Discontinuity in Earnings Reports and Managerial Incentives

Tatiana Fedyk *

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Abstract

This paper provides a rational explanation for earnings discontinuity in the context of the agency model. A company manager often possesses private information about the project's expected return. This information is valuable to the firm because early warning that a project is unlikely to succeed allows the firm to fire the manager and to discontinue a project with an expected loss. When issuing a report, the manager can choose to engage in real earnings management and report higher-than-actual earnings for the current period, but as a result, the overall expected cash flow from the project will be undermined. The only way to extract the manager's private information is to offer him a generous severance payment as compensation for disclosing bad news. It is shown that any optimal contract induces overinvestment and earnings management. Furthermore, discontinuity in earnings reports arises endogenously under most circumstances. For a linear cost of misreporting, the paper presents the closed-form solution for the optimal contract and shows that the existence of an area of discontinuity in the earnings report depends negatively on the firm size and positively on the cost of managerial effort. These results are in line with empirical studies on discontinuity in earnings and executive severance agreements.

*Haas School of Business, UC Berkeley, CA 94720, 510-643-1411, or by email at fedyk@haas.berkeley.edu.
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1 Introduction

This paper provides a rational explanation for earnings discontinuity in the context of the agency model. There is a common perception that managers possess superior information about their firms' performance and have the incentives and the ability to manipulate earnings. A large body of empirical evidence supports this belief[1]. Meanwhile, in a rational framework, users of financial information, investors or shareholders, can undo earnings management and, in equilibrium, compensate managers based on unbiased expectations[2]. Given commonly used continuous compensation contracts, it is difficult to explain why managers would try to avoid reporting certain thresholds, such as negative earnings, earnings decline, or missing of analyst forecasts, or exhibit other signs of discontinuity in earnings.

The fact of discontinuity in earnings, i.e. too few firms report small losses and too many firms report small profits, was first documented by Hayn [1995]. Burgstahler and Dichev [1997] suggest that the cause of discontinuity in the earnings distribution is earnings management. Subsequently, a whole stream of accounting empirical research has explored this phenomenon in order to determine the different characteristics of firms that report small losses and firms that report small gains, and to explain their manager's reporting behavior. These studies suggest that the unusually low frequency of firm-year observations below the threshold arises because firms that would otherwise have ended the accounting period with small negative earnings managed their earnings upward to reach the threshold of positive earnings[3].

This paper studies the association between managerial incentives and discontinuity in earnings reports using an agency setting to characterize the relationship between a firm's shareholders and a manager. In particular, it examines the design of optimal incentive contracts when the manager not only has private information about his own effort, but also receives a private signal about the firm's expected cash flow. This information would also be valuable to the shareholders since early termination of a negative net present value (NPV) project would shelter the firm from a future loss. But the manager has little, if any, incentive to reveal his information to the public if that information is unfavorable. If the manager is not granted a generous severance payment for disclosing bad news, he may prefer to prepare a misleading report and continue the project even if the probability of success is very small,

[1] The empirical literature on earnings management is voluminous. For reviews see Healy and Wahlen [1999], McNichols [2000], and Fields, Lys and Vincent [2001].

[2] Some theoretical works on revelation and earnings management include Maggi and Rodriguez-Clare [1995], Arya, Glover, and Sunder [1998], and Dutta and Gigler [2002].

[3] Although the most common explanation for discontinuity in the earnings report is earnings management, other explanations, such as different effects of taxes on firms with small losses vs. those with small profits, proposed by Beaver, McNichols, and Nelson [forthcoming], are also considered plausible. Dechow, Richardson, and Tuna [2003] investigate and discuss a number of alternative explanations for the discontinuity in the earnings distribution.

but still positive. If reported earnings differ from actual earnings, the manager is said to be involved in earnings management.

The focus of this paper is real earnings management instead of accounting earnings management[4]. Schipper [1989] defines real earnings management as being "accomplished by timing investment or financing decisions to alter reported earnings or some subset of it." In contrast to accounting earnings management, real earnings management consumes real resources and therefore reduces the firm's value. Real earnings management implies that the manager deviates from an otherwise optimal plan of action only to affect current-period earnings, thus imposing a real cost to the firm. Brunes and Murchant [1990] show in their survey paper that managers prefer manipulating operating decisions or procedures to accounting earnings management, and that "the short term earnings will be emphasized at the expense of the long term"[5]. Roychowdhury [2006] provides evidence of real earnings management among groups of firms attempting to reach an earnings threshold.

A number of results emerge from the model. An optimal contract specifies the equilibrium threshold level such that the project is liquidated, the manager is fired, and a constant severance is paid to the manager if reported earnings fall below that threshold[6]. If the manager reports earnings higher than the threshold, then the project is implemented. In this case, the manager receives a bonus if the project is successful. It is shown that the optimal incentive contract is structured so that managers who report low earnings receive severance payment that is between those of the managers who obtain good outcomes and the managers who obtain bad outcomes but did not report low earnings. A project's cancellation undermines the managerial incentives to exert high effort ex ante since, ex post, there is no way to determine what the project's outcome would have been if it had not been cancelled. It turns out that the optimal balancing of managerial incentives and the project's cancellation decision leads the firm to overinvest i.e., to undertake some ex ante negative net present value projects. To induce the manager to truthfully report bad news, the firm proposes to pay him severance even for an unfavorable earnings report. Since severance pay represents managerial informational rent, the firm could try to reduce a severance package by proposing the manager an increasing wage on undertaken projects. However, an increasing wage triggers earnings management. As a result, an optimal incentive contract is structured so that the manager

[4]The main result (i.e., that discontinuity in the earnings report arises endogenously under an optimal contract) is the same for both accounting and real earnings management. However, the properties of optimal contracts are different for these two types of earnings management. The most pronounced distinction is that, for accounting earnings management, under the optimal contract the manager manages earnings even if his earnings report ends up slightly *below* the threshold. This reporting strategy is consistent with the observation by Dechow et al. [2003] that there is an abnormal level of accruals not only for firms with small positive earnings, but also for firms with small losses.

[5]A recent survey paper by Graham, Harvey, and Rajgopal [2005], which conducts interviews with CFOs about earnings management decisions, supports the idea that managers engage in real earnings management.

[6]A recent study by Lillis and Pinnuck [2006] finds that reporting an accounting loss acts as a trigger event for firms to exercise the abandonment option and discard unproductive investments.

always engages in real, value-destroying earnings management for some range of earnings. Furthermore, the combination of a constant severance for cancelled projects and an increasing wage on undertaken projects leads to the emergence of discontinuity in the earnings report under any optimal contract.

In an extension of the basic analysis, optimal incentive contracts for linear misreporting costs are considered. It is determined that the form of an optimal contract depends on the project's characteristics and the cost of the manager's productive effort. For large projects the optimal contract always induces a truthful report and there is no discontinuity in the earnings distribution. But for small projects the optimal contract results in earnings management, while the manager manipulates earnings just to reach the threshold.

Interestingly, the model predicts that larger firms offer higher severance payments to their managers, but also fire their managers more often since their managers report bad news more frequently than managers of smaller firms. While the empirical literature on severance payments is of growing interest but still scarce, a recent paper by Rusticus [2006] provides evidence consistent with these predictions. Rusticus shows that one of the main factors driving the size of the severance package is firm size, and that higher severance amounts are associated with more managerial turnover. Another prediction of the model, consistent with empirical evidence[7], is that managers of smaller firms engage in earnings management to beat earnings thresholds more often than do the managers of larger firms. Finally, the analysis shows that small gain firms will underperform small loss firms in the next period[8]. In addition, the model predicts that the level of underperformance is negatively correlated with firm size.

Despite the numerous theoretical papers on earnings management focused on identifying conditions under which earnings management emerges as an optimal strategy in either a contracting or a market setting[9], there are only a few attempts to endogenously model the discontinuity in earnings reporting[10]. Thus, Guttman, Kadan, and Kandel [2006] propose a game theoretic model explaining this phenomenon. In their model, given the investors' expectations of manipulative behavior by the manager, the manager's best response is to fulfill those expectations. The discontinuity in the distribution of reported earnings arises as a result of a partially pooling equilibrium in a game between rational investors and a price-maximizing manager. Such discontinuity necessarily requires stock-based compensation in the managerial contract. However, in my model, I show that even without stock-based

[7]See Xue [2003], Roychowdhury [2006].

[8]Gunny [2005] demonstrates that real earnings management has a negative impact on future operation performance, while not being perfectly recognized by investors.

[9]See Dye [1988], Evans and Sridhar [1996], Demski [1998], Ewert and Wagenhofer [2006].

[10]For a behavioral model of earnings management to exceed threshold see Degeorge, Patel and Zeckhauser [1999]. In their model a manager receives a bonus if he meets the benchmark. However, in practice, there is little empirical evidence that managers are paid bonuses just for exceeding zero earnings or meeting analysts' forecasts.

compensation, there is a discontinuity in the earnings distribution[11]. Furthermore, the discontinuity in the earnings report arises naturally under the optimal contract even when the proposed contract is continuous in reported earnings.

Levitt and Snyder [1997] examine the optimal incentive schemes when the agent has a private signal about the eventual state of the world. It is shown that the optimal contract consists of a positive constant payment proposed to the agent if the project is cancelled, and a constant wage received by the agent upon successful project completion. Laux [2006] further shows that some lack of board independence can be in the interest of shareholders since it serves as a substitute for commitment and reduces the overinvestment. My study differs from theirs in that I consider the manager's report subject to costly earnings management. In my setting the results obtained in Levitt and Snyder correspond to the subcase where earnings management is costless.

The rest of the paper proceeds as follows. Section 2 outlines the model. Section 3 analyzes optimal contract properties for a widely considered class of weakly convex earnings management cost functions. It is also shown that for strictly convex misreporting costs, earnings management and discontinuity in earnings reports always arise under an optimal contract. Section 4 presents the optimal contract when the cost of earnings management is linear and studies the properties of that optimal contract. Empirical implications are discussed in Section 5. Sections 6 concludes. The proofs of all results presented in the body of the paper are contained in the appendix.

2 Model

I consider an agency relationship between a firm's shareholders and a manager. The timing of the model is depicted in Figure 1. At date 1 the firm's shareholders (hereafter the firm) offer the manager an employment contract. The contract specifies a wage w to be paid to the manager as a function of the contractible variables listed below. If the manager accepts the contract, he begins to work on a project and undertakes productive effort denoted by e. The manager can choose one of two possible effort levels: low effort, e_L, or high effort, e_H. The manager's cost of exerting low effort is $v(e_L)$ and of exerting high effort is $v(e_H)$, where $v(e_H) > v(e_L)$. For simplicity, I normalize the cost associated with low effort to zero, $v(e_L) = 0$, and denote the cost associated with high effort as v: $v(e_H) = v$. Effort is unobservable by the firm and noncontractible.

At date 2, the manager privately observes an intermediate signal θ about the project's expected outcome. I refer to θ as economic, or real, earnings, as higher earnings indicate higher expected cash flow. The project's outcome is realized at date 3, determining the project's return. If the state of the world is "good", the firm earns a gross return of $R_H > 0$

[11] Beaver, McNichols and Nelson [2003] find that a discontinuity in the earnings distribution exists for privately held companies as well.

at date 3. If the state of the world is "bad", the firm incurs a loss $R_L < 0$. The project's realized outcome is observable and contractible. The state of the world is stochastic, depending in part on the level of effort exerted by the manager. Specifically, I will model effort as affecting the distribution of the intermediate signal, observed by the manager at date 2. If $e = e_L$, then the intermediate signal is represented by the distribution function $F_L(\theta)$ and the continuous density $f_L(\theta)$. If $e = e_H$, then the distribution function is $F_H(\theta)$, and the (continuous) density is $f_H(\theta)$. I assume that higher effort leads to a higher realization of θ in the sense of first-order stochastic dominance: i.e., $F_L(\theta) > F_H(\theta)$ for all $\theta \in (0, 1)$. The intermediate signal is related to the final outcome in a straightforward way: θ is the probability of the R_H outcome, and $(1 - \theta)$ is the complementary probability that the outcome is R_L. Therefore, informationally, reporting θ is equivalent to reporting the expected outcome. Given this formulation, the probability of a good state is higher when the manager exerts more effort. To summarize, high effort implies higher expected earnings and higher earnings implies a better expected outcome.

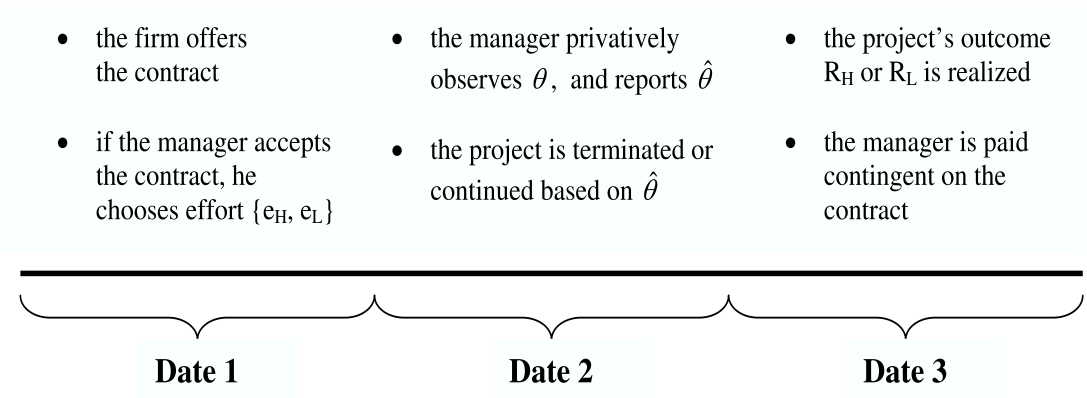


Figure 1: **Timeline**

At the end of date 2, after privately observing the realized earnings θ the manager is obligated by a regulator to issue a public accounting report $\hat{\theta}$ about earnings. A key assumption of the model is that the manager can engage in "performance manipulation" activities such that the report may deviate from the underlying earnings θ. In this paper I focus on real earnings management activities. Real earnings management occurs if the manager undertakes transactions that are inefficient from the firm's perspective, but that generate desired earnings in the current period. Thus, real earnings management imposes costs on the firm and changes the firm's expected cash flow. Let us denote the degree of manipulation by δ, where $\delta = \hat{\theta} - \theta \geq 0$[12]. In particular, I assume that by misreporting

[12]In this paper, I do not assume any benefits for the manager from understating the actual earnings. For

earnings by δ, the manager decreases the probability of a successful outcome from θ to $\theta' = \theta - C(\delta)$, where $C(\delta)$ is the cost of misreporting. I make the following assumptions about the cost of misreporting:

Assumption 1 $C(\delta) \geq 0$; $C(0) = 0$; $C'(\delta) \geq 0$; $C''(\delta) \geq 0$.

When the manager's report $\hat{\theta}$ is issued at date 2, the firm may decide to cancel the project contingent on the manager's report. I restrict attention to deterministic cancellation policies. If the project is cancelled, the manager is fired, the project outcome is not realized, and the project provides no return (positive or negative) to the firm. If the project continues, the manager stays with the firm until the realization of the project's outcome, R_H or R_L, is revealed at date 3. After the outcome is realized, a wage is paid to the manager in accordance with the contract, and the firm receives the residual of the project's return.

Both players, the manager and the firm, are assumed to be risk-neutral. It is supposed that the manager has a reservation utility normalized to zero. Furthermore, it is presumed that the manager is protected by limited liability. In particular, it is assumed that the manager's compensation must be non-negative in all states of the world. The limited-liability assumption can be justified by the existence of minimum-wage laws or limited wealth on the part of the manager.

In the first-best case, it is optimal to have the manager exert high productive effort and not engage in value-destroying performance manipulation. To avoid a trivial setting, I will restrict attention to parameters such that the firm also prefers to induce high productive effort in the second-best case.

3 Optimal Contracts

A general contract specifies the following: $[d(\hat{\theta}), w(\hat{\theta}), w_L(\hat{\theta}), s(\hat{\theta})]$, where $\hat{\theta}$ denotes the manager's report, and the wages $w(\hat{\theta})$ and $w_L(\hat{\theta})$ are paid to the manager in cases of the high project outcome R_H and the low project outcome R_L, respectively. The indicator variable d denotes the firm's decision to continue or to cancel the project, where $d = 1$ if the project is continued and $d = 0$ otherwise. If the project is cancelled, the manager is dismissed and receives severance payment $s(\hat{\theta})$. All provisions of the contract can be contingent on the manager's earnings announcement $\hat{\theta}$. Obviously, the payment to the manager cannot be contingent on the project's outcome (R_H or R_L) if the project is cancelled, but can be contingent on the project's outcome if the project is continued.

Note that, the amount of the severance payment cannot be any but a constant function of the manager's report $\hat{\theta}$. If the project is cancelled the project's outcome will never be

a model where the manager's objectives are uncertain and both earnings-increasing and earnings-decreasing behavior could be equilibrium strategies, see Fisher, Verrecchia (2000) realized. So, for any $\hat{\theta}_1$ and $\hat{\theta}_2$, if $s(\hat{\theta}_1) > s(\hat{\theta}_2)$, the manager would report $\hat{\theta}_1$ since such misreporting is costless to him. Therefore, in equilibrium $s(\hat{\theta}_1) = s(\hat{\theta}_2) = s$. Since all parties are risk-neutral, it is optimal to set the wage w_L as low as possible, and given the manager's limited liability, $w_L = 0$. It also can be shown that there exists a unique threshold level $\bar{\theta}$, such that $d(\hat{\theta}) = 0$ (i.e. the manager is fired and the project is not undertaken, for all $\hat{\theta} < \bar{\theta}$), and $d(\hat{\theta}) = 1$ (i.e. the manager stays and runs the project to completion, for all $\hat{\theta} \geq \bar{\theta}$). The above observations can be summarized in the following Lemma:

Lemma 1 *An optimal contract can be characterized by the triplet $[\bar{\theta}, s, w(\hat{\theta})]$, where $\bar{\theta}$ is the equilibrium threshold level such that for any reported earnings $\hat{\theta} < \bar{\theta}$ the project is cancelled and the manager is fired. If the project is cancelled the manager is paid a severance payment s, where s is a constant independent of $\hat{\theta}$. If the project is continued, the manager gets wage $w(\hat{\theta})$ when the realized return from the project is R_H, and zero otherwise.*

Even though a managerial contract is stated in terms of the reported earnings $\hat{\theta}$, it is convenient to solve the firm's maximization problem in terms of backed out real earnings θ. Let us denote by $\underline{\theta}$ the real earnings threshold corresponding to the reported earnings threshold $\bar{\theta}$. This definition implies the following relationship between $\underline{\theta}$ and $\bar{\theta}$: $\bar{\theta} = \hat{\theta}(\underline{\theta})$. Thus, for any $\theta < \underline{\theta}$, the project is cancelled, the manager receives constant severance s and truthfully reports $\hat{\theta} = \theta$. However, for any $\theta \geq \underline{\theta}$, the project is continued, and the manager gets $w(\hat{\theta})$ if the project's outcome is R_H, and zero if the project's outcome is R_L. Of course, $\underline{\theta}$ will be determined endogenously as part of the optimal contract.

The firm maximizes the expected return from the project net of the expected payments to the manager. Four constraints govern the construction of the optimal contract: individual rationality, limited liability, and two incentive compatibility constraints. The parameters of the model are such that the individual rationality constraint is never binding and, therefore, is omitted.

The Firm's Problem

$$\max_{s,\underline{\theta},w(\theta),\delta(\theta)} -s \cdot F_H(\underline{\theta}) + \int_{\underline{\theta}}^{1} [(R_H - w(\hat{\theta}))(\theta - C(\delta)) + R_L(1 - \theta + C(\delta))] f_H(\theta) d\theta \tag{1}$$

subject to

$$-v + s \cdot F_H(\underline{\theta}) + \int_{\underline{\theta}}^{1} w(\hat{\theta}) \cdot (\theta - C(\delta)) \cdot f_H(\theta)\, d\theta \geq$$

$$s \cdot F_L(\underline{\theta}) + \int_{\underline{\theta}}^{1} w(\hat{\theta}) \cdot (\theta - C(\delta)) \cdot f_L(\theta)\, d\theta \tag{2}$$

$$\delta(\theta) \in \quad argmax \;\; w(\hat{\theta})(\theta - C(\delta)) \quad \forall \theta \geq \underline{\theta} \tag{3}$$

$$s = w(\hat{\theta}(\underline{\theta})) \cdot (\underline{\theta} - C(\underline{\delta})) \tag{4}$$

$$w, s \geq 0 \tag{5}$$

The effort incentive constraint (2) requires the manager to exert high effort if and only if the manager's marginal benefit of high effort exceeds his marginal cost. The incentive constraint (3) ensures that the manager chooses the earnings report to maximize his expected payoff. Constraint (4) guarantees that the manager truthfully reports low earnings if $\theta \leq \underline{\theta}$, which will trigger the project cancellation and leave the manager with constant severance payment s. If $\theta = \underline{\theta}$ the manager is indifferent between truthfully reporting $\underline{\theta}$ and getting s, and reporting higher earnings $\hat{\theta} = \underline{\theta} + \underline{\delta}$ in order to continue the project and receive wage $w(\hat{\theta})$ with probability $\underline{\theta} - C(\underline{\delta})$. The limited liability constraint (5) requires that payments to the manager always be non-negative.

Contracts satisfying constraints (2)-(5) will be called feasible.

3.1 Optimal Investment Policy

Next, let us derive some general properties of optimal contracts. In particular, let us explore the following questions. First, would it ever be optimal to cancel some projects? Even though cancellation undermines managerial incentives, not spending resources on projects that are predicted to fail allows the firm to earn a higher net profit. Second, if cancellation is possible, would it be optimal to cancel some positive net present value projects as well as all negative net present value projects? The analysis shows that under an optimal contract all positive and some negative net present value projects will be undertaken, i.e. an optimal contract results in overinvestment. The intuition for this result is that the lower the cutoff level, the lower the informational rent that the manager earns. Third, let us ask whether earnings management is ever optimal. The main result is that earnings management always arises under an optimal contract for the general class of strictly convex and differentiable cost of effort functions $C(\cdot)$, such that $C(0) = 0$ and $C'(0) = 0$, and an optimal managerial reporting strategy always includes an area of discontinuity. This result follows from the fact that the negative effect of value-destroying earnings management is outweighed by positive savings on reduced severance.

To fix the ideas, it is instructive to compute the cancellation policy that will be chosen by the firm in the first-best case (i.e. the case in which effort and the intermediate signal are public information). The firm would cancel all negative net present value projects and continue all positive net present value projects. Since the project's expected NPV is $R_H \cdot \theta + R_L \cdot (1 - \theta)$, the first-best investment policy is to cancel the project if and only if $\theta < \theta^0$, where $\theta^0 \equiv -R_L/(R_H - R_L)$.

In the case where θ is not public information, and only the reported earnings $\hat{\theta}$ are available for contracting, the firm would still choose to cancel some projects. To see this, let us consider the possible effects of cancellation on managerial incentives and on the expected return from the project. If the firm cancels a project with a small θ then an almost-certain loss is avoided. On the other hand, intervention by the firm would obscure the relationship between managerial incentives and the project's eventual return, since a cancelled project would not produce any return. However, when θ is very small, the effect of the avoided loss is a first-order effect while the undermined managerial incentive is only a second-order effect. To prove this let us take any initial contract that does not allow cancellation with initial wage structure $w^0(\hat{\theta})$, and consider modifying it in the following way: set the cancellation level as $\underline{\theta} = \epsilon > 0$, and set severance payment s and a new wage $w^N(\hat{\theta})$ at the lowest level that maintains the truth-telling constraint (4) and the incentive constraint (2). Next, let us show that the modified contract ensures a higher profit than the initial one at least for the cutoff level in the neighborhood of zero. Formally:

Lemma 2 *Any optimal contract entails cancellation; that is,* $\underline{\theta} > 0$*.*

It follows from Lemma 2 that the firm will always choose to cancel at least the projects with very low real earnings. By offering a constant severance payment to the manager (if he reports low earnings) the firm increases its overall expected outcome since the manager's report will reveal the projects with almost-certain losses.

Lemma 2 implies that the added flexibility of being able to cancel the project is useful to the firm even though the linkage between effort and outcome is obscured when the project is cancelled. An interesting question then is: what is an optimal cancellation policy? Is it ever optimal to cancel *all* negative NPV projects and avoid potential losses associated with those projects? Or, is it ever optimal to cancel some positive NPV projects? While the exact cutoff level depends on the parameters of the cost and density functions, it is possible to provide some general characteristics of the optimal cancellation policy. For example, the firm would never cancel any positive NPV project, so $\underline{\theta} \leq \theta^0$. By canceling a positive NPV project the firm reduces its expected payoff and undermines managerial incentives at the same time. Both effects hurt the firm. In addition, the result below shows that it is never optimal to cancel *all* negative NPV projects, so $\underline{\theta} < \theta^0$.

Proposition 1 *It is always optimal to induce overinvestment; that is,* $\underline{\theta} < \theta^0$*.*

Proposition 1 rules out the possibility that all negative NPV projects would be cancelled. For projects just below the break-even point θ^0, the expected loss associated with the project is second order, whereas the benefit in terms of improved incentives is first order. Thus, the firm would gain from continuing the project for some θ in an interval below θ^0. One important implication of Proposition 1 is that under an optimal contract the firm decides to overinvest since such a decision reduces managerial surplus. This result is in seeming contrast to underinvestment as an optimal investment strategy in a principal-agent model when an agent has private information about a project's expected outcome (Dutta and Reichelstein, 2002). In the Dutta and Reichelstein model a manager is endowed with the investment return, whereas in my model, the return is driven by the manager's private and costly effort. As a result, in my model, the manager earns informational rent in the form of a severance payment only if the firm decides to cancel some projects.

3.2 Optimal Earnings Management

The previous subsection focused on the firm's optimal investment policy. It was shown that the firm always exercises its "cancellation right", but not to the extreme: i.e., some negative NPV projects still go on to completion. Therefore, the first best level of investment cannot be attained unless misreporting is prohibitively costly. In this section I will show that an optimal contract tolerates not only some overinvestment, but earnings management as well. The reason to overinvest is to make the project cutoff level as low as possible while balancing the expected outflow from continued projects with high managerial incentives. Real earnings management, though costly to both the manager and the firm, is another potential instrument for reducing the managerial informational rent. To see this, let me first point out that the higher the severance payment, the higher the managerial surplus. Next, the amount of severance payment s is determined as the amount of the expected wage at the cutoff point: $s = w(\hat{\theta}(\underline{\theta}))(\underline{\theta} - C(\underline{\delta}))$. So, by making wage w an increasing function of θ, the firm achieves two goals: it reduces the severance since the wage at the cutoff level is minimal, and it supports the managerial incentives to expend high effort. On the other hand, the increasing wage could trigger earnings management. For further analysis I consider a strictly and globally convex differentiable cost function.

Assumption 2 $C(\delta) \geq 0$; $C(0) = 0$; $C'(0) = 0$; $C''(\delta) > 0$.

Let us consider any initial contract under which the manager always chooses truthful reporting. Since the marginal cost of misreporting is zero if $\delta = 0$, and the cost is convex at $\delta = 0$, the only wage structure preventing misreporting is a constant wage. I denote the optimal constant wage by w^0; and the optimal initial severance pay by $s^0 = w^0\underline{\theta}$. Keeping the cutoff level $\underline{\theta}$ fixed, consider a new contract with an increasing wage $w^N(\hat{\theta})$ determined as follows: $w^N(\hat{\theta}) = w^0 - \frac{1-\hat{\theta}}{\hat{\theta}}\epsilon$, where ϵ is small and positive. Then the new severance $s^N = w^N(\hat{\theta}(\underline{\theta}))(\underline{\theta} - C(\underline{\delta}))$ is less than s^0. The new contract is feasible. The expected profit under the new contract is higher than under the initial one since the loss from real earnings management is a second-order effect, while savings on the reduced severance is a first-order effect. I have thus sketched a proof that it is never optimal to eliminate earnings management.

Proposition 2 *An optimal contract always induces some earnings management.*

Although the firm can design a contract that induces no earnings management, Proposition 2 implies that this kind of contract can be improved upon by an earnings-management-inducing contract. The next step is to prove that if earnings management is allowed at some point, it is optimal to allow it at the cutoff level. While the formal proof of Proposition 2 requires the use of an optimal control technique, the intuition behind this result is quite simple.

A contract that induces earnings management benefits the firm in two ways. First, severance payment may be lowered if earnings management is allowed. Second, such a contract provides greater managerial incentives since an increasing wage w helps maintain a larger difference in compensation for successful and failed outcomes. Both effects are strongest if earnings management starts at the cutoff point. Therefore, for any $\theta \leq \underline{\theta}$ the manager gets severance s and truthfully reports $\hat{\theta} = \theta$, and for any $\theta \geq \underline{\theta}$ the manager gets an increasing wage such that his optimal earnings management at the cutoff point $\underline{\theta}$ is greater than zero. Let us denote optimal earnings management at the cutoff point by $\underline{\delta}$: i.e., $\hat{\theta}(\underline{\theta}) = \underline{\theta} + \underline{\delta}$. Then, as θ approaches $\underline{\theta}$ from below, the manager's report is $\lim_{\epsilon \to 0} \hat{\theta}(\underline{\theta} - \epsilon) = \underline{\theta}$, but as θ approaches $\underline{\theta}$ from above, the manager's report is $\lim_{\epsilon \to 0} \hat{\theta}(\underline{\theta} + \epsilon) = \underline{\theta} + \underline{\delta}$. So, given the monotonicity of reporting (proven as a footnote to Proposition 1), I have shown that the manager will never report any earnings within the interval $(\underline{\theta}, \underline{\theta} + \underline{\delta})$. Formally:

Proposition 3 *A discontinuity in the earnings report always arises under an optimal contract.*

Proposition 3 states that an area of discontinuity in the managerial report always arises under an optimal contract for the cost of real earnings management that satisfies: $C(\delta) \geq 0$, $C(0) = 0$, $C'(0) = 0$, $C''(\delta) > 0$. However, if the cost of earnings management is zero (purely private information), or if the cost of earnings management is infinite (purely public information), the earnings report does not show any sign of discontinuity. For example, an optimal contract for the purely private information setting would be a constant wage w, and a constant severance $s = w\underline{\theta}$, where $\underline{\theta}$ is a project's optimal cutoff level such that $\underline{\theta} < \theta^0$[13]. The manager always truthfully reports real earnings under such a contract because his payment does not depend on his reporting. There is no discontinuity for the purely public information setting as well, since there is no way for the manager to report anything but the real earnings. Therefore, the discontinuity in the earnings report in my model is attributed to the cost of misreporting that is neither zero nor infinity.

4 Linear Cost Function

There are reasons to believe that some types of real earnings management are described by linear or quasi-linear cost functions: i.e., the marginal cost of earnings management is larger than some strictly positive number. However, these functions were partially excluded from the previous analysis since they satisfied Assumption 1, but did not satisfy Assumption 2. To complete the analysis, I proceed with a case where the marginal cost of earnings

[13]For an explicit form of an optimal contract when the cost of misreporting is zero, see Levitt and Snyder [1997], Proposition 7.

management is non-zero, i.e. $C'(0) > 0$[14]. Specifically, I assume that $C(\delta) = k\delta$, where $\delta = \hat{\theta} - \theta$ is real earnings management and the parameter $k \in [0, \infty)$ captures the cost of real earnings management. If $k = 0$, earnings management is costless, and the manager can report any $\hat{\theta}$ without affecting the probability of a favorable outcome. If $k = \infty$, earnings management is prohibitively costly. For interior values of k, earnings management has a bounded cost. For example, if $k = 1$, the probability of obtaining the favorable outcome R_H is reduced by exactly the amount of earnings management δ[15].

Since the linear cost function satisfies Assumption 1, Lemma 2 and Proposition 1 hold. That means that any optimal contract entails managerial turnover and project cancellation if earnings are low and induces overinvestment. On the other hand, Proposition 2 and Proposition 3 are not directly applicable to the linear cost setting because a linear cost function does not satisfy Assumption 2. The next Proposition shows that earnings management arises under an optimal contract for linear cost as well, but only under certain circumstances:

Proposition 4 *For small projects, an optimal contract always induces some earnings management. For large projects, an optimal contract always entails truthful earnings reporting.*

The reason why some earnings management always arises under an optimal contract when the cost of misreporting satisfies Assumption 2 is that the marginal cost of allowing misreporting is zero. Hence, the negative effect of earnings management is of second order, while the positive effect from reduced severance is of first order. In contrast, when the cost of misreporting is linear, allowing even a small amount of earnings management is very expensive since the marginal cost of misreporting is greater than zero. Proposition 4 proves that if a project is large, i.e. $(R_H - R_L)$ is large relative to the cost of the manager's effort v – it is never optimal to allow earnings management. This happens since even a small amount of earnings management leads to a major destruction of value, whereas a full severance payment guarantees truthful reporting and is sufficiently cheap because of relatively low v. However, if a project is small relative to the cost of the manager's effort, ensuring a truthful report becomes too expensive. In this case, in order to reduce the severance payment to the manager, it could be optimal for the firm to allow some earnings management.

In order to derive the explicit form of the optimal contract, I further assume that θ is uniformly distributed over the interval $[0, 1]$ if effort is high, and $\theta = 0$ with certainty for low effort.

[14]It is worth noting that it is a typical finding in the earnings management literature that if the marginal cost of falsification is constant, earnings management is not supported in equilibrium (See, for example, Maggi and Rodriguez-Clare [1995], or Lacker and Weinberg [1989]). However, in my model, earnings management and discontinuity in the earnings report arise under certain circumstances even with linear misreporting costs. Furthermore, the linear cost assumption allows to get a closed-form solution for the firm's optimization problem and, combined with simple density functions, explicitly analyze the properties of the optimal contracts.

[15]I assume that $\theta' = 0$ if $C(\delta) \geq \theta$, i.e., the worst possible outcome of real earnings management is that the probability of success is reduced to zero.

The tradeoff between attempts to reduce the severance payment and to reduce the value-destroying effect of earnings management leads to the following optimal reporting strategy:

Proposition 5 *Under the optimal contract the manager's reporting strategy is:*

1. *For any* $\theta \in [0;\ \underline{\theta}]$*, the manager truthfully reports* $\hat{\theta} = \theta$*;*
2. *For any* $\theta \in (\underline{\theta};\ \bar{\theta})$*, the manager engages in real earnings management and reports* $\hat{\theta} = \bar{\theta}$*;*
3. *For any* $\theta \in [\bar{\theta};\ 1]$*, the manager truthfully reports* $\hat{\theta} = \theta$*.*

As it follows from Proposition 5, under the optimal contract the manager truthfully reports real earnings θ if they are either sufficiently low or sufficiently high. However, the manager misreports earnings if θ falls between the threshold levels $\underline{\theta}$ and $\bar{\theta}$, where the values of $\underline{\theta}$ and $\bar{\theta}$ are endogenously determined from the firm's maximization problem. Proposition 4 implies that $\underline{\theta} = \bar{\theta}$ for large projects, and $\underline{\theta} < \bar{\theta}$ for small projects. The main feature of earnings management for the linear cost of misreporting is that if earnings management arises under the optimal contract (which always happens for small projects), the manager manages earnings exactly to reach the upper threshold $\bar{\theta}$. Therefore, the earnings reports pool at one point: i.e., $\hat{\theta} = \bar{\theta}$ for any $\theta \in (\underline{\theta}, \bar{\theta})$. Consequently, no report is present on the interval $(\underline{\theta}, \bar{\theta})$. Such a reporting strategy allows the firm to reduce the severance payment by tolerating earnings management on some projects with low expected returns, while still prohibiting value-destroying earnings management on highly profitable projects.

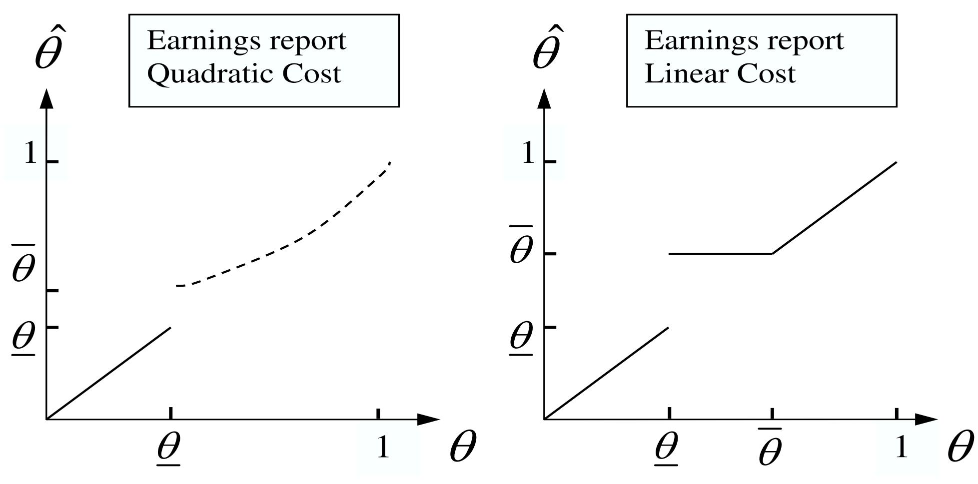


Figure 2: **Earnings Reports Discontinuities**

Fig. 2 compares the manager's reporting strategies if the marginal cost of misreporting is zero (e.g. quadratic cost), and if the marginal cost of misreporting is non-zero (e.g. linear cost). Propositions 2 and 3 imply that for a quadratic cost function, some earnings management is always optimal, and if $\theta < \underline{\theta}$ the manager reports truthfully $\hat{\theta} = \theta$, but if $\theta = \underline{\theta}$ the manager reports $\hat{\theta} = \underline{\theta} + \underline{\delta} \equiv \bar{\theta}$. As for the linear cost function, Proposition 5 shows that if the manager engages in earnings management, he chooses the earnings report $\hat{\theta} = \bar{\theta}$ for any $\theta \in (\underline{\theta}, \bar{\theta})$.

To summarize, at this point it was shown that for the linear cost of misreporting both reporting strategies, earnings management and truthful earnings reports, are supported in equilibrium for some values of the project's outcomes, R_H and R_L, and the cost of the manager's productive effort v. Furthermore, if earnings management is optimal, there is an area of discontinuity in the earnings report, and all managed reports pool at the threshold level.

A natural corollary of Proposition 5 is the form of the optimal wage structure conditional on the manager's earnings report.

Corollary 1 *The optimal wage structure is given by:*

1. *For any report $\hat{\theta} \in [0; \bar{\theta})$[16] the manager gets fired and receives the severance payment $s = \gamma\bar{\theta}^k[\underline{\theta} - k(\bar{\theta} - \underline{\theta})]$;*

2. *For any report $\hat{\theta} \in [\bar{\theta}; 1]$ the manager receives wage $w(\hat{\theta}) = \gamma\hat{\theta}^k$,*

where the performance sensitivity constant γ is determined from the binding incentive constraint (2) and depends on $v, k, \underline{\theta}$, and $\bar{\theta}$[17].

According to Corollary 1 the manager's wage $w(\hat{\theta}) = \gamma\hat{\theta}^k$ is an increasing function of the manager's report. What is important here is the fact that the wage is increasing slowly enough to prevent misreporting. For example, if $k = 1$, the linear wage $w(\hat{\theta}) = \gamma\hat{\theta}$ is optimal since it supports the managerial incentives to exert high effort and makes earnings management unattractive. To see this, let us compare the manager's expected payment if he reports earnings truthfully, and if he misreports earnings by ϵ. In the first case the manager's expected payment is $w(\theta) \cdot \theta = \gamma \cdot \theta \cdot \theta$. In the latter case, the manager expects to receive $w(\theta + \epsilon) \cdot (\theta - \epsilon) = \gamma \cdot (\theta + \epsilon) \cdot (\theta - \epsilon) = \gamma \cdot \theta \cdot \theta - \gamma \cdot \epsilon^2$, which is less than the payment he expects if he reports truthfully.

Given the form of the managerial reporting strategy stated in Proposition 5 and the optimal wage structure described in Corollary 1, the optimal control problem (1)-(5) can be restated as a simple maximization problem in terms of three constants, $\underline{\theta}$, $\bar{\theta}$, and γ:

[16]The firm's out-of-equilibrium actions have to be specified for any report $\hat{\theta} \in (\underline{\theta}; \bar{\theta})$. One example of out-of-equilibrium actions supporting the existing equilibrium would be: for any report $\hat{\theta} \in (\underline{\theta}; \bar{\theta})$, the beliefs are that $\theta < \underline{\theta}$, so the project is not undertaken and the manager receives severance s.

[17]The explicit expression for γ is presented in the Appendix as a part of the proof of Corollary 1.

$$\max_{\underline{\theta},\bar{\theta},\gamma} \quad -s\cdot\underline{\theta} + \int_{\underline{\theta}}^{\bar{\theta}} [(R_H - \gamma\bar{\theta}^k)(\theta - k(\bar{\theta}-\theta)) + R_L(1-\theta+k(\bar{\theta}-\theta))]d\theta$$
$$+\int_{\bar{\theta}}^{1}[(R_H-\gamma\theta^k)\theta + R_L(1-\theta)]d\theta \qquad (6)$$

subject to

$$-v + s\cdot\underline{\theta} + \int_{\underline{\theta}}^{\bar{\theta}} \gamma\bar{\theta}^k(\theta - k(\bar{\theta}-\theta))d\theta + \int_{\bar{\theta}}^{1}\gamma\theta^{k+1}d\theta \geq s \qquad (7)$$
$$s = \gamma\bar{\theta}^k(\underline{\theta} - k(\bar{\theta}-\underline{\theta})) \qquad (8)$$
$$s \geq 0 \qquad (9)$$

The firm's maximization problem (6)-(9) can be analytically solved. First, I express the constant γ as a function of $\underline{\theta}$ and $\bar{\theta}$ from the inequality (7), which holds as an equality since the incentive constraint is binding. Substituting the obtained expression for γ into the maximization problem (6) and taking the F.O.C.s for the two remaining variables, $\underline{\theta}$ and $\bar{\theta}$, I determine the optimal values for $\underline{\theta}$ and $\bar{\theta}$.

There are three possible solutions for the system of F.O.C. equations of the firm's maximization problem (6)-(9). The first two solutions arise when $s > 0$ – i.e., the non-negativity constraint (9) is not binding. These two possible solutions are: $\underline{\theta} = \bar{\theta}$ and $\underline{\theta} < \bar{\theta}$. If $\underline{\theta} = \bar{\theta}$ there is no earnings management and there is no discontinuity in the earnings report. I refer to this case as the full-severance case since the proposed severance is large enough to prevent any misreporting. If $\underline{\theta} < \bar{\theta}$ the manager engages in earnings management such that for any $\theta \in (\underline{\theta}, \bar{\theta})$ he reports $\hat{\theta} = \bar{\theta}$. I refer to this solution as the intermediate-severance case since the proposed severance is higher than zero, but less than the full-severance that precludes any earnings management. Finally, the third solution arises when the non-negativity constraint binds (i.e. $s = 0$) and is a corner solution corresponding to the zero-severance case. The earnings management is extreme and the discontinuity in the earnings report is maximal under the zero-severance contract. The solution that provides the highest expected profit to the firm solves the firm's maximization problem and is the optimal solution.

4.1 Three Types of Optimal Contracts. Numerical Analysis.

This section provides numerical examples of three possible optimal contracts. The optimality of each contract depends on the size of the project, where size is defined as $R := R_H - R_L = |R_H| + |R_L|$.

1. *zero-severance*: is optimal for small projects; earnings management arises under the optimal contract, and the area of discontinuity in the earnings report is maximal.

2. *intermediate-severance*: is optimal for intermediate projects; earnings management arises under the optimal contract, but the area of discontinuity in the earnings report is smaller than under the zero-severance contract;

3. *full-severance*: is optimal for large projects; there is no earnings management, and there is no discontinuity in the earnings report.

In order to present tractable solutions and analyze optimal contracts, I further consider the linear cost of misreporting with parameter $k = 1$; i.e., if the manager decides to report $\hat{\theta} = \theta + \delta$, the probability of a favorable outcome R_H is reduced by exactly the amount of earnings management δ: $\theta' = \theta - \delta$.

The optimal contract if severance is zero is given by:

$$(s=0)\begin{cases} w(\hat{\theta}) = \frac{12v}{4-\bar{\theta}^3} \cdot \hat{\theta} & if \quad \hat{\theta} \geq \bar{\theta} \\ s = 0 & otherwise \end{cases}$$

where the equilibrium threshold level is given by $\bar{\theta} = \frac{-R_L}{R_H - R_L}$. The expected profit of the firm is:

$$\pi_{\{s=0\}} = \frac{R_H + R_L}{2} + \frac{1}{4} \cdot \frac{R_L^2}{(R_H - R_L)} - v \tag{10}$$

The optimal contract if severance is non-zero is given by:

$$(s \neq 0)\begin{cases} w(\hat{\theta}) = \gamma \cdot \hat{\theta} & if \quad \hat{\theta} \geq \bar{\theta} \\ s = \gamma\bar{\theta}(2\underline{\theta} - \bar{\theta}) & otherwise \end{cases}$$

where the constant $\gamma = \frac{3v}{3\underline{\theta}^2\bar{\theta} - 6\underline{\theta}\bar{\theta} + 3\bar{\theta}^2 + 1 - \bar{\theta}^3}$. The upper threshold level $\bar{\theta}$ and the lower threshold level $\underline{\theta}$ are determined from the system of F.O.C. equations for the firm's maximization problem (6)-(8).

The expected profit of the firm is:

$$\pi_{\{s\neq 0\}} = \frac{-v(3\underline{\theta}^2\bar{\theta} + 1 - \bar{\theta}^3)}{3\underline{\theta}^2\bar{\theta} + 1 - \bar{\theta}^3 - 6\underline{\theta}\bar{\theta} + 3\bar{\theta}^2} + (R_H - R_L)(\underline{\theta}\bar{\theta} - \underline{\theta}^2 + \frac{1}{2} - \frac{\bar{\theta}^2}{2}) + R_L(1 - \underline{\theta}) \tag{11}$$

Table 1 summarizes three numerical examples.

First, I consider the following values of parameters R_H, R_L, and v: $R_H = 7$, $R_L = -3$, and $v = 2$. The expected profit under the zero-severance contract is $\pi_0 = 0.225$ which is

Table 1: **Three Types of Optimal Contracts**

Project's parameters	Zero-severance contract	Intermediate-severance contract	Full-severance contract
$R_H = 7$ $R_L = -3$ $v = 2$	$\underline{\theta} = 0.15$ $\bar{\theta} = 0.3$ $s_0 = 0$ $w_0 = 6\theta$ $\pi_0 = \mathbf{0.225}$	n/a	$\underline{\theta} = 0.13$ $\bar{\theta} = 0.13$ $s_{full} = 0.106$ $w_{full} = 6.3\theta$ $\pi_{full} = 0.199$
$R_H = 7$ $R_L = -3$ $v = 1.55$	$\underline{\theta} = 0.15$ $\bar{\theta} = 0.3$ $s_0 = 0$ $w_0 = 4.6\theta$ $\pi_0 = 0.675$	$\underline{\theta} = 0.149$ $\bar{\theta} = 0.244$ $s_{inter} = 0.065$ $w_{inter} = 4.8\theta$ $\pi_{inter} = \mathbf{0.677}$	$\underline{\theta} = 0.146$ $\bar{\theta} = 0.146$ $s_{full} = 0.104$ $w_{full} = 4.9\theta$ $\pi_{full} = 0.676$
$R_H = 7$ $R_L = -3$ $v = 1$	$\underline{\theta} = 0.15$ $\bar{\theta} = 0.3$ $s_0 = 0$ $w_0 = 3\theta$ $\pi_0 = 1.225$	n/a	$\underline{\theta} = 0.17$ $\bar{\theta} = 0.17$ $s_{full} = 0.096$ $w_{full} = 3.3\theta$ $\pi_{full} = \mathbf{1.272}$

higher than the expected profit under the full-severance contract $\pi_{full} = 0.199$[18]. Therefore, the zero-severance contract is optimal.

Next, I assign the same values for $R_H = 7$ and $R_L = -3$. However, I consider a slightly lower value of $v = 1.55$. For these parameters the expected profit under the zero-severance contract is $\pi_0 = 0.675$, under the intermediate-severance contract the expected profit is $\pi_{inter} = 0.677$, and under the full-severance contract the expected profit is $\pi_{full} = 0.676$. Hence, the intermediate-severance contract is optimal.

Finally, while keeping the values for R_H and R_L the same as before, I let v be lower than it was in the previous two examples. Specifically, I assume that $v = 1$. For considered parameters the full-severance contract is optimal since the expected profit under this contract is $\pi_{full} = 1.272$, which is higher than expected profit under the zero-severance contract of $\pi_0 = 1.225$.

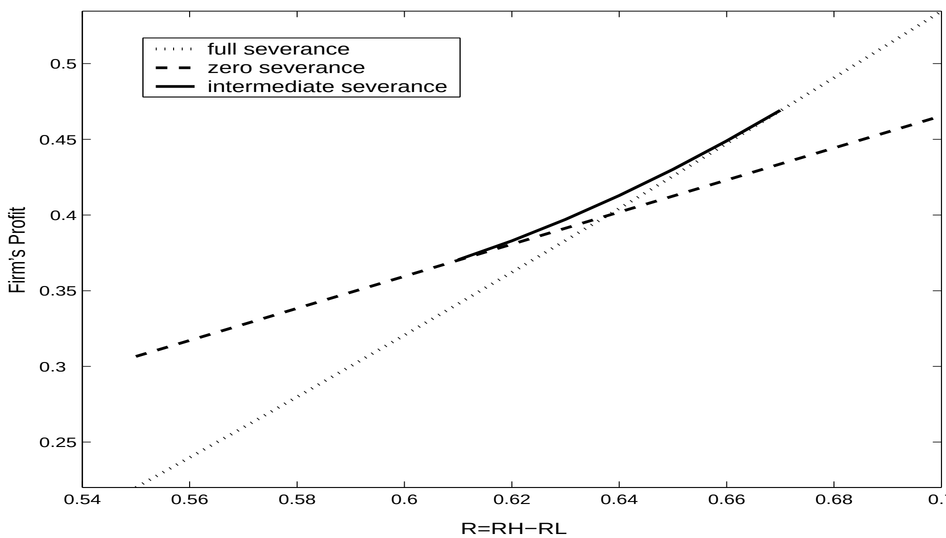
In further analysis I examine how a project's size is related to the firm's expected profit under three possible contracts: with zero, full, and intermediate severance. First, I introduce a variable $R = R_H - R_L$ which captures the project's size. So, the larger the potential gain

[18]For these parameters the only appropriate solution for the system of F.O.C. equations for the firm's maximization problem (6)-(8) is $\underline{\theta} = \bar{\theta}$; i.e., the solution $\underline{\theta} < \bar{\theta}$ corresponding to the intermediate-severance case does not arise for these parameters. By appropriate solution I mean a real value solution such that: $\bar{\theta} \in [0, 1]$ & $\underline{\theta} \in [\frac{k}{1+k}\bar{\theta}, \bar{\theta}]$.

R_H or loss R_L, or both, the larger is the project. In addition, I define the riskiness of the project, ρ, where $\rho = -R_L/R$, so $\rho \in [0, 1]$. This means that a higher ratio of potential loss from the project constitutes more risk.

Fig. 3 depicts how the firm's profit depends on the project's size for a given cost of managerial effort $v = 1$ and the riskiness of the project $\rho = 0.3$.

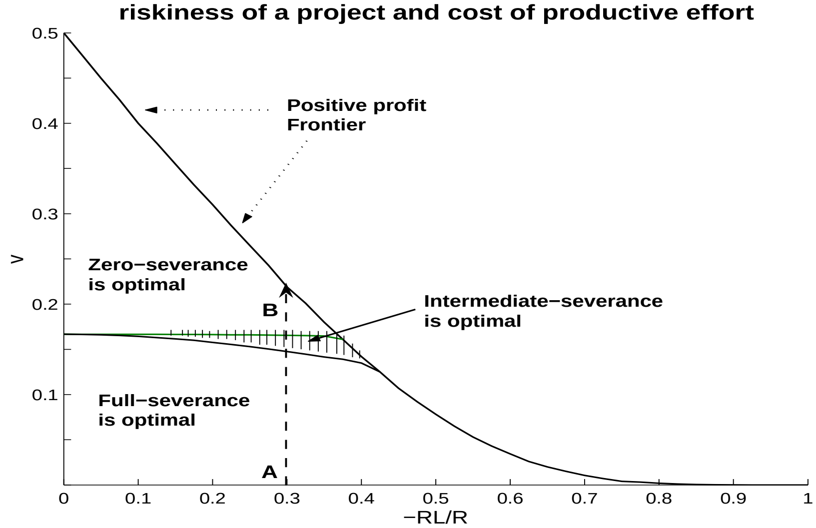
Fig.3 Firm's profit as a function of the project's size



As shown in Fig. 3, a zero-severance contract is optimal for small projects. So, when the managerial cost of effort is relatively high compared to the project's size, it is too expensive for the firm to propose a positive severance to the manager. However, when the project is large compared to the managerial cost of effort, the full-severance contract is optimal. This happens because, if the firm did not offer the full severance, the manager would engage in real earnings management, which would result in significant value-destruction for large projects. Finally, intermediate severance is optimal when the managerial cost of effort is neither too high nor too low in relation to the project's size.

Next, I explore how the optimal contract depends on the riskiness of the project for a given project's size $R = R_H - R_L = 1$. As shown in Fig. 4, if the project is very risky (i.e. $\rho \in [0.4, 1]$), the firm undertakes the project only if the cost of the manager's effort v is low relative to the project's size R. The only optimal contract for this range is the full-severance contract since early warning is critical to avoid probable losses. However, as the riskiness of the project decreases, any one of the three contract types could be optimal. For example, if the proportion of potential loss to potential gain is $0.3 : 0.7$ (line $A \rightarrow B$ on the the graph) for low $v \in [0, 0.14]$ the full-severance contract is optimal; for intermediate $v \in (0.14, 0.16)$ the intermediate-severance contract is optimal; for large $v \in [0.16, 0.219]$ the zero-severance contract is optimal; and if $v > 0.219$ the firm's expected return is negative. It is clear from Fig.4 that firms with low v always prefer full-severance contracts, and they are able to undertake a broad range of risky projects; i.e., $\rho \in [0, 1)$. Firms with high v prefer zero-severance contracts, although they are able to undertake only reasonably safe projects.

Fig.4 Optimal contracts for different levels of riskiness of a project and cost of productive effort



5 Empirical Implications

By examining the linear cost of misreporting, I have shown here that all three scenarios - zero, intermediate, and full severance - are supported in equilibrium. Which contract a firm chooses as optimal depends on the ratio of the project's size, $R = R_H - R_L$, to the cost of the manager's high effort, v. For the same values of R_H and R_L, a firm with a low v prefers the full-severance contract, while a firm with a high relative value of v chooses the zero-severance contract, therefore allowing for real earnings management, but saving substantially on severance pay. I classify a firm as large(small) if the project's size is high(low) relative to the cost of the manager's productive effort. So, the larger the potential gain R_H or loss R_L, or both, relative to the cost of the manager's high effort, the larger the firm. Therefore, one of my empirical predictions is that severance pay is included in the contracts offered to managers of large firms, while I do not expect the managerial contracts of many small firms to offer severance pay. This also implies that managers of large firms are fired more often than managers of small firms because they report bad news more frequently. A recent empirical study by Rusticus [2006] on executive severance agreements provides evidence consistent with my predictions. He shows that one of the main factors driving the size of the severance package is firm size, and that higher severance amounts are associated with more managerial turnover.

Next, my model predicts that discontinuity in the earnings report is more pronounced for small firms than for large firms. Since large firms propose higher severance than small firms, and given that the severance payment effectively precludes earnings management, managers of small firms manage earnings to reach the threshold more often than managers of large firms. Empirical evidence supports my prediction. Xue [2003] and Roychowdhury [2006] document a negative correlation between firm size and an attempt to avoid small negative earnings.

Another prediction of my model, consistent with empirical evidence[19], is that firms reporting earnings just above the threshold, in the followingt period will underperform firms reporting earnings below the threshold. The future underperformance of firms reporting earnings just above the threshold is attributed to overinvestment and earnings management. However, I predict that the level of underperformance is negatively correlated with a firm's size since large firms are less exposed to real earnings management.

An additional interesting implication of my model is the result that the expected overall payment to the manager of a large firm is *endogenously* higher than the expected overall payment to the manager of a small firm. To explain this, let us consider two identical managers with the same cost of effort v, but one of them works for a large firm (the relative value of v is low compared to R_H and R_L), and the other works for a small firm (the relative value of v is high). Then, in expectation, a small firm's manager gets only his reservation utility, since his contract does not include severance pay; and a large firm's manager, in expectation, obtains a surplus proportional to severance pay in addition to his reservation utility, simply because he works for a large firm.

Finally, a broader interpretation of the firm's decision to continue or to terminate a single project would be whether it plans to continue its current business strategy if the company is doing well, or to change that strategy if the company's performance is poor. So, even though I focused my model on a single project selection decision, it is applicable more broadly where the firm is facing a decision about its prospective business strategy. My model is also applicable to a setting in which a manager is fired only with some probability or is not fired but is still forced to change the business strategy if his report reveals low performance.

6 Conclusion

Timely access to accurate accounting information is important to strategic decision makers. Thus, the early warning that comes with a low earnings report could prevent a company from future losses if it made timely changes in its corporate strategy. A manager of a company often possesses this valuable information. However, managerial incentives may

[19]See Degeorge, Patel and Zeckhauser [1999], or Gunny [2005].

not be well aligned with the shareholders', leading the manager to provide incomplete or even inaccurate information, especially when that information is unfavorable.

This paper studies the association between managerial incentives and discontinuity in earnings reports in the context of the agency model. I examine the design of optimal incentive contracts when the manager has a private signal about the firm's expected cash flow. After privately observing earning for the current period, the manager can decide to engage in real earnings management and undertake actions that are not economically optimal for the company in order to boost current period earnings. The "cost" of these actions is a reduction in expected cash flow. The only way to prevent the manager from engaging in value-destroying earnings management is to offer him severance pay if he reports low earnings, even though such a payment undermines managerial incentives.

A number of results emerge from the model. First, it is determined that any optimal contract leads to managerial turnover and to the liquidation of an unprofitable project if the firm's performance is low. Next, any optimal contract leads to overinvestment. The firm decides to continue some negative net present value projects since this helps reduce the manager's informational rent. Furthermore, an optimal incentive contract is structured so that for a strictly convex and differentiable cost of misreporting, the manager always engages in earnings management and discontinuity in the earnings report arises endogenously under any optimal contract.

Finally, I present the closed-form solution for optimal contracts if the cost of misreporting is linear. It is shown that for large projects the optimal contract offers full severance, which precludes any earnings management. The earnings report is smooth in this case. However, for small projects, the optimal contract consists of intermediate, or even zero, severance. Under the intermediate- or zero-severance contracts, the manager truthfully reports low and high earnings, but he manages earnings if they fall below the equilibrium threshold level in order to just reach the threshold. These results are in line with empirical studies on discontinuity in earnings and executive severance agreements.

While severance agreements have received substantial recent attention and criticism from institutional investors and the business press[20], the paper provides analytical support for the necessity of severance pay not only as a way to encourage early warnings, but also as an instrument to prevent value-destroying earnings management.

[20]The US Council for Institutional Investors argues that no severance should be paid in the event of termination or poor performance. In Europe, the United Kingdom's Department of Trade and Industry proposes to curtail severance pay in the UK (UK DTI(2003)).

Appendix

PROOF **of Lemma 1**

1. $w_L = 0$. Since the manager is risk-neutral, it is optimal to set the manager's wage in the bad state to the lowest level that preserves his limited liability.
2. $s(\theta) = constant$ on the set of all cancelled projects. To show this let us consider two different levels of real earnings, θ_1 and θ_2, such that $\theta_1 < \theta_2$. If $s(\theta_1) < s(\theta_2)$ then the manager would choose to report θ_2 instead of θ_1 since such misreporting is costless for him given that, *ex post*, there is no way of knowing what would have occurred had the project not been cancelled.
3. The uniqueness of the equilibrium threshold level $\bar{\theta}$.

Consider any contract with a threshold level $\hat{\theta}_2 = \hat{\theta}(\theta_2)$. Suppose $\exists\ \hat{\theta}_1 = \hat{\theta}(\theta_1) < \hat{\theta}_2$ such that the project is not cancelled at that point. Then

$$s = w(\hat{\theta}_2)(\theta_2 - C(\hat{\theta}_2 - \theta_2)) \geq w(\hat{\theta}_1)(\theta_2 - C(\hat{\theta}_1 - \theta_2)) \geq w(\hat{\theta}_1)(\theta_1 - C(\hat{\theta}_1 - \theta_1)) \tag{12}$$

The first equality is determined from truth-telling if $\theta = \theta_2$ since at the cutoff point the manager is indifferent between reporting the truth and getting s and reporting $\hat{\theta}_2$ and continuing the project. The second inequality holds because $\hat{\theta}_2$ is the manager's optimal reporting strategy given θ_2, so if his reporting deviates from the optimal his expected payment is lower (recall that $\hat{\theta}_1$ is the optimal reporting strategy given θ_1). The third inequality follows from $\theta_1 < \theta_2$[21]. Consider replacing the original contract with a new contract under which the project is cancelled at $\hat{\theta}_1$ and the manager gets s. The new contract is feasible and maintains the same expected wage payment as the original contract. Proposition 1 will show that the optimal cutoff level is always below the first best cutoff θ^0, i.e. $\hat{\theta}_2 \leq \theta^0$, and, therefore, $\hat{\theta}_1 < \theta^0$. By cancelling the project at $\hat{\theta}_1$, the firm cancels a negative NPV project and therefore increases the expected payoff. ∎

PROOF **of Lemma 2**

Let us consider any initial contract with no cancellation specified by some initial wage $w^0(\hat{\theta})$ satisfying the incentive compatibility constraint (2). By Lemma 1, it is always optimal to set $w_L^0(\hat{\theta}) = 0$. Since there is no cancellation and all projects are undertaken, there is no

[21]Here I use the monotonicity of reporting, i.e., $\theta_1 < \theta_2 \Longleftrightarrow \hat{\theta}_1 \leq \hat{\theta}_2$. To prove this suppose that the contrary is true: $\theta_1 < \theta_2$, but $\hat{\theta}_1 > \hat{\theta}_2$. First, notice that decreasing wage is not rationalizable, i.e. if $\hat{\theta}_1 > \hat{\theta}_2$ then $w(\hat{\theta}_1) > w(\hat{\theta}_2)$. Since deviation from the equilibrium strategy is never optimal I have the following two inequalities: $w(\hat{\theta}_1)(\theta_1 - C(\hat{\theta}_1 - \theta_1)) \geq w(\hat{\theta}_2)(\theta_1 - C(\hat{\theta}_2 - \theta_1))$ and $w(\hat{\theta}_2)(\theta_2 - C(\hat{\theta}_2 - \theta_2)) \geq w(\hat{\theta}_1)(\theta_2 - C(\hat{\theta}_1 - \theta_2))$. Combining these two inequalities and using the assumption that $w(\hat{\theta}_2) < w(\hat{\theta}_1)$ I have $w(\hat{\theta}_1)[\theta_2 - \theta_1 + C(\hat{\theta}_1 - \theta_1) - C(\hat{\theta}_1 - \theta_2)] \leq w(\hat{\theta}_2)[\theta_2 - \theta_1 + C(\hat{\theta}_2 - \theta_1) - C(\hat{\theta}_2 - \theta_2)] < w(\hat{\theta}_1)[\theta_2 - \theta_1 + C(\hat{\theta}_2 - \theta_1) - C(\hat{\theta}_2 - \theta_2)] \Longrightarrow C(\hat{\theta}_1 - \theta_1) - C(\hat{\theta}_2 - \theta_1) < C(\hat{\theta}_1 - \theta_2) - C(\hat{\theta}_2 - \theta_2)$. The last inequality contradicts the convexity of the cost function, given that $\theta_1 < \theta_2 \leq \hat{\theta}_2 < \hat{\theta}_1$.

need for a firm to offer severance pay. Assuming cancellation is possible, I shall show that the initial contract is strictly dominated by a new contract that allows cancellation on a set of positive measure. Consider a class of contracts such that the cutoff level $\underline{\theta}$ is greater than zero. For any $\theta < \underline{\theta}$ the project is cancelled and the manager gets the severance pay $s^N = w^N(\hat{\theta}(\underline{\theta})) \cdot (\underline{\theta} - C(\underline{\delta}))$. For any $\theta \geq \underline{\theta}$ the project continues and the manager gets wages $w^N(\hat{\theta}) = w^0(\hat{\theta}) \cdot \alpha$ and $w_L^N(\hat{\theta}) = 0$, where α is a constant determined from the binding incentive constraint. From the manager's maximization problem it is easy to see that if the new wage equals the initial wage multiplied by a constant then the manager would choose the same level of earnings management under both pay schedules for any $\theta \geq \underline{\theta}$. Calculating a constant α from the incentive constraint (2), I have the following payment structure for the new contract

$$s^N = w^0(\hat{\theta}(\underline{\theta}))(\underline{\theta} - C(\underline{\delta})) \cdot \frac{v}{\int_{\underline{\theta}}^1 [w^0(\hat{\theta}(\theta))(\theta - C(\delta)) - w^0(\hat{\theta}(\underline{\theta}))(\underline{\theta} - C(\underline{\delta}))](f_H - f_L) d\theta} \quad (13)$$

$$w^N(\hat{\theta}(\theta)) = w^0(\hat{\theta}(\theta)) \cdot \frac{v}{\int_{\underline{\theta}}^1 [w^0(\hat{\theta}(\theta))(\theta - C(\delta)) - w^0(\hat{\theta}(\underline{\theta}))(\underline{\theta} - C(\underline{\delta}))](f_H - f_L) d\theta} \quad (14)$$

Denoting the firm's expected net profit under the new contract by $\pi^N(\underline{\theta})$ I have

$$\pi^N(\underline{\theta}) = \int_{\underline{\theta}}^1 [(R_H - R_L)(\theta - C(\delta)) + R_L] f_H d\theta - \frac{v \cdot w^0(\hat{\theta}(\underline{\theta})(\underline{\theta} - C(\underline{\delta})) \int_0^{\underline{\theta}} f_H d\theta}{\int_{\underline{\theta}}^1 [w^0(\hat{\theta}(\theta))(\theta - C(\delta)) - w^0(\hat{\theta}(\underline{\theta}))(\underline{\theta} - C(\underline{\delta}))](f_H - f_L) d\theta} - \frac{v \cdot \int_{\underline{\theta}}^1 w^0(\hat{\theta}(\theta)(\theta - C(\delta)) f_H d\theta}{\int_{\underline{\theta}}^1 [w^0(\hat{\theta}(\theta))(\theta - C(\delta)) - w^0(\hat{\theta}(\underline{\theta}))(\underline{\theta} - C(\underline{\delta}))](f_H - f_L) d\theta} \quad (15)$$

Differentiating the expected net profit with respect to the cutoff level $\underline{\theta}$ and using the first-order stochastic dominance properties of the distribution functions, i.e., $F_L(\theta) > F_H(\theta)$ for $\forall\ \theta \in (0,1)$, I have

$$\frac{\partial \pi^N(\underline{\theta})}{\partial \underline{\theta}}|_{\underline{\theta}=0} = -R_L \cdot f_H(\underline{\theta}) - o(\underline{\theta}) > 0 \quad (16)$$

Note that setting $\underline{\theta} = 0$ gives the initial contract. Hence there exists a $\underline{\theta}$-cutoff contract that strictly improves on the initial contract at least in some neighborhood of zero. ∎

Proof **of Proposition 1**

I will prove Proposition 1 in two steps. First, I will show that it is always optimal to undertake all positive NPV projects. Next, I will prove that it is optimal to continue some negative NPV projects as well.

Step 1. Let us consider any feasible initial contract $[w^0(\hat{\theta}), s^0, \underline{\theta}]$, such that $\underline{\theta} > \theta^0$, where θ^0 stands for the first best cutoff level. Such a contract cancels some positive NPV projects, i.e. projects from the interval $[\theta^0, \underline{\theta})$. From the condition (4) it follows that the severance pay under the initial contract is $s^0 = w^0(\hat{\theta}(\underline{\theta}))(\underline{\theta} - C(\delta(\underline{\theta})))$. I construct a modified contract such that all positive NPV projects are undertaken under that contract, i.e., a modified cutoff level coincides with the first best level: $\underline{\theta}^N = \theta^0$. I define a modified wage structure in the following way:

1. $w^N(\hat{\theta}(\theta)) = w^0(\hat{\theta}(\theta))$ for any $\theta \in [\underline{\theta}, 1]$
2. $w^N = s^0/\underline{\theta} = const$ for any $\theta \in [\theta^0, \underline{\theta}]$
3. $s^N = w^N \cdot \theta^0$ for any $\theta \in [0, \theta^0]$

The modified contract is feasible. It satisfies the condition (4) and the non-negativity constraint (5) by construction. I will show that it also satisfies the incentive constraint (2):

$$\begin{aligned} s^N \int_0^{\theta^0} (f_H - f_L) d\theta + w^N \int_{\theta^0}^{\underline{\theta}} \theta (f_H - f_L) d\theta + \int_{\underline{\theta}}^1 w^0(\hat{\theta}(\theta))(\theta - C(\delta))(f_H - f_L) d\theta = \\ \frac{s^0 \theta^0}{\underline{\theta}} \int_0^{\theta^0} (f_H - f_L) d\theta + \frac{s^0}{\underline{\theta}} \int_{\theta^0}^{\underline{\theta}} \theta (f_H - f_L) d\theta - s^0 \int_0^{\underline{\theta}} (f_H - f_L) d\theta + v = \\ \int_0^{\theta^0} s^0 \frac{\theta^0 - \underline{\theta}}{\underline{\theta}} (f_H - f_L) d\theta + \int_{\theta^0}^{\underline{\theta}} s^0 \frac{\theta - \underline{\theta}}{\underline{\theta}} (f_H - f_L) d\theta + v = \\ \int_0^{\underline{\theta}} s^0 \cdot max\{\frac{\theta^0 - \underline{\theta}}{\underline{\theta}}, \frac{\theta - \underline{\theta}}{\underline{\theta}}\} (f_H - f_L) d\theta + v \geq v \end{aligned} \tag{17}$$

While proving that the modified contract satisfies the incentive constraint I used the feasibility of the initial contract, the first-order stochastic dominance of F_H over F_L, and the observation that $max\{\frac{\theta^0 - \underline{\theta}}{\underline{\theta}}, \frac{\theta - \underline{\theta}}{\underline{\theta}}\}$ is a non-decreasing function. So, integrating by parts the integral in the last line allows us to conclude that the value of that integral is non-negative, and therefore the modified contract satisfies the incentive constraint.

It is a straightforward exercise to show that the expected payoff under the modified contract, π^N, is higher than under the initial contract π^0.

$$\pi^N - \pi^0 = \int_{\theta^0}^{\underline{\theta}} (R_H \theta + R_L(1 - \theta)) f_H d\theta + s^0 \int_0^{\theta^0} \frac{\underline{\theta} - \theta^0}{\underline{\theta}} f_H d\theta + s^0 \int_{\theta^0}^{\underline{\theta}} \frac{\underline{\theta} - \theta}{\underline{\theta}} f_H d\theta > 0 \tag{18}$$

Step 2. I will prove now that any contract that cancels all negative NPV projects is dominated by a contract that continues some negative NPV projects. To show this I will modify a feasible initial contract $[s^0, w^0(\hat{\theta}(\theta)), \theta^0]$ with a cutoff level at the first-best point θ^0 to allow some negative NPV projects to continue to completion. I define a modified wage structure in the following way:

1. $w^N(\hat{\theta}(\theta)) = w^0(\hat{\theta}(\theta))$ for any $\theta \in [\theta^0, 1]$

2. $w^N = s^0/\theta^0 = const$ for any $\theta \in [\underline{\theta}, \theta^0]$

3. $s^N = w^N \cdot \underline{\theta}$ for any $\theta \in [0, \underline{\theta}]$

By analogy with the Step 1 procedure, it could be shown that the modified contract is incentive compatible. The last step is to prove that the modified contract brings a higher expected payoff to the firm than the initial one, at least for some small deviation from the first-best cutoff level.

Let us consider the following value for the modified cutoff level: $\underline{\theta} = \theta^0 - \epsilon$. Then the difference between the expected payoffs from the new and the initial contracts is computed and estimated as:

$$\pi^N - \pi^0 = \int_{\theta^0-\epsilon}^{\theta^0} (R_H\theta + R_L(1-\theta)) f_H d\theta + s^0 \int_0^{\theta^0-\epsilon} \frac{\epsilon}{\theta^0} f_H d\theta + s^0 \int_{\theta^0-\epsilon}^{\theta^0} f_H d\theta - \frac{s^0}{\theta^0} \int_{\theta^0-\epsilon}^{\theta^0} \theta f_H d\theta > 0 \tag{19}$$

The first term in the equation (19) is negative of the order ϵ^2, the second term is positive of the order ϵ, the difference between the third and the fourth terms is positive of the order ϵ^2. So, I have shown that $\pi^N > \pi^0$, and therefore a contract that continues all positive and some negative NPV projects, dominates any contract that cancels all negative NPV projects. ∎

PROOF **of Proposition 2**

Denote the manager's expected payment as a function of reported and unmanaged earnings $U(\hat{\theta}, \theta) := w(\hat{\theta})(\theta - C(\hat{\theta} - \theta))$. The manager chooses his reporting strategy to maximize his expected payment. The first-order condition $\partial U(\hat{\theta}, \theta)/\partial \hat{\theta} = 0$ implies:

$$\partial w(\hat{\theta})/\partial \hat{\theta} = w(\hat{\theta}) \frac{\partial C(\hat{\theta} - \theta)/\partial \hat{\theta}}{\theta - C(\hat{\theta} - \theta)} \tag{20}$$

Let us consider the condition under which the manager always chooses truthful reporting. From (20) for truthful reporting $\hat{\theta} = \theta$ I have $\partial w(\hat{\theta})/\partial \hat{\theta}|_{\hat{\theta}=\theta} = 0$ since $C'(0) = 0$. This means that the manager decides to always report truthfully only if his wage does not depend on his reporting – that is, only if the wage is constant.

Take an initial contract without earnings management with an optimal constant wage w^0. Fix the initial cutoff level $\underline{\theta}$. Severance pay in such a contract is $s^0 = w^0 \underline{\theta}$. Consider a new contract with the same cutoff level $\underline{\theta}$ and a new wage $w^N(\hat{\theta}) = w^0 - \frac{1-\hat{\theta}}{\hat{\theta}}\epsilon$, where ϵ is small and positive. Severance pay under the new contract is $s^N = w^N(\hat{\theta}(\underline{\theta}))(\underline{\theta} - C(\underline{\delta}))$.

First, let us estimate the level of earnings management $\delta(\epsilon)$ under the new contract. Substituting $w^N(\hat{\theta})$ into the first order condition (20) we obtain:

$$\frac{\epsilon}{\hat{\theta}^2}(\hat{\theta} - \delta - C(\delta)) = (w^0 - \frac{1-\hat{\theta}}{\hat{\theta}}\epsilon) C'(\delta) \tag{21}$$

An implicit function differentiation of (21) with respect to ϵ and δ gives us the following expression:

$$[\frac{\hat{\theta}-\delta-C(\delta)}{\hat{\theta}^2}+\frac{1-\hat{\theta}}{\hat{\theta}}C'(\delta))]d\epsilon=[\frac{\epsilon}{\hat{\theta}^2}(1+C'(\delta))+(w^0-\frac{1-\hat{\theta}}{\hat{\theta}}\epsilon)C''(\delta)]d\delta \tag{22}$$

When $\delta \to 0$ and $\epsilon \to 0$ (recall that $C(0)=0$ and $C'(0)=0$) I have:

$$\frac{d\delta}{d\epsilon}|_{\delta=0,\epsilon=0}=\frac{\hat{\theta}-\delta-C(\delta)+\hat{\theta}(1-\hat{\theta})C'(\delta)}{\epsilon(1+C'(\delta))+[w^0\hat{\theta}^2-\hat{\theta}(1-\hat{\theta})\epsilon]C''(\delta)}|_{\delta=0,\epsilon=0}=\frac{1}{w^0\hat{\theta}C''(0)} \tag{23}$$

The Taylor expansion for $\delta(\epsilon)$ around $\epsilon=0$ gives:

$$\delta(\epsilon)=\delta(0)+\delta'(0)\epsilon+o(\epsilon)\Longrightarrow\delta(\epsilon)=\epsilon\frac{1}{w^0\hat{\theta}C''(0)}+o(\epsilon) \tag{24}$$

In the last expression I used the result proven before that if the wage is constant there is no earnings management, so if $\epsilon=0$ then $\delta=0$. So, I have shown that $\delta(\epsilon)\sim\epsilon$.

Next, I demonstrate that the new contract is feasible. It satisfies the condition on severance pay (4) and the non-negativity constraint (5) by construction. I will show that it also satisfies the incentive constraint (2).

$$\begin{aligned}
s^N\int_0^{\underline{\theta}}(f_H-f_L)d\theta+\int_{\underline{\theta}}^1 w^N(\hat{\theta})(\theta-C(\delta))(f_H-f_L)d\theta=\\
v+\int_{\underline{\theta}}^1(\frac{1-\underline{\hat{\theta}}}{\underline{\hat{\theta}}}\epsilon(\underline{\theta}-C(\underline{\delta}))+w^0C(\underline{\delta})-\frac{1-\hat{\theta}}{\hat{\theta}}\epsilon(\theta-C(\delta))-w^0C(\delta))(f_H-f_L)d\theta\approx\\
v+\int_{\underline{\theta}}^1(\frac{1-\underline{\hat{\theta}}}{\underline{\hat{\theta}}}\underline{\theta}-\frac{1-\hat{\theta}}{\hat{\theta}}\theta)\epsilon(f_H-f_L)d\theta=v+\int_{\underline{\theta}}^1(\frac{1-\underline{\theta}-\underline{\delta}}{\underline{\theta}+\underline{\delta}}\underline{\theta}-\frac{1-\theta-\delta}{\theta+\delta}\theta)\epsilon(f_H-f_L)d\theta=\\
v+\int_{\underline{\theta}}^1((1-\underline{\theta}-\underline{\delta})\epsilon-\frac{1-\underline{\theta}-\underline{\delta}}{\underline{\theta}+\underline{\delta}}\underline{\delta}\epsilon-(1-\theta-\delta)\epsilon+\frac{1-\theta-\delta}{\theta+\delta}\delta\epsilon)(f_H-f_L)d\theta\approx\\
v+\int_{\underline{\theta}}^1[(1-\underline{\theta})-(1-\theta)]\epsilon(f_H-f_L)d\theta=v+\epsilon\int_{\underline{\theta}}^1(\theta-\underline{\theta})(f_H-f_L)d\theta>v
\end{aligned} \tag{25}$$

The first equality holds since an initial contract was feasible. The second approximate equality follows since the Taylor expansion for the cost function gives $C(\delta)=C(0)+C'(0)\delta+C''(0)\delta^2+o(\delta^2)=C''(0)\delta^2+o(\delta^2)\sim\epsilon^2$, and I disregard the second-order terms of ϵ. The fourth approximate equality follows as $\delta\cdot\epsilon\sim\epsilon^2$ since, as was proven at the beginning, $\delta\sim\epsilon$. The last inequality follows from the f.o.s.d. of F_H over F_L, and the fact that the function under the integral, $(\theta-\underline{\theta})$, is positive and increasing. So, integration by parts gives us the result that the value of the integral is positive and of order ϵ.

The final step of the proof is to show that the firm's expected payoff under the new contract is higher than under the initial contract. Let us consider the difference between the new and the old expected payoffs:

$$\pi^N - \pi^0 = \int_0^{\underline{\theta}} (s^0 - s) f_H d\theta +$$

$$\int_{\underline{\theta}}^1 [(R_H - w^N(\hat{\theta}))(\theta - C(\delta)) + R_L(1 - \theta + C(\delta)) - (R_H - w^0)\theta - R_L(1-\theta)] f_H d\theta =$$

$$\int_0^{\underline{\theta}} (w^0 C(\underline{\delta}) + \frac{1-\hat{\theta}}{\underline{\hat{\theta}}}\epsilon(\underline{\theta} - C(\underline{\delta}))) f_H d\theta +$$

$$\int_{\underline{\theta}}^1 [\frac{1-\hat{\theta}}{\hat{\theta}}\epsilon(\theta - C(\delta)) - (R_H - R_L - w^0)C(\delta)] f_H d\theta \approx$$

$$\int_0^{\underline{\theta}} \frac{1-\hat{\underline{\theta}}}{\hat{\underline{\theta}}}\underline{\theta}\epsilon f_H d\theta + \int_{\underline{\theta}}^1 \frac{1-\hat{\theta}}{\hat{\theta}}\theta\epsilon f_H d\theta \approx \int_0^{\underline{\theta}} (1-\underline{\theta})\epsilon f_H d\theta + \int_{\underline{\theta}}^1 (1-\theta)\epsilon f_H d\theta = \alpha\epsilon > 0, \quad (26)$$

where α is some positive constant. In (26), while estimating the sign of $\pi^N - \pi^0$, I disregarded terms with $C(\delta)$ and $\delta \cdot \epsilon$ since they are second order of ϵ. The last sum of two integrals is of the order ϵ and positive since the functions under the integrals are positive. Therefore, I have proven that the new contract that allows for some earnings management dominates the initial contract that does not allow for any earnings management. ∎

PROOF **of Proposition 3**

Let us formulate the firm's maximization problem (1)-(5) in terms of the manager's expected payment $u(\theta) := w(\hat{\theta}(\theta))(\theta - C(\hat{\theta}(\theta) - \theta))$ and show that the optimal level of misreporting at the cutoff point $\underline{\theta}$ is greater than zero: i.e., $\delta(\underline{\theta}) > 0$. The firm's problem can be written as:

$$\max_{u(\theta),\delta(\theta),\underline{\theta}} -u(\underline{\theta}) \int_0^{\underline{\theta}} f_H d\theta + \int_{\underline{\theta}}^1 [(R_H - R_L)(\theta - C(\delta)) + R_L - u(\theta)] f_H d\theta \quad (27)$$

subject to

$$u(\underline{\theta}) \int_0^{\underline{\theta}} (f_H - f_L) d\theta + \int_{\underline{\theta}}^1 u(\theta)(f_H - f_L) d\theta \geq v \quad (28)$$

$$\frac{du(\theta)}{d\theta} = u(\theta)\frac{1 + C'(\delta)}{\theta - C(\delta)} \quad (29)$$

$$u(\theta) \geq 0 \quad \forall\, \theta \quad (30)$$

I treat δ as the control variable, u as the state variable, and $\underline{\theta}$ as the free initial point. The Lagrangian for this problem is given by

$$\mathcal{L} := \int_{\underline{\theta}}^1 \lambda_0[(R_H - R_L)(\theta - C(\delta)) + R_L - u(\theta)] f_H + \lambda_1 u(\theta)(f_H - f_L) -$$

$$p(\theta)[\frac{du(\theta)}{d\theta} - u(\theta)\frac{1 + C'(\delta)}{\theta - C(\delta)}]d\theta - \lambda_0 u(\underline{\theta})F_H(\underline{\theta}) + \lambda_1 u(\underline{\theta})[F_H(\underline{\theta}) - F_L(\underline{\theta})] - \lambda_1 v + \lambda_2 u(\underline{\theta}) \quad (31)$$

where $p(\theta)$ is a costate variable, and λ_0, λ_1 and λ_2 are non-negative multipliers for the incentive and non-negativity constraints, respectively.

To solve the problem I make use of the Pontryagin Principle[22] for an optimal control problem. The first condition is the maximization of the Lagrangian with respect to δ:

$$\max_{\delta} \{\lambda_0[(R_H - R_L)(\theta - C(\delta)) + R_L - u(\theta)]f_H + \lambda_1 u(\theta)(f_H - f_L) + p(\theta)u(\theta)\frac{1 + C'(\delta)}{\theta - C(\delta)}\} \quad (32)$$

The other conditions are:

1. Costate equation:

$$\dot{p}(\theta) = -p(\theta)\frac{1 + C'(\theta)}{\theta - C(\theta)} + \lambda_0 f_H - \lambda_1(f_H - f_L) - \lambda_2 \quad for\ any \quad \theta \in [\underline{\theta}; 1] \quad (33)$$

2. Transversality conditions:

$$p(\underline{\theta}) = \lambda_0 F_H(\underline{\theta}) - \lambda_1[F_H(\underline{\theta}) - F_L(\underline{\theta})] - \lambda_2 \quad (34)$$

$$p(1) = 0 \quad (35)$$

3. Stationarity for $\underline{\theta}$:

$$\lambda_0[(R_H - R_L)(\underline{\theta} - C(\underline{\delta})) + R_L]f_H(\underline{\theta}) + [\lambda_0 F_H(\underline{\theta}) - \lambda_1(F_H(\underline{\theta}) - F_L(\underline{\theta})) - \lambda_2]\dot{u}(\underline{\theta}) = 0 \quad (36)$$

4. Complementary slackness:

$$\lambda_1[u(\underline{\theta})(F_H(\underline{\theta}) - F_L(\underline{\theta})) + \int_{\underline{\theta}}^{1} u(\theta)(f_H - f_L)d\theta - v] = 0 \quad (37)$$

$$\lambda_2 u(\underline{\theta}) = 0 \quad (38)$$

5. Nonnegativity of the Lagrange multipliers:

$$\lambda_0, \lambda_1, \lambda_2 \geq 0 \quad (39)$$

[22]For references to the Pontryagin Principle, see, for example, Fleming and Rishel [1975], or Seierstad and Sydsaeter [1987].

There are two possible cases: $\{\lambda_2 = 0, u(\underline{\theta}) > 0\}$ and $\{\lambda_2 \geq 0, u(\underline{\theta}) = 0\}$. The first case corresponds to positive severance pay, and the second case corresponds to zero severance pay. Let us start with non-zero severance pay: i.e., $\lambda_2 = 0$ and $s = u(\underline{\theta})\underline{\theta} > 0$. Then from the transversality condition (34) it follows that $p(\underline{\theta}) > 0$ since $F_H(\underline{\theta}) < F_L(\underline{\theta})$ due to f.o.s.d. In order to determine the optimal earnings management at the cutoff point $\underline{\theta}$ I take F.O.C. to the maximization problem (32) and evaluate it for $\underline{\delta} = 0$.

$$\begin{aligned}
\frac{d}{d\delta}\{\lambda_0[(R_H - R_L)(\theta - C(\delta)) + R_L - u(\theta)]f_H + \lambda_1 u(\theta)(f_H - f_L) + p(\theta)u(\theta)\frac{1 + C'(\delta)}{\theta - C(\delta)}\}|_{\underline{\delta}=0} = \\
\frac{d}{d\delta}\{-\lambda_0(R_H - R_L)C(\delta)f_H + p(\theta)u(\theta)\frac{1 + C'(\delta)}{\theta - C(\delta)}\}|_{\underline{\delta}=0} = \\
\{-\lambda_0(R_H - R_L)C'(\delta)f_H + p(\theta)u(\theta)\frac{C''(\delta)(\theta - C(\delta)) + (1 + C'(\delta))C'(\delta)}{(\theta - C(\delta))^2}\}|_{\underline{\delta}=0} = \\
p(\underline{\theta})u(\underline{\theta})\frac{C''(0)}{\underline{\theta}} > 0
\end{aligned} \tag{40}$$

Since the derivative is positive, the maximized expression will increase if $\underline{\delta}$ increases in the neighborhood of zero. Therefore, it is optimal to allow some earnings management $\underline{\delta} > 0$ at the cutoff point $\underline{\theta}$. It means that if $\theta \to \underline{\theta}$ from below the manager truthfully reports $\underline{\theta}$, and if $\theta \to \underline{\theta}$ from above the manager reports $\underline{\theta} + \underline{\delta}$, where $\underline{\delta} > 0$. So, the manager never reports anything in between, and the interval $(\underline{\theta}, \underline{\theta} + \underline{\delta})$ is an area of discontinuity in managerial reporting.

To finish the proof let us consider the zero-severance case. Denote by Θ the set of real earnings such that the wage is positive on that set. The set Θ is not empty since the wage w has to be greater than zero at some point to provide the incentive for high effort. Let θ_1 be the infinum of Θ. Define $\tilde{\theta}$ as the point for which $\tilde{\theta} - C(\hat{\theta}(\theta_1) - \tilde{\theta}) = 0$. Then for any $\theta < \tilde{\theta}$ the manager truthfully reports $\hat{\theta} = \theta$ and gets zero, and for any $\theta > \tilde{\theta}$ the manager reports at least $\hat{\theta}(\theta_1)$ and receives some positive expected payment. From the definition of the set Θ it follows that $\tilde{\theta} = \theta_1$, and from the definition of $\tilde{\theta}$ it follows that $\theta_1 - C(\hat{\theta}(\theta_1) - \theta_1) = 0$, i.e. $\hat{\theta}(\theta_1) > \theta_1$. Therefore, the discontinuity in reported earnings arises, as the manager never reports earnings from the nontrivial interval $(\theta_1, \hat{\theta}(\theta_1))$. ∎

Proof **of Proposition 4**

In order to determine the optimal earnings management at the cutoff point $\underline{\theta}$ for the linear cost, I take F.O.C. to the firm's maximization problem (32) and evaluate it for $\underline{\delta} = 0$.

$$\begin{aligned}
\frac{d}{d\delta}\{-\lambda_0(R_H - R_L)C'(\delta)f_H(\theta) + p(\theta)u(\theta)\frac{C''(\delta)(\theta - C(\delta)) + (1 + C'(\delta))C'(\delta)}{(\theta - C(\delta))^2}\}|_{\underline{\delta}=0} = \\
-\lambda_0(R_H - R_L)f_H(\underline{\theta}) + p(\underline{\theta})u(\underline{\theta})\frac{k+1}{\underline{\theta}^2}
\end{aligned} \tag{41}$$

Since $p(\underline{\theta})$ and $u(\underline{\theta})$ are positive, the sign of the expression (41) depends on the value of $(R_H - R_L)$. If $(R_H - R_L)$ is sufficiently low, the expression (41) is positive and, therefore, some earnings management is optimal. If $(R_H - R_L)$ is sufficiently high, the expression (41) is negative and no earnings management is optimal. ∎

PROOF **of Proposition 5**

I proceed with the proof of Proposition 5 in three steps.

Step 1. I will prove that costate variable $p(\theta)$ is a positive decreasing function of θ for $\forall\, \theta \in [\underline{\theta}, 1)$.

Step 2. Next, I will prove that the set $\Theta = \{\theta : \delta(\theta) = 0; \theta \geq \underline{\theta}\}$ is non-empty by showing that $\delta(1) = 0$.

Step 3. Finally, I will prove that $\delta(\theta) = \tilde{\theta} - \theta$ for $\forall\ \theta \in [\underline{\theta}, \tilde{\theta})$, where $\tilde{\theta}$ is the infinum of the set Θ. This result means that for any $\theta \in [\underline{\theta}, \tilde{\theta})$ the managerial optimal reporting strategy is to report $\hat{\theta} = \tilde{\theta}$.

Proof of Step 1.

Let us assume that $\lambda_1 < \lambda_0$. Then, from the costate equation (33) and from the transversality condition (35), it follows that $\dot{p}(1) = \lambda_0 - \lambda_1 > 0$, $p(1) = 0$, $\dot{p}(\theta) > 0$, and $\Longrightarrow p(\theta) < 0$. Therefore, $p(\theta)$ is a negative increasing function reaching its highest value (equal to zero) at the point $\theta = 1$. But the negativity of the function $p(\theta)$ contradicts the transversality condition (34) and the fact that $\lambda_0, \lambda_1 \geq 0$.

Next, I assume that $\lambda_0 = \lambda_1$. Then, from the costate equation (33) and from the transversality condition (35), it follows that $p(\theta) \equiv 0$[23]. But this contradicts the transversality condition (34) implying $p(\underline{\theta}) = \lambda_1 = \lambda_0 > 0$.

Thus, the only possibility left is $\lambda_1 > \lambda_0$. From the costate equation (33) and from the transversality condition (35), it follows that $p(\theta)$ is a positive decreasing function reaching its minimum value (equal to zero) at $\theta = 1$.

Proof of Step 2.

The optimal control $\hat{\delta}(\theta)$ should bring the maximum to the expression (32). It immediately follows from (32) and the transversality condition (35) that if $\theta = 1$ then $\delta(1) = 0$.

Proof of Step 3. The F.O.C. for the expression (32) is:

$$-\lambda_0(R_H - R_L) + p(\theta)u(\theta)\frac{k+1}{(\theta - k\delta(\theta))^2} \tag{42}$$

The S.O.C. condition for the expression (32) is:

$$p(\theta)u(\theta)\frac{2(k+1)k}{(\theta - k\delta(\theta))^3} \tag{43}$$

[23]Since for $\lambda_0 = \lambda_1$ I have the differential equation $\dot{p}(\theta) = -p(\theta)\frac{k+1}{\theta - k\delta(\theta)}$ with terminal condition $p(1) = 0$, $\Longrightarrow \exists$ unique solution to this equation, $p(\theta) \equiv 0$.

Since, as it was proven in Step 1, $p(\theta) > 0$ for $\forall\theta < 1$, the S.O.C. is always positive[24]. Therefore, the expression (32) attains its maximum on the boundaries[25], i.e. either $\delta(\theta) = 0$, or $\delta(\theta) = \tilde{\theta} - \theta$, where $\tilde{\theta}$ is the infinum of $\Theta = \{\theta : \delta(\theta) = 0; \theta \geq \underline{\theta}\}$. Also, using (29) and the result of Step 1, it is easy to see that if for some $\theta_1 < \tilde{\theta}$ it is optimal to choose $\delta(\theta_1) = \tilde{\theta} - \theta_1$, then it is optimal also to choose $\delta(\theta_2) = \tilde{\theta} - \theta_2$ for all $\underline{\theta} \leq \theta_2 < \theta_1$. Therefore, since $\hat{\theta}(\underline{\theta}_+) = \tilde{\theta}$, by definition, $\tilde{\theta} = \bar{\theta}$.

To summarize, for any $\theta \in [0, \underline{\theta}[\cup[\tilde{\theta}, 1]$ the optimal contract induces truthful reporting $\hat{\theta} = \theta$, and for any $\theta \in (\underline{\theta}, \tilde{\theta})$ the optimal contract induces earnings management: $\hat{\theta} = \tilde{\theta}$. ∎

Proof **of Corollary 1**

The manager chooses his reporting strategy to maximize his expected payment; i.e., $\delta \in \ argmax\ w(\hat{\theta})(\theta - k(\hat{\theta} - \theta))$, which is equivalent to:

$$\frac{dw(\hat{\theta})}{d\hat{\theta}}(\theta - k(\hat{\theta} - \theta)) - k \cdot w(\hat{\theta}) = 0 \tag{44}$$

Truthful reporting is optimal for the manager if and only if:

$$\{\frac{dw(\hat{\theta})}{d\hat{\theta}}(\theta - k(\hat{\theta} - \theta)) - k \cdot w(\hat{\theta})\}|_{\hat{\theta}=\theta} \leq 0 \quad \Longleftrightarrow \quad w'(\theta) \cdot \theta \leq k \cdot w(\theta) \tag{45}$$

The solution to the last equality is:

$$w(\theta) = \gamma\theta^k \tag{46}$$

where γ is a constant determined from the binding incentive constraint 2.

Next, from the truth-telling condition (4) and from the manager's optimal reporting defined in Proposition 4, it follows that $s = w(\bar{\theta})(\underline{\theta} - k(\bar{\theta} - \underline{\theta})) = \gamma\bar{\theta}^k(\underline{\theta} - k(\bar{\theta} - \underline{\theta}))$. ∎

Solution to the firm's maximization problem (6)-(9):

Case 1. Non-zero severance.

The optimal contract for the linear earnings management case with a nonzero severance is given by:

1. For any report $\hat{\theta} \in [0; \bar{\theta})$, the project is terminated and the manager is fired receiving the severance payment $s = \gamma\bar{\theta}^k[(k+1)\underline{\theta} - k\bar{\theta}]$;

[24] S.O.C. is zero for $\theta = 1$, but I already found that the optimal control for $\theta = 1$ is $\delta(1) = 0$.

[25] The formal proof for the $\delta(\theta) = \tilde{\theta} - \theta$ to be an upper boundary is:
For $\forall\theta_1, \theta_2 : \theta_1 < \theta_2$ the monotonicity of the manager's reporting implies: $\theta_1 + \delta(\theta_1) \leq \theta_2 + \delta(\theta_2)$. So, if $\theta = 1, \Longrightarrow \theta_1 + \delta(\theta_1) \leq 1 + \delta(1) = 1$. If I define $\tilde{\theta} = min\{\theta : \delta(\theta) = 0; \theta \geq \underline{\theta}\}$, then for any $\underline{\theta} \leq \theta \leq \tilde{\theta}$, $\theta + \delta(\theta) \leq \tilde{\theta} \Longrightarrow \delta(\theta) \leq \tilde{\theta} - \theta$. Therefore, the upper boundary for the δ set is exactly: $\delta(\theta) = \tilde{\theta} - \theta$.

2. For any report $\hat{\theta} \in [\bar{\theta}; 1]$, the project is undertaken and the manager gets wage $w_H(\hat{\theta}) = \gamma\hat{\theta}^k$.

3. The performance sensitivity constant γ is given by:

$$\gamma = \frac{2v(k+2)}{\beta(\underline{\theta}; \bar{\theta})} \tag{47}$$

4. The equilibrium threshold level $\bar{\theta}$ and the starting point for the real earnings management $\underline{\theta}$ are determined from the following system of equations (48) and (49):

$$\frac{2vk(k+1)(k+2)\alpha_1(\underline{\theta}; \bar{\theta})}{\beta^2(\underline{\theta}; \bar{\theta})} + (R_H - R_L)k(\underline{\theta} - \bar{\theta}) = 0 \tag{48}$$

$$\frac{2v(k+1)(k+2)\bar{\theta}^k\alpha_2(\underline{\theta}; \bar{\theta})}{\beta^2(\underline{\theta}; \bar{\theta})} + (R_H - R_L)[k\bar{\theta} - (k+1)\underline{\theta}] - R_L = 0 \tag{49}$$

where

$$\alpha_1(\underline{\theta}; \bar{\theta}) = (k+2)\underline{\theta}^2\bar{\theta}^{2k} + k\bar{\theta}^{2k+2} + 2\bar{\theta}^k - 2(k+1)\underline{\theta}\bar{\theta}^{2k+1} - 2\underline{\theta}\bar{\theta}^{k-1} \tag{50}$$

$$\alpha_2(\underline{\theta}; \bar{\theta}) = (k+1)(k+2)\underline{\theta}^2\bar{\theta}^k + k(k+1)\bar{\theta}^{k+2} - 2 - 2k(k+2)\underline{\theta}\bar{\theta}^{k+1} \tag{51}$$

$$\beta(\underline{\theta}; \bar{\theta}) = (k+1)(k+2)\underline{\theta}^2\bar{\theta}^k - k(k+1)\bar{\theta}^{k+2} + 2 - 2(k+1)(k+2)\underline{\theta}\bar{\theta}^k + 2k(k+2)\bar{\theta}^{k+1} \tag{52}$$

Case 2. Zero severance.

The optimal contract for the linear earnings management case with zero severance is given by:

1. For any report $\hat{\theta} \in [0; \bar{\theta})$, the project is terminated and the manager is fired without any payment;

2. For any report $\hat{\theta} \in [\bar{\theta}; 1]$, the project is undertaken and the manager gets wage $w_H(\hat{\theta}) = \gamma\hat{\theta}^k$, where the equilibrium threshold $\bar{\theta} = \theta^0 = \frac{-R_L}{R_H - R_L}$ and $\gamma = \frac{2v(k+2)}{2 - \frac{k}{1+k}\bar{\theta}^{k+2}}$.

References

Arya, A., J. Glover, and S. Sunder (1998): "Earnings Management and the Revelation Principle," *Review of Accounting Studies*, 3, 7–34.

Beaver, W., M. McNichols, and K. Nelson (2003): "Management of the Loss Reserve Accrual and the Distribution of Earnings in the Property-Casualty Insurance Industry," *Journal of Accounting and Economics*, 35, 347–376.

——— (forthcoming): "An Alternative Interpretation of the Discontinuity in Earnings Distribution," *Review of Accounting Studies*.

Bruns, W., and K. Merchant (1990): "The Dangerous Morality of Managing Earnings," *Management Accounting*, 72, 22–25.

Burgstahler, D., and I. Dichev (1997): "Earnings Management to Avoid Earnings Decreases and Losses," *Journal of Accounting and Economics*, 28, 641–661.

Dechow, P., S. Richardson, and I. Tuna (2003): "Why Are Earnings Kinky? An Examination of the Earnings Management Explanation," *Review of Accounting Studies*, 8, 355–384.

Degeorge, F., J. Patel, and R. Zeckhauser (1999): "Earnings Management to Exceed Thresholds," *The Journal of Business*, 72, 1–33.

Demski, J. (1998): "Performance Measure Manipulation," *Contemporary Accounting Research*, 15(3), 261–285.

Dutta, S., and F. Gigler (June 2002): "The Effect of Earnings Forecasts on Earnings Management," *Journal of Accounting Research*, 40, 631–655.

Dutta, S., and S. Reichelstein (2002): "Controlling Investment Decisions: Depreciation- and Capital Charges," *Review of Accounting Studies*, 7, 253–281.

Dye, R. (1988): "Earnings Management in an Overlapping Generations Model," *Journal of Accounting Research*, 26, 195–235.

Evans, J., and S. Sridhar (1996): "Multiple Control Systems, Accrual Accounting, and Earnings Management," *Journal of Accounting Research*, 34, 45–65.

Ewert, R., and A. Wagenhofer (2005): "Economic Effects of Tightening Accounting Standards to Restrict Earnings Management," *The Accounting Review*, 80, 1101–1124.

Fields, T., T. Lys, and L.Vincent (2001): "Empirical Research on Accounting Choice," *Journal of Accounting and Economics*, 31, 255–307.

Fisher, P., and R. Verrecchia (2000): "Bias Reporting," *The Accounting Review*, 75, 229–245.

Fleming, W., and R. Rishel (1975): *Deterministic and Stochastic Optimal Control*. Springer, Berlin.

Graham, J., C. Harvey, and S. Rajgopal (2005): "The Economic Implications of Corporate Financial Reporting," *Journal of Accounting and Economics*, 40, 3–73.

Gunny, K. (2005): "What Are the Consequences of Real Earnings Management?," *Working Paper*, University of Colorado at Boulder.

Guttman, I., O. Kadan, and E. Kandel (July 2006): "A Rational Expectations Thoery of Kinks in Financial Reporting," *The Accounting Review*, 81, 811–848.

Hayn, C. (1995): "The Information Content of Losses," *Journal of Accounting and Economics*, 20, 125–153.

Healy, P., and J. Wahlen (December 1999): "A Review of the Earnings Management Literature and Its Implications for Standard Setting," *Accounting Horizons*, 13, 365–383.

Lacker, J., and J. Weinberg (1989): "Optimal Contracts Under Costly State Falsification," *Journal of Political Economy*, 97, 1345–1363.

Laux, V. (September 2006): "Boards Independence and CEO Turnover," *Working Paper*, University of Texas at Austin.

Levitt, S., and M. Snyder (Winter 1997): "Is No News Bad News? Information Transmission and the Role of "Early Warning" in the Principal-Agent Model," *The RAND Journal of Economics*, 28, 641–661.

Lillis, A., and M. Pinnuck (Fall 2006): "Profit versus Losses: Does Reporting an Accounting Loss Act as a Heuristic Trigger to Exercise the Abandonment Option and Divest Employees?," *Working Paper*, University of Melbourne.

Maggi, G., and A. Rodriguez-Clare (Winter 1995): "Costly Distortion of Information in Agency Problems," *The RAND Journal of Economics*, 26, 675–689.

McNichols, M. (2000): "Research Design Issues in Earnings Management Studies," *Journal of Accounting and Public Policy*, 19, 313–345.

Roychowdhury, S. (2006): "Earnings Management through Real Activities Manipulation," *Journal of Accounting and Economics*, 42, 335–370.

Rusticus, T. (January 2006): "Executive Severance Agreements," *Working Paper*, Northwestern University.

Schipper, K. (1989): "Commentary on Earnings Management," *Accounting Horizons*, 3, 91–102.

Seierstad, A., and K. Sydsaeter (1987): *Optimal Control Theory with Applications*. New York: North-Holland.