance, managerial compensation was taken to be exogenous, with a given equity stake γ. From here onwards, we shall consider managerial compensation as part of the internal governance of the firm, chosen jointly with auditing quality, and possibly including a fixed salary, options and severance pay, beside equity-based pay.

The previous section shows that, depending on the parameters, the continuation decision may be based on (i) the manager's report r_M alone, (ii) the auditor's report r_A alone, or (iii) neither of the two. Below we will show that to ensure the truthfulness of each of these reports shareholders must rely on different managerial compensation schemes: (i) for r_M to be reliable, the optimal managerial compensation is a severance payment; (ii) for r_A to be reliable, the optimal managerial compensation may entail or not a severance pay, depending on the quality of external corporate governance. Moreover, it is always optimal to trust either the report of the manager or that of the auditor. In what follows, we proceed in two steps. First, we identify the efficient compensation scheme to induce truth-telling by the manager and the auditor, respectively. Second, we characterize the parameter region in which each compensation scheme yields the largest payoff for shareholders.

The efficient compensation scheme to ensure truth-telling by the manager is a payment *D* when he reports the bad state and zero otherwise. Under this scheme, in the bad state he receives *D* if he tells the truth and the same amount, as private benefit, if he lies: being indifferent, by our tie-breaking rule he reports truthfully. In the good state, he gets the private benefit *D* if he tells the truth and zero if he lies, so again truth-telling is assured.[27] This compensation scheme can be also achieved by making it contingent on the final price of the company: the manager gets zero when the company's value is high ($V_0 + V_H - I - D$, upon continuation in the good state) or low ($V_0 + V_L - I - D$, upon continuation in the bad state), and *D* when the value is unchanged (V_0, upon no continuation in the bad state). The most natural interpretation of this compensation scheme is that of a severance payment D, which the manager receives if the firm is liquidated:

Proposition 4. *The optimal compensation to ensure truth-telling by the manager is severance pay* $s = D$.

[27] Notice that shareholders have no choice but to leave private benefit *D* to the manager in the good state, since by assumption it cannot be seized. In a setting where the manager has a positive reservation utility, this private benefit would help satisfy his participation constraint. If his reservation utility exceeds *D*, then the optimal compensation scheme would also have to include a fixed salary.

Therefore, worse external governance (higher private benefits *D*) implies a larger severance pay. This accords with the empirical finding by Rusticus (2006) that the magnitude of severance pay is inversely correlated with the quality of governance (as proxied by excess pay to managers) in a representative sample of S&P 1500 corporations. The result that severance pay is an efficient mechanism to elicit bad news from a CEO is also present in Levitt and Snyder (1997), Inderst and Müller (2008), Eisfeldt and Rampini (2008) and Laux (2008). In all these studies, severance pay induces truth-telling by compensating the manager for his dismissal and/or loss of private benefits. Differently from these papers, however, we will show that severance pay is not always the best internal governance device from the shareholders' standpoint: when external corporate governance is sufficiently good, it may be dominated by reliance on auditors.

Truth-telling by auditors requires that managers have no incentive to bribe them. This is always the case if the penalties against fraudulent auditing (whether aimed at auditors themselves or at the manager) are so large as to exceed the manager's private benefits of control, that is, if $\bar{B} \geq D$. But even if this condition does not hold, it is possible to prevent managers from bribing auditors by giving them a large enough severance pay, that is, a payment conditional on auditors correctly reporting the bad state (and thus inducing liquidation when appropriate):

Proposition 5. *The optimal compensation to ensure truth-telling by the auditor is severance pay* $s = D - \bar{B}$ *if* $D > \bar{B}$, *and* $s = 0$ *otherwise. The optimal auditing quality is* q^{**} *as defined by*

$$(1-p)(I - V_L + \bar{B}) = C'(q^{**}). \qquad (12)$$

if $D > \bar{B}$*; and it is* q^{*} *as defined by (10) otherwise.*

Intuitively, this proposition states that the manager should be given a severance pay only when he would otherwise be tempted to bribe the auditor, that is, when his private benefit exceeds the auditor's reservation bribe. In this situation, audit quality no longer increases in the size of the private benefit, being just a function of the reservation bribe (q^{**} does not depend on *D*, differently from q^{*}, while it depends on $\bar{B}$): an increase in audit quality reduces the chance of losing the private benefit *D* to the manager in the bad state, but requires paying him the difference $D - \bar{B}$ as severance pay, so that it brings a net gain $\bar{B}$, beside the loss from the mistaken investment $I - V_L$.

5. Optimal internal governance regimes

We are now equipped to characterize the optimal governance regime – that is, the optimal audit quality and managerial compensation – for each parameter region. Building on Propositions 4 and 5, we can establish when shareholders prefer to elicit truth-telling from the manager, the auditor, or neither. Their payoffs in these three cases are respectively:

$$\begin{aligned}
&\Pi(r_M) = V_0 + p(V_H - I) - D, \\
&\Pi(r_A) = \begin{cases} V_0 + \bar{V} - I - D + q^*(1-p)(I - V_L + D) - C(q^*) & \text{if } \bar{B} \geq D, \\ V_0 + \bar{V} - I - D + q^{**}(1-p)(I - V_L + \bar{B}) - C(q^{**}) & \text{if } D > \bar{B}, \end{cases} \\
&\Pi(\varnothing) = V_0 + \bar{V} - I - D,
\end{aligned} \tag{13}$$

where q^* and q^{**} are defined by equations (10) and (12), respectively. The expression for $\Pi(r_M)$ follows directly from Proposition 4: when shareholders rely on the manager, they give him severance pay *D*, so that they always end up losing *D* to the manager: as private benefit in good states, or as severance pay in bad ones. In exchange, they benefit from the manager's accurate information, by investing only in the good state. The expression for $\Pi(r_A)$ is the company's value when shareholders rely on the auditor, based on Proposition 5. The expression for $\Pi(\varnothing)$ is intuitive: when shareholders do not care about eliciting truthful information from either the manager or the auditor, they will not pay either one, thereby setting $s = q = 0$. In this case, however, their payoff is simply the company's unconditional value when investment is always undertaken, so that the private benefit *D* is invariably lost to the manager. This expected payoff is strictly worse than $\Pi(r_M)$, since it entails a worse investment decision but the same wealth loss to the manager, *D*. So this regime is always dominated – a non-trivial result, since in our model investment has positive NPV if undertaken with no information.

Therefore, the relevant comparison is only between $\Pi(r_M)$ and $\Pi(r_A)$, and the associated compensation schemes of Propositions 4 and 5. A key condition in this comparison is whether auditing is cost-efficient compared to elicit truthful revelation from managers, when audit quality is set optimally at q^* in the region $\bar{B} > D$ (the most favorable to auditing). The relevant condition is

$$(1-p)\left[(1-q^*)(V_L - I) + q^* D\right] - C(q^*) > 0. \tag{14}$$

If this condition is met, shareholders will choose to hire an auditor ($\Pi(r_A) > \Pi(r_M)$) at least in some regions of the parameter space. Otherwise, auditing will always be dominated

($\Pi(r_A) < \Pi(r_M)$) and shareholders will rely on the manager, using severance pay to ensure his truthfulness. The following proposition describes the comparison in the various cases:

Proposition 6. (i) *If condition (14) holds and the reservation bribe exceeds the private benefit* ($\bar{B} \geq D$)*, it is optimal to choose audit quality* $q = q^*$ *from equation (10) and severance pay* $s = 0$.

(ii) *If condition (14) holds and the reservation bribe* $\bar{B} \in (\bar{B}_0, D]$*, where* $\bar{B}_0$ *is the value of* $\bar{B}$ *such that* $\Pi(r_M) = \Pi(r_A)$*, then it is optimal to choose audit quality* $q = q^{**}$ *from equation (12) and severance pay* $s = D - \bar{B}$.

(iii) *In all other cases, it is optimal not to hire an auditor (*$q = 0$*) and choose severance pay* $s = D$.

To grasp the economic significance of this proposition, consider a gradual strengthening of the regulation against fraudulent auditing, that is, a gradual increase in the reservation bribe $\bar{B}$ starting from zero. For very low values of the reservation bribe ($\bar{B} < \bar{B}_0$), shareholders will choose to elicit truth-telling by the manager, compensating them with a severance payment $s = D$ irrespective of the value of $\bar{B}$, and will not hire an auditor. As the reservation bribe crosses the threshold $\bar{B}_0$, two cases can occur, depending on whether auditing, when set at the optimal level q^*, is cost-efficient compared with eliciting truth-telling from the manager (that is, whether condition (14) holds or not). If it is, then as $\bar{B}$ rises above the threshold $\bar{B}_0$, shareholders will hire an auditor and rely on him rather than on the manager for the investment decision, and will gradually raise the audit quality and reduce the manager's severance pay *s* as $\bar{B}$ increases over the interval $[\bar{B}_0, D)$.[28] As the reservation bribe increases further beyond the threshold *D*, the audit quality will remain constant at the highest value attained in the previous interval, and the manager's severance *s* pay falls to zero. This is shown in Figure 6: as improvements in auditing regulation raise $\bar{B}$, audit quality *q* increases, while severance pay *s* decreases. So, while optimal audit quality is complementary to auditing regulation, severance pay tends to behave as its substitute.

[Insert Figure 6]

[28] An increase in the cost-effectiveness of auditing expands this region: if the efficiency of auditing is captured by a parameter θ (that is, $C(q,\theta)$ with $C_\theta < 0$ and $C_{q\theta} < 0$), a larger θ implies a lower threshold $\bar{B}_0$, thereby expanding the interval $(\bar{B}_0, D]$.

The case where auditing is less cost-efficient than eliciting truth-telling from the manager (that is, condition (14) is not met) is not shown graphically, being trivial: in that case, it is always optimal to set the severance pay at the level of the private benefit ($s = D$) and forgo auditing ($q = 0$).

From Proposition 6, we can also infer how the degree of shareholder protection, $P \equiv \bar{V} - I - D$, affects the internal governance regime. We have to distinguish two cases, depending on whether the reservation bribe $\bar{B}$ is below or above the threshold $\bar{B}_0$, and in each of these two cases we must distinguish between a strong and a poor shareholder protection region, the boundary between them now being defined as the critical protection level $P(\bar{B}) \equiv \bar{V} - I - \bar{B}$ (where $D = \bar{B}$).

If the reservation bribe is high, i.e. auditing regulation is good ($\bar{B} \geq \bar{B}_0$), then shareholders will always rely on auditing, even though they will choose audit quality as a decreasing function of shareholder protection, as shown by the solid line in Figure 7. If shareholder protection is poor, i.e. $P < P(\bar{B})$, audit quality will be set at the maximal level q^{**}, which is invariant to *P*. In this region, the manager will be given severance pay $s = D - \bar{B} = P(\bar{B}) - P$, which is shown as the decreasing dashed line that reaches zero when *P* hits the critical level $P(\bar{B})$. Beyond this point, i.e. for $P \geq P(\bar{B})$, shareholders will gradually lower the audit quality, by setting it at q^*, and stop paying severance pay to the manager ($s = 0$).

[Insert Figure 7]

The case of a low reservation bribe ($\bar{B} < \bar{B}_0$) is illustrated in Figure 8. Then, if shareholder protection is also low, i.e. $P < P(\bar{B})$, shareholders will elicit information from the manager, setting severance pay equal to private benefits ($s = D = P_{\max} - P$) and forgoing auditing ($q = 0$). If shareholder protection is high, i.e. $P \geq P(\bar{B})$, they will instead switch to auditing, choosing its quality q^* as a decreasing function of *P*, and will pay no severance pay ($s = 0$).

[Insert Figure 8]

In both cases, we see that in general there is a relationship of substitutability between shareholder protection *P* and both dimensions of internal governance: as *P* increases, shareholders tend to rely less heavily on both severance pay and audit quality. The only exception is the jump in audit quality

from zero to q^* in the second case just considered, due to the substitution between the two internal governance mechanisms: below the critical protection level $P(\bar{B})$ shareholder rely on the manager, paying him a high severance pay; beyond that point, they rely on the auditor, and forgo all severance pay to the manager.

While Figures 6 to 8 illustrate the comparative statics of the optimal audit quality and managerial compensation with respect to the two external governance parameters $\bar{B}$ and *P*, they may not to convey the overall picture of how internal governance regimes respond to these external parameters. This is done in the three-dimensional diagrams of Figure 9 and 10, respectively for the optimal audit quality and the optimal severance pay. The figures show clearly that there are three distinct parameter regions in ($\bar{B}$,*P*) space – the horizontal plane of the diagrams:

(i) a trapezoidal region where auditing regulation is lax ($\bar{B} < \bar{B}_0$) and shareholder protection is weak ($P < P(\bar{B})$): here, audit quality is zero and severance pay is highest and decreasing in P;

(ii) a triangular region where auditing regulation is stringent ($\bar{B} > \bar{B}_0$) but shareholder protection is still weak ($P < P(\bar{B})$): here, audit quality is positive and increasing in the stringency of auditing regulation (though invariant to shareholder protection), while severance pay is decreasing in both of the external governance parameters;

(iii) another triangular region where both auditing regulation and shareholder protection are strong ($P > P(\bar{B})$, i.e. outside the diagonal connecting the two points on the axes with coordinates $P_{\max}$): here, audit quality is positive and decreasing in shareholder protection (though invariant to auditing regulation), while severance pay is zero.

[Insert Figures 9 and 10]

On the whole, the results indicate that internal and external corporate governance mechanisms tend to be substitutes. As in the previous section, complementarity between the two arises only from the effect of auditing regulation on audit quality: stronger penalties against fraudulent auditors (or managers who bribe them) tend to raise the intensity of auditing, and also expand the region in which companies rely on it. This provides guidance to assess the effects of public policy on the internal governance mechanisms of firms. Reforms that directly affect the *size of the private benefits of control*, for instance by discouraging related party transactions, will tend to be counteracted by internal governance mechanisms: for instance, they may induce firms to reduce the quality of auditing as well as the severance pay of managers. In contrast, reforms that enhance the

monitoring ability of shareholders, such as those that promote the loyalty of auditors, facilitate the appointment of independent directors, or simply improve the disclosure of corporate information, will encourage companies to step up monitoring activities in their internal governance. In short, the first type of reforms highlights a relation of substitutability between external and internal governance, while the second underscore their complementarity.

This distinction is potentially important for empirical research. To this date, most (but not all) empirical work suggests that firm-level internal governance tends to substitute for country-level external governance, in their effects on company valuation. For instance, Klapper and Love (2004) and Durnev and Kim (2005) find that subjective measures of internal governance quality (based on Credit Lyonnais Securities Asia scores) are larger in countries with poor legal environments. Similarly, Aggarwal, Erel, Stulz and Williamson (2007) and Chhaochharia and Laeven (2009) find that firm-level internal governance provisions correlate with valuation, controlling for country-level rules, and Lins (2003) documents that the valuation impact of pyramid structures and non-management blockholdings is larger in countries with low legal shareholder protection. However, Doidge, Karolyi and Stulz (2007) find that the correlation between company-level governance ratings and country-level shareholder protection standards changes sign depending on the degree of financial development: it is positive for countries with developed financial markets, and negative or absent for countries with undeveloped markets. So this study appears to suggest that complementarity may prevail in certain cases, and substitutability in others. Our model suggests that future empirical work should distinguish between external governance provisions that directly limit private benefits of control and those that enhance the effectiveness of monitoring within companies, as they should elicit opposite responses from the internal governance of firms.

Before concluding, it is worth noticing that in our model efficient managerial compensation has no role either for equity-based or options-based compensation. This may appear surprising in view of the fact that in Section 4 we saw that giving the manager a larger equity stake γ tends to mitigate the agency problem, making the manager less prone to misreport accounting information or to bribe the company's auditor. The point is that, even though equity-based compensation does improve the manager's incentives, it does so at a greater cost than severance pay: insofar as it places some downside risk on the manager's shoulders, an equity stake tends to mitigate his continuation bias, but at the cost of giving the manager a larger financial payoff in the good state, which has no use in terms of managerial incentives.

Option-based pay is even worse than equity in terms of its effect on managerial incentives in this model: either it has no effect on incentives or it worsens the manager's bias towards inefficient

continuation, depending on whether the options have long and short vesting periods, i.e. can be exercised only after the state is publicly known or already at the time of the investment decision (stage 5 of the model). If options can be exercised only once the state of nature is public knowledge, they do not alter the manager's incentive to lie or bribe, as they will be in the money only in the good state, when the manager already wants to tell the truth so as to pocket the private benefit from continuation. Vesting the manager with such options simply imposes a cost on shareholders without improving the manager's incentives. Therefore, such options are dominated by equity-based compensation, which penalizes the manager for inefficient continuation.

If instead options can be exercised already at the time of investment and their exercise price is such that they are in the money if the good state is believed to have occurred, a manager who induced investment in the bad state by lying or bribing the auditor, would not only earn the private benefit D but also be able to exercise his options. This is tantamount to boosting the private benefits from continuation, thus exacerbating the tendency to file fraudulent reports and/or bribe auditors. This accords with recent empirical literature showing that the importance of options in managerial compensation is correlated with proxies for accounting fraud (see for instance Bergstresser and Philippon, 2006, Burns and Kedia, 2006, Kedia and Philippon, 2007, and Peng and Röell, 2008).

The inefficiency of equity-based and option-based pay in our model arise from the assumption that the only agency problem in the company arises from private benefits that bias managers in favor of "empire building". In contrast, in other models of executive compensation call options enhance the incentive to exert effort and take risk (see for instance Smith and Stulz, 1985, Hall and Murphy, 2000, and Dittmann and Maug, 2007). This illustrates that depending on the agency problem that executive compensation is supposed to mitigate, the efficient set of financial contracts may be dramatically different. It is natural to conjecture that in a more general model where both types of agency problems are present, equity, call options and severance pay might all be employed, depending on the model parameters.

6. Conclusions

This paper presents a model of managerial fraud where managers possess superior information about the prospects of the company but, owing to the private benefits from empire building, have a bias against the liquidation of the firm. This may prompt them to misreport their information or even to bribe auditors when liquidation would be optimal. We use the model to study how

shareholders should design internal corporate governance so as to curb managerial fraud, along two dimensions: the quality of auditing, and the design of managerial compensation.

Our main contribution is to characterize how both these aspects of the internal governance of firms respond to changes in public policy parameters, namely, the degree of shareholder protection and the stringency of auditing regulation. Our overall findings are that in countries or industries where shareholders are less exposed to the risk of expropriation by managers, they will spend less resources on auditing to check management and also provide less incentives for managers to truthfully report the company's business prospects. Conversely, in settings where auditing regulation punishes more harshly fraudulent auditing, shareholders will spend more resources on auditing, even though they will again rely less on compensation to provide correct managerial incentives.

Therefore, while in general our analysis predicts a relation of substitutability between external corporate governance parameters and internal corporate governance choices, it highlights that the auditing quality chosen by companies and the strictness of auditing regulation are complements. This is potentially useful for empirical research into the company-level arrangements that can control corporate fraud. First, both the resources allocated to auditing and the design of managerial compensation should be included in empirical studies as potential company-level determinants of the incidence of fraud. Second, and more interestingly, the way in which these dimensions of internal governance respond to regulation is not necessarily one of substitutability, since regulations that enhance the effectiveness of monitoring in corporate governance are predicted to promote greater reliance on corporate monitors, such as auditors and independent directors.

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Appendix

We start by presenting three lemmas containing results that will subsequently facilitate the derivation of equilibria. Lemma A1 identifies preferred choices and beliefs in cases where these do not depend on the managerial stake γ. These choices and beliefs will be part of any equilibrium and therefore are marked by asterisks.

Lemma A1. (i) $a_5^*(V_H, V_L) = a_5^*(V_L, V_L) = NI$. (ii) $\beta^*(V_H, V_L) = \beta^*(V_L, V_L) = 0$.

(iii) $\beta^*(V_L, V_H) = \beta^*(V_H, V_H) = p$ when $a_4^*(V_L, L) = a_4^*(V_L, NL) = B$.

(iv) $\beta^*(V_L, V_H) = \beta^*(V_H, V_H) = p/[p + (1-p)(1-q)]$ when $a_4^*(V_L, L) = a_4^*(V_L, NL) = NB$.

(v) $a_5^*(V_L, V_H) = a_5^*(V_H, V_H) = I$.

Proof of Lemma A1. (i) From Figure 2, it is evident that the couple of reports (V_H, V_L) received by shareholders corresponds to a singleton, so that they are aware that $V = V_L$ and therefore prefer no investment. The same applies when the couple of reports is (V_L, V_L).

(ii) As already explained under (i), the couple of reports (V_H, V_L) corresponds to a singleton, so that the belief that $V = V_H$ is zero: $\beta(V_H, V_L) = 0$. The same applies when the reports is (V_L, V_L).

(iii) When the reports received by *S* are (V_L, V_H), the information set is $\Psi = \{\Psi_1, \Psi_2, \Psi_3\}$. The assumption that *B* is chosen by *M* when $V = V_L$ (whether *M* previously lied or not) implies that the play may have reached node Ψ_1 or Ψ_2 with probability $1-p$, and Ψ_3 with probability *p*. Hence by Bayes' rule, the belief that $V = V_H$ is *p*: $\beta(V_L, V_H) = p$. When the reports received by *S* are (V_H, V_H), the information set is $\Theta = \{\Theta_1, \Theta_2, \Theta_3\}$. Using the same argument as before, the play may have reached node Θ_1 or Θ_2 with probability $1-p$, and Θ_3 with probability *p*. Hence by Bayes' rule, the belief that $V = V_H$ is *p*: $\beta(V_H, V_H) = p$.

(iv) The argument is similar to that used under point (iii), with the only difference that now *NB* is assumed to be chosen by *M* when $V = V_L$ (whether he previously lied or not). Then, when the reports received by *S* are (V_L, V_H), the play may have reached only node Ψ_2 or Ψ_3, with probabilities $(1-p)(1-q)$ and *p* respectively. Hence by Bayes' rule, the belief that $V = V_H$ is *p*:

$\beta(V_L,V_H) = p/\left[p+(1-p)(1-q)\right]$. When instead the reports received by *S* are (V_H,V_H), the play may have reached only node Θ_2 or Θ_3, with probabilities $(1-p)(1-q)$ and *p* respectively, so that the belief that $V = V_H$ is *p*: $\beta(V_H,V_H) = p/\left[p+(1-p)(1-q)\right]$.

(v) When the reports received by *S* are (V_L,V_H), from points (iii) and (iv) *S* holds the belief $\beta(V_L,V_H) = p$ if *M* chooses *B*, or $\beta(V_L,V_H) = p/\left[p+(1-p)(1-q)\right]$ if *M* chooses *NB*. If *M* chooses *B*, *S*'s expected payoff from investing is the unconditional expectation $(1-\gamma)(V_0+\bar{V}-I-D-F)$, which is to be compared with a payoff $(1-\gamma)(V_0-F)$ in case of no investment. The difference between these two expected payoffs is $(1-\gamma)(\bar{V}-I-D)$, which is positive by assumption. Therefore, *S* will invest. If instead *M* were to choose *NB*, then *S*'s payoff would be the conditional expectation $(1-\gamma)\left[V_0+E(V|V_L,V_H)-I-D-F\right]$, which is to be compared with a payoff $(1-\gamma)(V_0-F)$. The difference $(1-\gamma)\left[E(V|V_L,V_H)-I-D\right]$ is larger than its unconditional analogue, and therefore it is also positive, so that *S* would invest. Therefore, when *S* receive the reports (V_L,V_H), they will always invest. Using the same reasoning it is easy to show that when *S* receive the reports (V_H,V_H), they will always invest. ■

The following lemma shows that in the regions where corporate governance is intermediate or good, the manager does not bribe the auditor:

Lemma A2. $a_4^*(V_L,L)=a_4^*(V_L,NL) = NB$ if and only if $D \le D_1$.

Proof of Lemma A2. Suppose that $V = V_L$, the manager lied (*L*) and the auditor correctly identified the state, which happens with probability *q*. Then, *M* must decide whether bribing the auditor or not. If he chooses *B*, then *S* will receive reports (V_H,V_H), and by point (v) of Lemma A1 investment will follow. In this case, *M*'s payoff, net of the bribe $\bar{B}$, equals $\gamma(V_0+V_L-I-D-F)+D-\bar{B}$. If instead *M* chooses *NB*, then the reports will be (V_H,V_L) and no investment will occur (by point (i) of Lemma A1). In this case, *M*'s payoff equals $\gamma(V_0-F)$. Hence, *M*'s surplus from choosing *B* over *NB* is $\gamma(V_L-I-D)+D-\bar{B}$, which is positive if $D > D_1$, zero if $D = D_1$ and negative if $D < D_1$. Recalling our tie-breaking assumption, *M* opts for *NB* if and only if $D \le D_1$. The same argument shows that this result holds also if initially *M* did not lie (*NL*). ■

The next lemma derives the best response of shareholders for the case where the manager always reports the truth or never does:

Lemma A3. If $a_2^*(V_L)=a_2^*(V_H)=NL$, then $a_3^*(V_H)=NAI$ and $a_3^*(V_L)=NANI$. If $a_2^*(V_L)=a_2^*(V_H)=L$, then $a_3^*(V_H)=NANI$ and $a_3^*(V_L)=NAI$.

Proof of Lemma A3. For brevity, we provide a heuristic proof. When *M*'s preferred choice is $a_2^*(V_L)=a_2^*(V_H)=NL$, the expected payoff to *S* attains its highest possible value if they chose not to audit and invest if and only if $r_M=V_H$. Indeed, this policy leads them to invest only in the good state and to save auditing costs. A symmetric argument holds when *M*'s preferred choice is $a_2^*(V_L)=a_2^*(V_H)=L$, in this case, as *M* lies in a systematic fashion, a "contrarian" investment rule couple with no auditing achieves the highest possible payoff for *S*. ■

Taken together, Lemmas A1 and A2 identify the best responses of shareholders at stage 5 and the best responses of the manager at stage 4. Lemma A3 identifies the best responses of shareholders at stage 3 for some of the possible strategies of managers at stage 2.

Using these results, we can restrict the set of candidate equilibrium strategies to 20 cases, which are presented in Table 1 below for $D \le D_1$, where D_1 is defined by equation (6). Each row describes a strategy of shareholders (columns 2 to 7) and a strategy of the manager (columns 9 to 14).

We could produce a similar table for $D > D_1$, which would differ from Table 1 only in its two last columns, where *B* would simply replace *NB* throughout. We omit this second table for brevity.

A rapid check of Table 1 leaves us with the 8 candidate equilibrium strategies described in the following:

Lemma A4. In Table A1, the strategies subscripted by $\{3,5,6,7,8,11,12,13,16,18,19,20\}$ cannot be part of a PBE.

Table A1. Candidate equilibrium strategies for $D \le D_1$

	Report by M (r_M)		Reports by M and A (r_M, r_A)					True value (V)		True value and stage-2 action by M (V, a_2)	
S	V_H	V_L	V_H, V_H	V_H, V_L	V_L, V_H	V_L, V_L	M	V_H	V_L	V_L, L	V_L, NL
σ_{S1}	*NAI*	*NANI*	*I*	*NI*	*I*	*NI*	σ_{M1}	*NL*	*NL*	*NB*	*NB*
σ_{S2}	*NANI*	*NAI*	*I*	*NI*	*I*	*NI*	σ_{M2}	*L*	*L*	*NB*	*NB*
σ_{S3}	*A*	*A*	*I*	*NI*	*I*	*NI*	σ_{M3}	*NL*	*L*	*NB*	*NB*
σ_{S4}	*A*	*NANI*	*I*	*NI*	*I*	*NI*	σ_{M4}	*NL*	*L*	*NB*	*NB*
σ_{S5}	*A*	*NAI*	*I*	*NI*	*I*	*NI*	σ_{M5}	*NL*	*L*	*NB*	*NB*
σ_{S6}	*NANI*	*A*	*I*	*NI*	*I*	*NI*	σ_{M6}	*NL*	*L*	*NB*	*NB*
σ_{S7}	*NANI*	*NANI*	*I*	*NI*	*I*	*NI*	σ_{M7}	*NL*	*L*	*NB*	*NB*
σ_{S8}	*NANI*	*NAI*	*I*	*NI*	*I*	*NI*	σ_{M8}	*NL*	*L*	*NB*	*NB*
σ_{S9}	*NAI*	*A*	*I*	*NI*	*I*	*NI*	σ_{M9}	*NL*	*L*	*NB*	*NB*
σ_{S10}	*NAI*	*NANI*	*I*	*NI*	*I*	*NI*	σ_{M10}	*NL*	*L*	*NB*	*NB*
σ_{S11}	*NAI*	*NAI*	*I*	*NI*	*I*	*NI*	σ_{M11}	*NL*	*L*	*NB*	*NB*
σ_{S12}	*A*	*A*	*I*	*NI*	*I*	*NI*	σ_{M12}	*L*	*NL*	*NB*	*NB*
σ_{S13}	*A*	*NANI*	*I*	*NI*	*I*	*NI*	σ_{M13}	*L*	*NL*	*NB*	*NB*
σ_{S14}	*A*	*NAI*	*I*	*NI*	*I*	*NI*	σ_{M14}	*L*	*NL*	*NB*	*NB*
σ_{S15}	*NANI*	*A*	*I*	*NI*	*I*	*NI*	σ_{M15}	*L*	*NL*	*NB*	*NB*
σ_{S16}	*NANI*	*NANI*	*I*	*NI*	*I*	*NI*	σ_{M16}	*L*	*NL*	*NB*	*NB*
σ_{S17}	*NANI*	*NAI*	*I*	*NI*	*I*	*NI*	σ_{M17}	*L*	*NL*	*NB*	*NB*
σ_{S18}	*NAI*	*A*	*I*	*NI*	*I*	*NI*	σ_{M18}	*L*	*NL*	*NB*	*NB*
σ_{S19}	*NAI*	*NANI*	*I*	*NI*	*I*	*NI*	σ_{M19}	*L*	*NL*	*NB*	*NB*
σ_{S20}	*NAI*	*NAI*	*I*	*NI*	*I*	*NI*	σ_{M20}	*L*	*NL*	*NB*	*NB*

Proof of Lemma A4.

(i) Strategies subscripted by 3, 7 and 11: the manager has the incentive to deviating to *NL* when the company is worth V_L, as he would get the same payoff without lying, which he prefers under our

assumptions. Strategies 12, 16 and 20: by the same argument, the manager has the incentive to deviating to *NL* when the company is worth V_H.

(ii) Strategy 5: the manager has the incentive to deviate to *L* when the company is worth V_H, as he would induce the investment with no auditing, hence saving his fraction of the auditing costs. Strategy 18: by the same argument, the manager has the incentive to deviate to *NL* when the company is worth V_H.

(iii) Strategy 6: the manager has the incentive to deviate to *L* when the company is worth V_H. To see this, consider that by this deviation he would induce the investment with auditing and earn the continuation profit $\Pi_M^c = \gamma(V_0 + V_H - F - I - D) + D$, which is positive by assumption. Strategy 13: by the same argument, the manager has the incentive to deviate to *NL* when the company is worth V_H.

(iv) Strategy 8: the manager has the incentive to deviate to *L* when the company is worth V_H, as he would induce investment rather than no investment, and thereby earn the continuation profit $\Pi_M^c = \gamma(V_0 + V_H - I - D) + D > 0$. Strategy 19: by the same argument, the manager has the incentive to deviate to *NL* when the company is worth V_H. ■

Proof of Proposition 1. Based on Lemma A4, the remaining 8 set of candidate equilibrium strategies are subscripted by $\{1,2,4,9,10,14,15,17\}$. We will show that, of these, only those subscripted by 1 and 2 are part of a PBE for $D \le D_0$, whereas the other six are not.

(i) $\left\{\sigma_{S1}^*, \sigma_{M1}^*, \beta_1^*\right\}$, where σ_{S1}^* and σ_{M1}^* are given by Table A1, and β_1^* is the following belief:

$$\beta_1^* = \left\{\beta(V_L) = \beta(V_L, V_L) = \beta(V_H, V_L) = 0, \beta(V_H) = 1, \beta(V_H, V_H) = \beta(V_L, V_H) = \frac{p}{p + (1-p)(1-q)}\right\}.$$

In this candidate equilibrium, *M* does not lie and *S* invest according to *M*'s report. Hence the investment decision leads to the first-best expected profit $E(\Pi^*) = p(V_H - I)$, of which *M* diverts an amount *D*. Thus, *S* earn their maximal expected payoff $(1-\gamma)\left[V_0 + p(V_H - I - D)\right]$. They have eight possible deviations from σ_{S1}^*, which correspond to the strategies subscripted by 2 to 7, 9 and 11 in Table A1. In the deviations subscripted by 2, 7 and 11, their expected payoff is lower because

they rely on a suboptimal investment decision rule. In all the other deviations, their payoff is decreased by the auditor's fee and in some cases also by reliance on a suboptimal investment rule. As a result, all possible deviations yield a lower expected payoff to *S* than that of the candidate equilibrium.

Now consider the possible deviations by *M* from the strategy σ_{M1}^*. In the candidate equilibrium, *M* earns the highest possible payoff $\gamma(V_0 + V_H - I - D) + D$ in the good state and γV_0 in the bad state. Therefore, *M* will never deviate to lying in the good state, since this would produce no investment and he would earn γV_0. If he deviates to lying in the bad state, *S* would invest in this state, so that *M*'s payoff would be $\gamma(V_0 + V_L - I - D) + D < \gamma V_0$ for $D \le D_0$. Hence, both possible deviations yield a lower payoff to *M* than that of the candidate equilibrium.

The belief β_1^* is consistent with Lemma A1 insofar as $\beta(V_L, V_L)$, $\beta(V_H, V_L)$, $\beta(V_H, V_H)$ and $\beta(V_L, V_H)$ are concerned. Also $\beta(V_L) = 0$ and $\beta(V_H) = 1$ are consistent with Bayes' rule, given *M*'s strategy σ_{M1}^*. Hence $\left\{\sigma_{S1}^*, \sigma_{M1}^*, \beta_1^*\right\}$ is a PBE.

(ii) $\left\{\sigma_{S2}^*, \sigma_{M2}^*, \beta_2^*\right\}$, where σ_{S2}^* and σ_{M2}^* are given by Table A1, and β_2^* is the following belief:

$$\beta_2^* = \left\{\beta(V_H) = \beta(V_L, V_L) = \beta(V_H, V_L) = 0, \beta(V_L) = 1, \beta(V_H, V_H) = \beta(V_L, V_H) = \frac{p}{p + (1-p)(1-q)}\right\}.$$

In this candidate equilibrium, *M* always lies and *S* invests when *M* reports V_L and does not when *M* reports V_H, consistently with their new beliefs $\beta(V_L) = 1$ and $\beta(V_H) = 0$. Again, the investment decision leads to the first-best expected profit, and, following the same steps as under point (i), it is easy to show that there are no profitable deviations and that beliefs are consistent with Bayes' rule.

(iii) σ_{S4} and σ_{M4} cannot be part of an equilibrium: these strategies imply a smaller expected payoff for *M* than a deviation to *NL* in the bad state, which would give him γV_0. To see this, note that under σ_{S4} and σ_{M4} in the bad state *M* would lie, and *S* would hire an auditor and invest with probability $1-q$. As a result, *M*'s expected payoff would be $\gamma\left[V_0 + (1-q)(V_L - I - D) - F\right] + (1-q)D$, which is increasing in *D*. Hence, in the region under consideration this payoff achieves its maximum for $D = D_0$. From (5), this maximum payoff is

$\gamma(V_0 - F)$. If instead *M* deviates to *NL* in the bad state, there is no investment and a payoff of γV_0 for *M*.

(iv) σ_{S9} and σ_{M9} cannot be part of an equilibrium. Under these strategies, *S* do not hire an auditor and always invest, so that they earn the unconditional payoff $(1-\gamma)(V_0 + \bar{V} - I - D)$. If instead they deviate to auditing, the investment decision would lead to a total expected profit $V_0 + p(V_H - I) + (1-p)(1-q)(V_L - I) - F = V_0 + \bar{V} - I + (1-p)q(I - V_L) - F$. Then, *M* would divert an amount *D* whenever the investment is made, which happens with probability $p + (1-p)(1-q)$. As a result, *S* would earn a fraction $1-\gamma$ of the total expected profit minus the expected diversion $[p + (1-p)(1-q)]D$. Thus, after rearranging it, their payoff can be written as $(1-\gamma)\{V_0 + \bar{V} - I - D + (1-p)q(I - V_L + D) - F\}$. This deviation payoff can be shown to be larger than the unconditional profit $(1-\gamma)(V_0 + \bar{V} - I - D)$. To see this, consider that if *S* hire an auditor, they would choose the profit-maximizing audit quality q^*, defined by condition (10): $C'(q^*) = (1-p)(I - V_L + D)$. The difference between *S*'s deviation payoff and their payoff in the candidate equilibrium is $(1-\gamma)\left[q^*(1-p)(I - V_L + D) - C(q^*)\right] = (1-\gamma)\left[q^* C'(q^*) - C(q^*)\right] > 0$ by the convexity of $C(q)$. Hence, this deviation by *S* is profitable.

(v) σ_{S15} and σ_{M15} cannot be part of an equilibrium, since the argument under point (iii) above can be used to show that these strategies imply a smaller payoff for *M*, than a deviation to *L*.

(vi) Using the argument under (iv), one can rule out that the remaining three couples of strategies $(\sigma_{S10}, \sigma_{M10})$, $(\sigma_{S14}, \sigma_{M14})$ $(\sigma_{S17}, \sigma_{M17})$ are part of an equilibrium. ■

Proof of Proposition 2. As in the proof of Proposition 1, based on Lemma A4 we focus only on the 8 candidate equilibrium strategies subscripted by $\{1, 2, 4, 9, 10, 14, 15, 17\}$. We will show that, of these, only those subscripted by 4 and 15 may be part of a PBE for $D_0 < D \leq D_1$, whereas the other six are not.

(i) $\left\{\sigma_{S4}^*, \sigma_{M4}^*, \beta_4^*\right\}$, where σ_{S4}^* and σ_{M4}^* are given by Table 1, and the belief β_4^* is:

$$\beta_4^* = \left\{ \beta(V_L) = \beta(V_L, V_L) = \beta(V_H, V_L) = 0, \beta(V_H) = p, \beta(V_H, V_H) = \beta(V_L, V_H) = \frac{p}{p + (1-p)(1-q)} \right\}.$$

In this candidate equilibrium, *M* always reports V_H (and therefore lies in the bad state), *S* hires an auditor under the contract specified in Lemma 1, and invest according to *A*'s report. Thus, *S*'s payoff is given by equation (7). Recall that in point (iv) of the proof of Proposition 1 we have shown that, for $D_0 < D \leq D_1$, the payoff to *S* from hiring an auditor exceeds that obtainable from any strategy involving *NA*. In the present context, this implies that *S* will not deviate to such strategies.

Now consider the possible deviations by *M* from the strategy σ_{M4}^*. In the candidate equilibrium, *M* earns the highest possible payoff $\gamma(V_0 + V_H - I - D) + D$ in the good state and $\gamma[V_0 + (1-q)(V_L - I - D) - F] + (1-q)D$ in the bad state. Therefore, *M* will never deviate to lying in the good state, since this would produce no investment and he would earn γV_0. If he deviates to not lying in the bad state, *S* would not invest, so that *M*'s payoff would be γV_0. This deviation is not profitable if $D \geq \hat{D}$, where $\hat{D} = \left[(I - V_L) + \frac{C(q)}{1-q} \right] \frac{\gamma}{1-\gamma}$. For $D < \hat{D}$, the deviation is profitable, so that this equilibrium will not exist.

The belief β_4^* is consistent with Lemma A1 insofar as $\beta(V_L, V_L)$, $\beta(V_H, V_L)$, $\beta(V_H, V_H)$ and $\beta(V_L, V_H)$ are concerned. Also $\beta(V_H) = p$ are consistent with Bayes' rule, given *M*'s strategy σ_{M4}^*. Finally, $\beta(V_L) = 0$ is such that *NANI* upon a negative report by *M* is sequentially rational, since under this belief the expected payoff to *S* from σ_{S4}^* is $(1-\gamma)V_0$, while by deviating to *NAI* they would obtain $(1-\gamma)(V_0 + V_L - I - D)$, and by deviating to *A* they would obtain $(1-\gamma)[V_0 + (1-q)(V_L - I - D) - F]$. Hence $\left\{ \sigma_{S4}^*, \sigma_{M4}^*, \beta_4^* \right\}$ is a PBE.

(ii) $\left\{ \sigma_{S15}^*, \sigma_{M15}^*, \beta_{15}^* \right\}$, where σ_{S15}^* and σ_{M15}^* are given by Table A1, and the belief β_{15}^* is:

$$\beta_{15}^* = \left\{ \beta(V_H) = \beta(V_L, V_L) = \beta(V_H, V_L) = 0, \beta(V_L) = p, \beta(V_H, V_H) = \beta(V_L, V_H) = \frac{p}{p + (1-p)(1-q)} \right\}.$$

In this candidate equilibrium, *M* always reports V_L (and therefore lies in the good state), *S* hires an auditor under the contract specified in Lemma 1, and invest according to *A*'s report. The proof that this is a PBE for $D \geq \hat{D}$ proceeds as under point (i).

(iii) σ_{S1} and σ_{M1} cannot be part of an equilibrium, because *M* has the incentive to deviate to *L* when the company is worth V_L.

(iv) σ_{S2} and σ_{M2} cannot be part of an equilibrium, because *M* has the incentive to deviate to *NL* when the company is worth V_L.

(v) σ_{S9} and σ_{M9} cannot be part of an equilibrium, because under this strategy the firm would always invest and *S* would earn its unconditional payoff, while if it hires an auditor by Proposition 1 point (iv) they would increase their payoff.

(vi) $(\sigma_{S10},\sigma_{M10})$, $(\sigma_{S14},\sigma_{M14})$ and $(\sigma_{S17},\sigma_{M17})$ cannot be part of an equilibrium, by the same argument as under (v). ■

Proof of Proposition 3. As in the proof of Propositions 1 and 2, based on Lemma A4 we focus only on the 8 candidate equilibrium strategies subscripted by $\{1,2,4,9,10,14,15,17\}$. We will show that, of these, only those subscripted by 10 and 17 are part of a PBE for $D > D_1$, whereas the other six are not.

(i) $\left\{\sigma^*_{S10},\sigma^*_{M10},\beta^*_{10}\right\}$, where σ^*_{S10} is given by Table A1, σ^*_{M10} is obtained by replacing *NB* to *B* in the corresponding strategy in Table A1, and the belief β^*_{10} is:

$$\beta^*_{10} = \{\beta(V_L) = \beta(V_L,V_L) = \beta(V_H,V_L) = 0, \beta(V_H) = p, \beta(V_H,V_H) = \beta(V_L,V_H) = p\}.$$

In this candidate equilibrium, *M* always reports V_H (and therefore lies in the bad state), *S* do not hire an auditor and the firm always invests. Thus, *S*'s payoff is given by equation (11). To show that S will not want to deviate from σ^*_{S10}, note that the payoff to *S* exceeds that from any strategy involving *A* upon a positive report by *M*, since due to bribing an audit report would be uninformative (would lead to investment anyway) but still costly. The payoff in equation (11) also exceeds the payoff from a strategy involving *NANI* upon a positive report by *M*, which is $(1-\gamma)V_0$.

Now consider the possible deviations by *M* from the strategy σ^*_{M10}. In the candidate equilibrium, *M* earns the highest possible payoff $\gamma(V_0+V_H-I-D)+D$ in the good state and $\gamma(V_0+V_L-I-D)+D > \gamma V_0$ in the bad state, where the latter inequality is guaranteed by $D > D_1$.

Therefore, *M* will never deviate in the good state. If he deviates to not lying in the bad state, *S* would not invest, so that *M*'s payoff would be γV_0.

The belief β_{10}^* is consistent with Lemma A1 insofar as $\beta(V_L, V_L)$, $\beta(V_H, V_L)$, $\beta(V_H, V_H)$ and $\beta(V_L, V_H)$ are concerned. Also $\beta(V_H) = p$ are consistent with Bayes' rule, given *M*'s strategy. Finally, $\beta(V_L) = 0$ is such that *NANI* upon a negative report by *M* is sequentially rational, since under this belief the expected payoff to *S* from σ_{S10}^* is $(1-\gamma)V_0$, while by deviating to *NAI* or to *A* they would obtain $(1-\gamma)(V_0 + V_L - I - D)$ or $(1-\gamma)(V_0 + V_L - I - D - F)$ respectively. Hence $\left\{\sigma_{S10}^*, \sigma_{M10}^*, \beta_{10}^*\right\}$ is a PBE.

(ii) $\left\{\sigma_{S17}^*, \sigma_{M17}^*, \beta_{17}^*\right\}$, where σ_{S17}^* is given by Table A1, σ_{M17}^* is obtained by replacing *NB* to *B* in the corresponding strategy in Table A1, and the belief β_{17}^* is:

$$\beta_{17}^* = \left\{\beta(V_H) = \beta(V_L, V_L) = \beta(V_H, V_L) = 0, \beta(V_L) = p, \beta(V_H, V_H) = \beta(V_L, V_H) = p\right\}.$$

In this candidate equilibrium, *M* always reports V_L (and therefore lies in the good state), *S* does not hire an auditor and the firm always invests. The proof that this is a PBE for $D > D_1$ proceeds as under point (i).

(iii) σ_{S1} and σ_{M1} cannot be part of an equilibrium, because *M* has the incentive to deviate to *L* when the company is worth V_L.

(iv) σ_{S2} and σ_{M2} cannot be part of an equilibrium, because *M* has the incentive to deviate to *NL* when the company is worth V_L.

(v) σ_{S9} and σ_{M9} cannot be part of an equilibrium. For these strategies to be part of an equilibrium, one would need a belief $\beta(V_L)$ such that, upon a negative report by *M*, *A* is sequentially rational. However, *A* is not rational for any possible belief $\beta(V_L)$, as it would imply that the firm always invests and *S* earns its unconditional payoff net of the audit cost, while under *NAI* shareholders would save the audit cost.

(vi) σ_{S14} and σ_{M14} cannot be part of an equilibrium. For these strategies to be part of an equilibrium, one would need a belief $\beta(V_H)$ such that, upon a positive report by *M*, *A* is

sequentially rational. However, *A* is not rational for any possible belief $\beta(V_H)$, as it would imply that the firm always invests and *S* earns its unconditional payoff net of the audit cost, while under *NAI* shareholders would save the audit cost.

(vii) $(\sigma_{S4}, \sigma_{M4})$ and $(\sigma_{S15}, \sigma_{M15})$ cannot be part of an equilibrium, because for $D > D_1$ *M* would bribe the auditor, so that the audit report is uninformative but still costly, and therefore S would deviate to *NAI*. ■

Proof of Proposition 4. To induce truth-telling by the manager, shareholders must choose a couple of payments w_H^H and w_L^L to compensate the manager who reports the true state of the world and a couple of payments w_L^H and w_H^L for the manager who reports the wrong state. Hence, they solve:

$$\Pi(r_M) = \max_{w_H^H, w_H^L, w_L^H, w_L^L} V_0 + p\left(V_H - I - D - w_H^H\right) - (1-p)w_L^L,$$

subject to:

$$PC_M : p\left(w_H^H + D\right) + (1-p)w_L^L \geq 0,$$

$$IC_L : w_L^L \geq w_H^L + D,$$

$$IC_H : w_H^H + D \geq w_L^H,$$

$$LL : w_H^H \geq 0,\ w_H^L \geq 0,\ w_L^H \geq 0,\ w_L^L \geq 0,$$

where PC_M is the manager's participation constraint, IC_L and IC_H are his incentive compatibility constraint in the bad and good states respectively, and *LL* is his limited liability constraint. It is immediate that w_L^H and w_H^L should both be set equal to zero. Moreover, IC_L and the *LL* for w_H^H are both binding, which implies $w_H^H = 0$ and $w_L^L = D$. ■

Proof of Proposition 5. To induce truth-telling by the auditor, shareholders solve:

$$\Pi(r_A) = \max_{w_H, w_L^{1-q}, w_L^q, q, F} V_0 + p(V_H - I - D - w_H) + (1-q)(1-p)(V_L - I - D - w_L^{1-q}) - q(1-p)w_L^q - F$$

subject to:

$$PC_M : p(w_H + D) + q(1-p)w_L^q + (1-p)(1-q)(w_L^{1-q} + D) \geq 0,$$

$$IC_L : w_L^q \geq w_L^{1-q} + D - \bar{B},$$

$$PC_A : F \geq C(q),$$

$$LL : w_H \geq 0,\ w_L^q \geq 0,\ w_L^{1-q} \geq 0,$$

where w_H is the payment to the manager who reports the good state, w_L^q the payment to the manager if the auditor correctly reports the bad state (which happens with probability q), and w_L^{1-q} is the payment to the manager if the auditor mistakenly reports the good state (which happens with probability $1-q$). It is immediate that both w_H and w_L^{1-q} should both be set equal to zero. Moreover, IC_L is binding if $D > \bar{B}$, which implies that the payment to compensate a manager if the auditor correctly reported the bad state is $w_L^q = D - \bar{B}$. If on the contrary $D \leq \bar{B}$, IC_L is slack so that $w_L^q = 0$, due to the limited liability constraint. Competition ensures that in all cases the auditor's participation constraint PC_A is also binding. As a result, if $D > \bar{B}$ the optimal audit quality is q^{**} as implicitly defined by (12), while if $D \leq \bar{B}$ the optimal audit quality is q^* as implicitly defined by (10). So if $D > \bar{B}$ the audit quality is increasing in the reservation bribe $\bar{B}$ (and independent of D), while if $D \leq \bar{B}$ it is increasing in D (and independent of $\bar{B}$). ■

Proof of Proposition 6. Recalling from the analysis in Section 4 that eliciting truth-telling from the manager always dominates using no information, we now want to identify the parameter regions where shareholders prefer to elicit truth-telling from the manager or from the auditor. Substituting the optimal values from Propositions 4 and 5, the shareholders' profits become respectively:

$$\Pi(r_M) = V_0 + p(V_H - I - D) - (1-p)D,$$

$$\Pi(r_A) = V_0 + p(V_H - I - D) + (1-p)(1-q^*)(V_L - I - D) - C(q^*) \text{ if } D \leq \bar{B},$$

and

$$\Pi(r_A) = V_0 + p(V_H - I - D) + (1-p)\left[(1-q^{**})(V_L - I - D) - q^{**}(D - \bar{B})\right] - C(q^{**}), \text{ if } D > \bar{B},$$

where q^* and q^{**} are defined by equations (10) and (12), respectively.

Subtracting $\Pi(r_M)$ from $\Pi(r_A)$ and rearranging terms yields the condition under which shareholders want to elicit the truth from the auditor. If $D \le \bar{B}$, this condition is inequality (14) in the text, while if $D > \bar{B}$, it becomes:

$$(1-p)\left[(1-q^{**})(V_L - I) + q^{**}\bar{B}\right] - C(q^{**}) > 0. \qquad (15)$$

There are two cases to be considered, depending on whether condition (14) holds or not.

If (14) holds, for $D \le \bar{B}$ shareholders rely on auditing, setting audit quality at q^* and managerial severance pay at zero. Then, by continuity, condition (15) also holds for $\bar{B} \to D^-$ (where $q^* \to q^{**}$). Using the envelope theorem, the derivative of expression (15) with respect to $\bar{B}$ is equal to $(1-p)q^{**} > 0$. Therefore, as $\bar{B}$ decreases below *D*, inequality (15) eventually turns into an equality for a threshold $\bar{B}_0$ defined by

$$\bar{B}_0 \equiv \frac{1}{q^{**}(\bar{B}_0)}\left[\left(1-q^{**}(\bar{B}_0)\right)(I - V_L) + \frac{C\left(q^{**}(\bar{B}_0)\right)}{1-p}\right], \qquad (16)$$

where $q^{**}(\bar{B}_0)$ is obtained by setting $\bar{B} = \bar{B}_0$ in (12). Therefore, shareholders will still rely on the auditor's report in the interval $[\bar{B}_0, D)$. In this interval, audit quality is set at q^{**} (and therefore is increasing in $\bar{B}$) and managerial severance pay is $D - \bar{B}$. For $\bar{B} < \bar{B}_0$, instead, $\Pi(r_A) < \Pi(r_M)$, so that shareholders elect to rely on the manager's report, raise his severance pay to *D*, and no longer hire an auditor ($q = 0$).

If instead (14) does not hold, then by the previous argument condition (15) does not hold either, and therefore for any value of $\bar{B}$ shareholders choose to rely on the manager's report, the manager is given severance pay *D* and no auditor is ever hired. ■

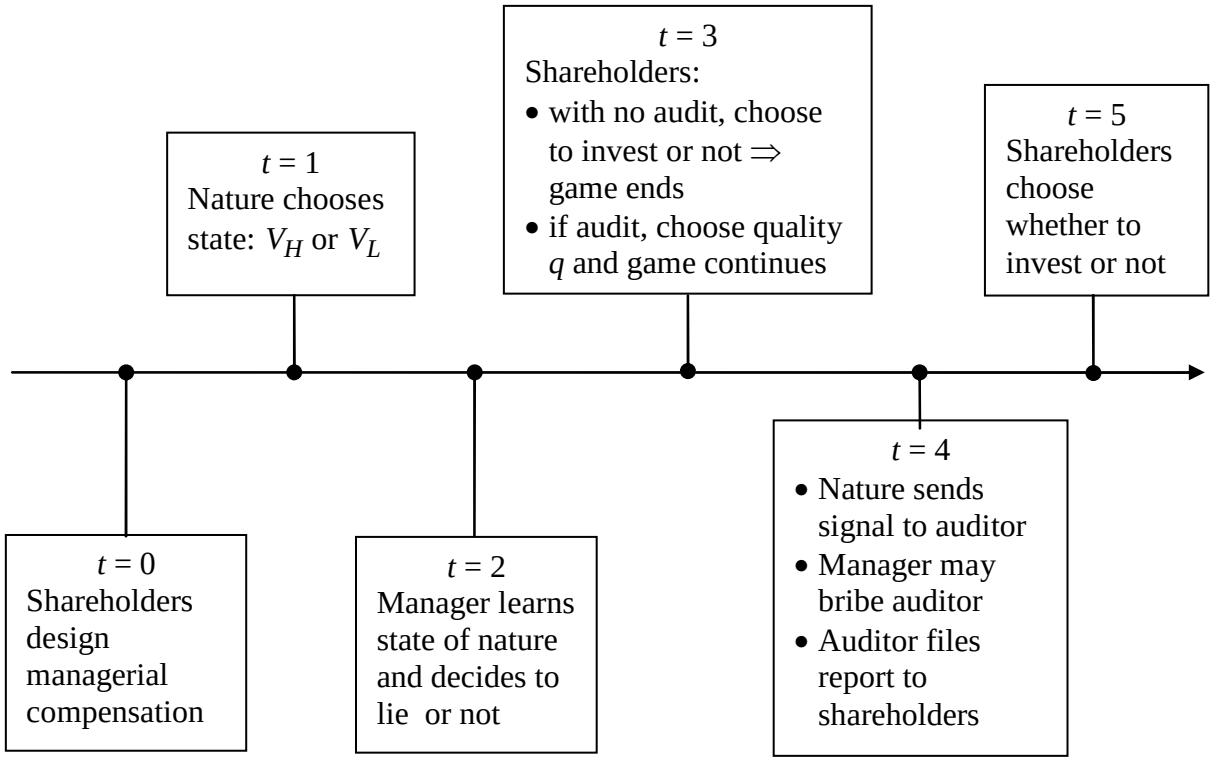

Figure 1. Time line

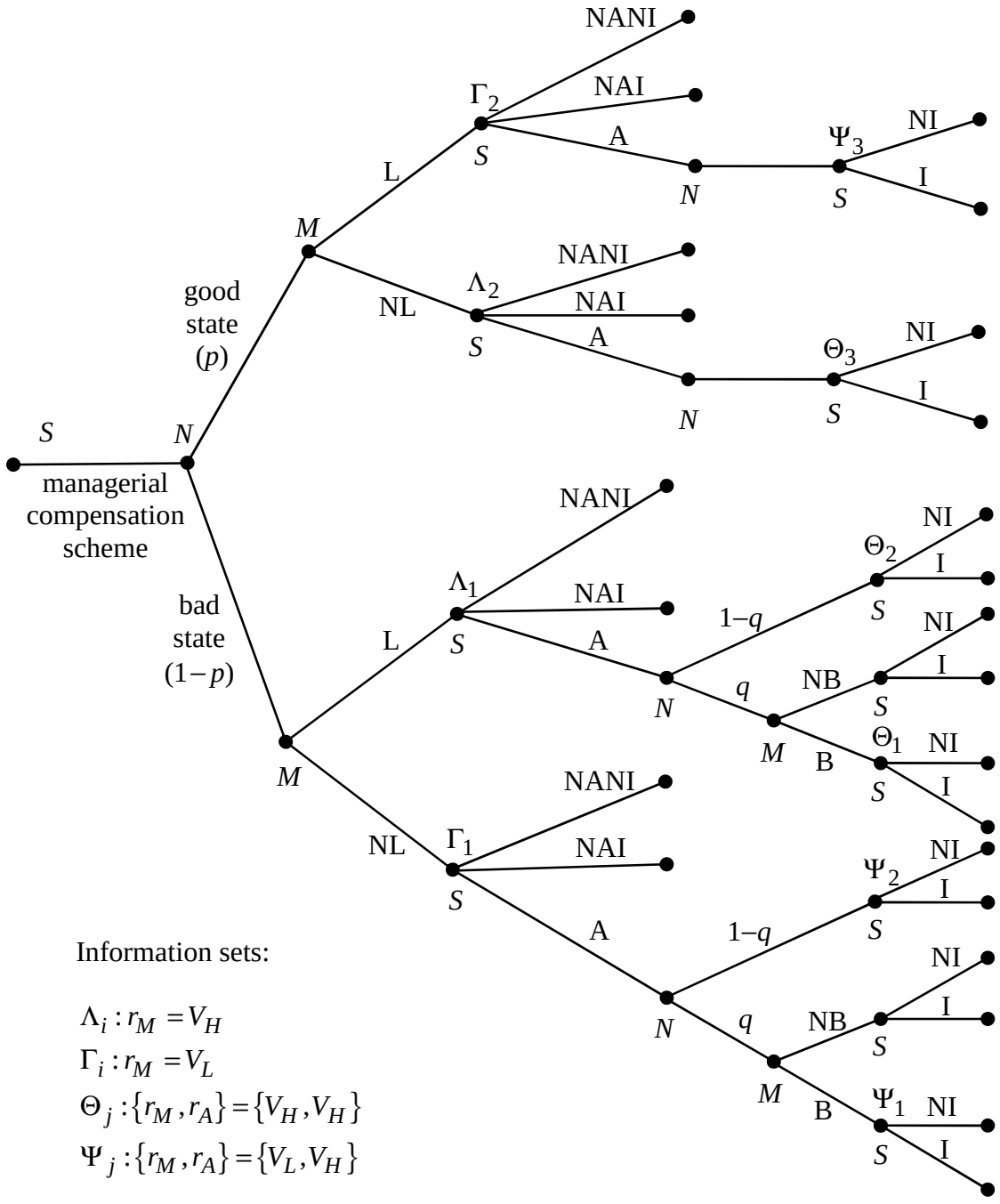

Figure 2. Game tree

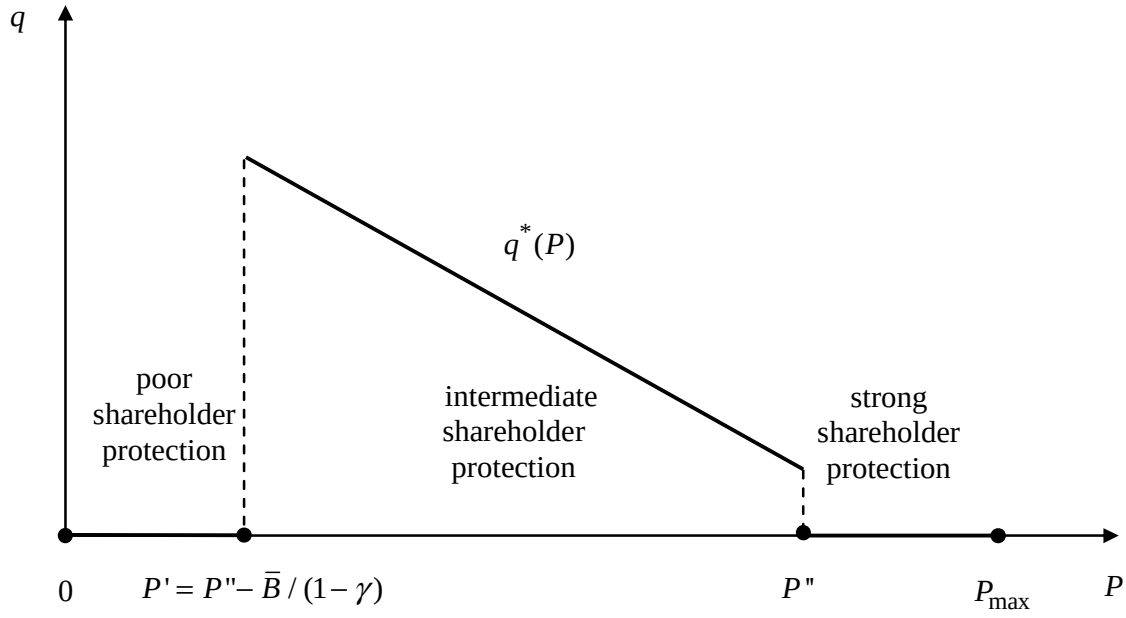

Figure 3. Audit quality q as function of shareholder protection P
(for given auditing regulation $\bar{B}$ and managerial equity stake γ)

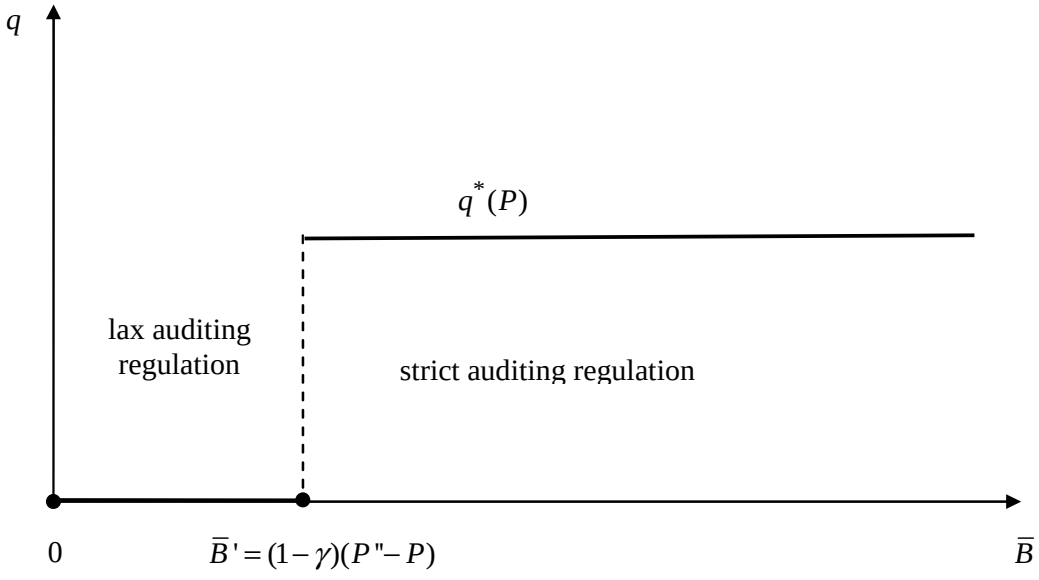

Figure 4. Audit quality q as function of strictness of auditing regulation $\bar{B}$
(for given shareholder protection P and managerial equity stake γ)

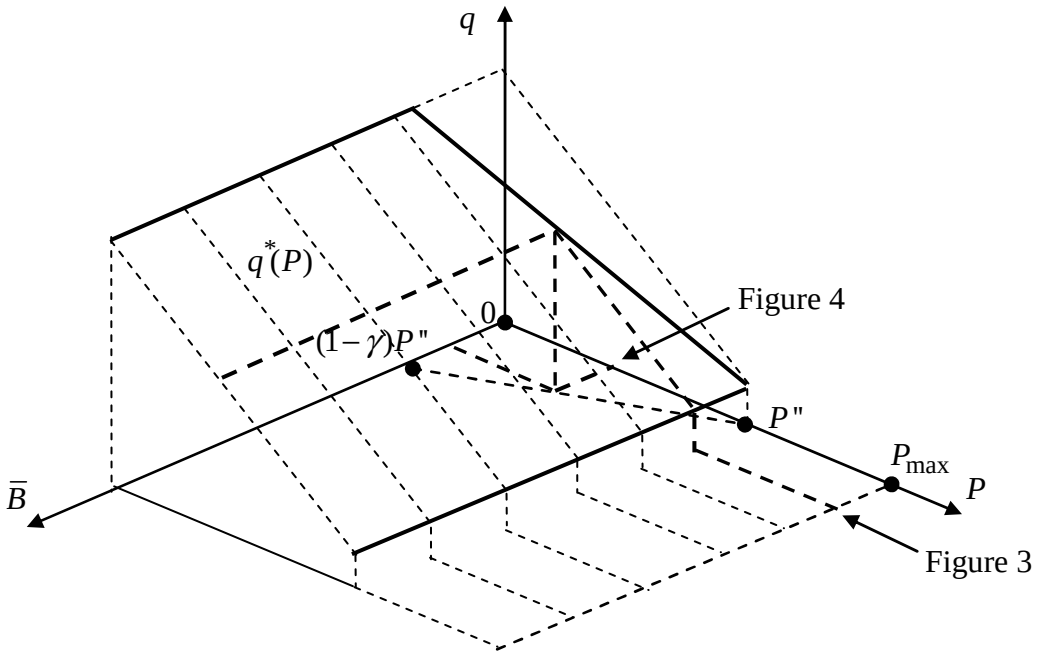

Figure 5. Audit quality q as function of shareholder protection P and strictness of auditing regulation $\bar{B}$ (for given managerial equity stake γ)

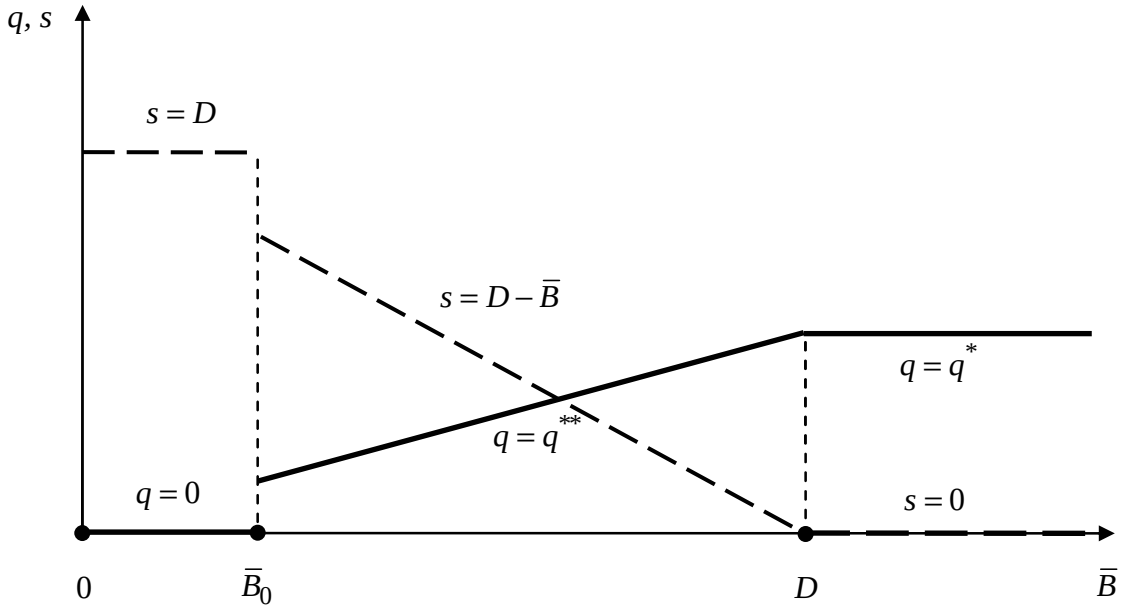

Figure 6. Optimal audit quality q and severance pay s as functions of the strictness of auditing regulation $\bar{B}$ (for given P)

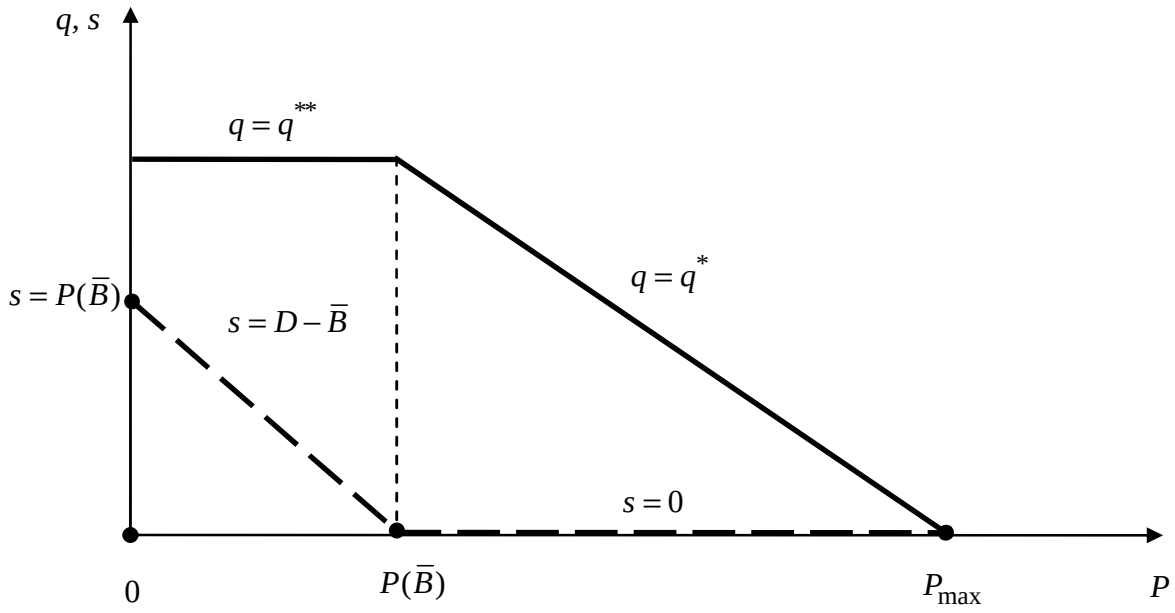

Figure 7. Optimal audit quality q and severance pay s
as functions of shareholder protection P (for given $\bar{B} > \bar{B}_0$)

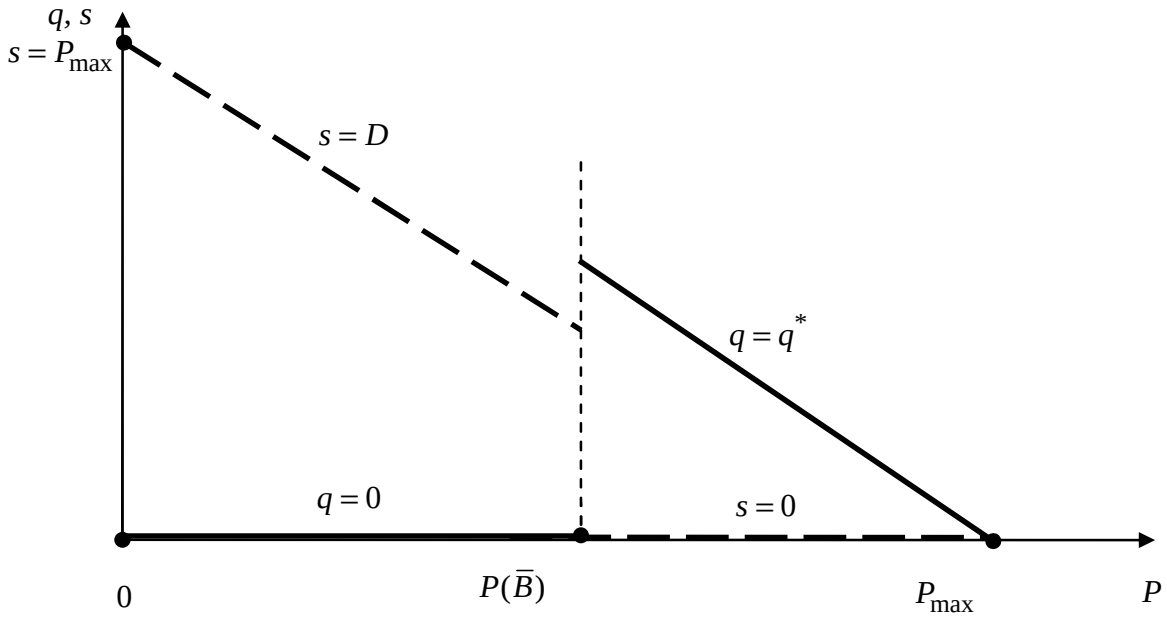

Figure 8. Optimal audit quality q and severance pay s
as functions of shareholder protection P (for given $\bar{B} < \bar{B}_0$)

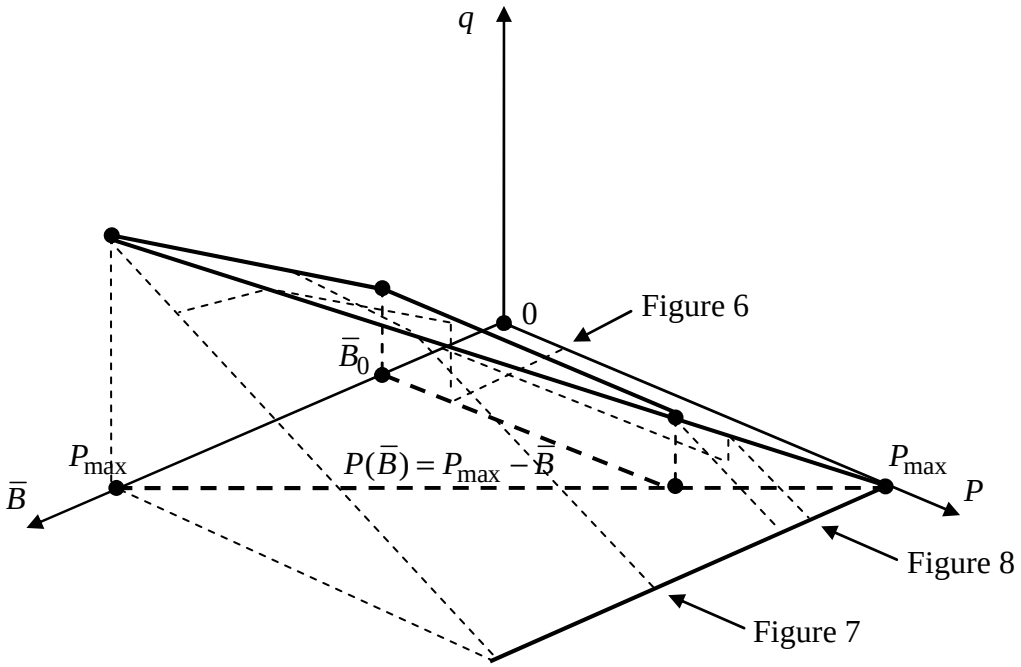

Figure 9. Optimal audit quality q as function of shareholder protection P and strictness of auditing regulation $\bar{B}$ (for optimal managerial compensation)

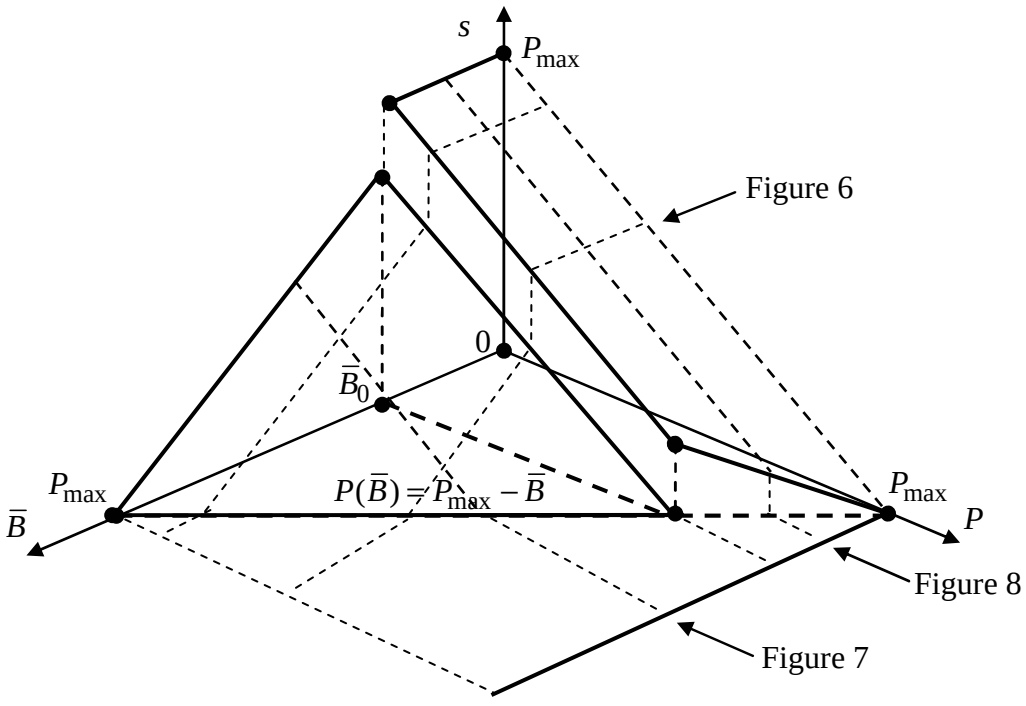

Figure 10. Optimal severance pay s as function of shareholder protection P and strictness of auditing regulation $\bar{B}$