

# Earnings Manipulation and Incentives in Firms\*

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## **Abstract**

We show that earnings manipulation destroys incentives within the corporate hierarchy. In the model, top management has incentives to over-report earnings. An insider, for instance, a division manager may gain evidence about over-reporting. We show that the division manager is more likely to have evidence, when the performance of her own division is low. Top management wants to prevent information leakage to the outside world. Hence, when the division manager threatens to blow the whistle, top management pays her a bribe. As this occurs when division output is low, the wedge between payments in high and low states of nature decreases. Earnings manipulation therefore undermines incentives to exert effort and destroys value. We show that earnings manipulation is more likely to occur in flatter hierarchies; we also discuss implications of the auditing and whistle-blowing regulations of the Sarbanes-Oxley Act.

**Keywords:** agency costs, Sarbanes-Oxley Act, whistleblowing, flat hierarchies.

**JEL Classification Codes:** D23, G30, M40, M52

## Introduction

Recent corporate scandals have reinforced existing skepticisms about the efficiency of financial markets and have triggered regulatory reforms like the *Sarbanes-Oxley Act*. While these events spurred a number of research avenues, our understanding of the numerous and sizeable corporate misfortunes is far from complete.<sup>1</sup>

Looking inside the corporate hierarchy, we here offer a new perspective on earnings manipulation. Our theory focuses on the intra-firm agency conflicts that are associated with earnings manipulation and on the role of corporate insiders as potential “internal gatekeepers”. The paper is motivated by a number of questions that are now increasingly discussed in economics, accounting and finance: Why did the mechanisms of corporate governance fail to detect massive earnings manipulation by management? What are the costs of earnings manipulation for society? What effect can regulatory reforms have on avoiding earnings manipulation in the future?

The corporate governance literature has traditionally focused on external gatekeepers such as auditors, non-executive board members, and financial institutions. However, corporate insiders often have direct evidence that top executives engage in manipulation and their threat of blowing the whistle can be a powerful corporate governance mechanism. But this mechanism may fail as insiders can be bribed and silenced by management. Our theory shows that these bribes destroy value, as they distort the incentives of firm insiders. While other authors have stressed the external costs of earnings manipulation, such as the transfer of utility from less informed investors to more sophisticated players or the shattered confidence of shareholders in financial markets, we identify a direct, immediate cost of earnings manipulation: By undermining incentives, it obstructs creation of value within firms. Our perspective also provides some new insights about the role of regulations like *Sarbanes-Oxley*, and it highlights the importance of organisational structure as a determinant of earnings manipulation. In particular, we show that the recent tendency to flatten hierarchies may have contributed to the widespread earnings manipulation.

A growing literature has shown that executive stock options and other short-term incentives have played an important role in explaining the incidence of earnings manipulation.<sup>2</sup> In our theory,

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<sup>1</sup>The problem of earnings manipulation is not limited to a few household names such as *Enron*, *Tyco*, *WorldCom* (in the US) or *Ahold* and *Parmalat* (in Europe). The *Forbes’* Corporate Scandal Sheet, for instance, lists more than 20 large corporate scandals (Patsuris, 2002) where the value of manipulations amounted to billions of dollars. To give some examples: *Xerox* inflated its earnings over five years by \$1.5 billion; *HealthSouth Corp.* overstated profits by \$2.5 billion between 1997 and 2003; *Waste Management* manipulated earnings by \$1.7 billion by overstating the value of their trucks (Levitt and Dwyer, 2003).

<sup>2</sup>Peng and Roell (2004) provide an overview of empirical literature on the relationship between the structure of managerial incentives and earnings manipulation. Bergstresser and Philippon (2002) and Gao and Shrieves (2002)

both top management and initial shareholders have an interest in overreporting short-term earnings, because they can sell stocks at inflated prices to uninformed outside investors. We assume that the latter base their valuations of the stock (at least to certain extent) on the accounting reports. This assumption is in line with empirical evidence showing that even sophisticated investors may fail to fully account for the possibility of earnings manipulation (e.g. Louis, 2004).

In our model, short-term incentives of top management affect the incentives inside firms via two channels. First, as top managers have incentives to report high earnings even if outcomes are low, they provide weaker incentives to their subordinates. The second, more interesting, channel relates to the policies top management undertakes in order to prevent the leakage of information to the outside world. A division manager may have evidence that top management inflates earnings. Then, if she can prove that top management tries to lie about earnings, the threat of blowing the whistle allows her to claim a share in top management's benefits of hiding the truth from the public. Our theory thus explains why it is costly to maintain two accounting systems, one for the outside world, potentially reporting inflated figures, and one as the basis of internal decisions and incentives for insiders. Insiders with sensitive information would have a credible threat to blow the whistle unless their compensation relates to the reported, rather than the true earnings.

The important feature of the model is that it is easier for a division manager to prove earnings manipulation by the top management if her own division has underperformed. The knowledge about earnings manipulation and the threat of blowing the whistle can provide division managers with an additional payment. Hence, there is a smaller difference between the division's payoffs associated with high *vs* low output. This distorts the division managers' effort choices.

Whistle-blowers do not have to be silenced *ex post*, at the bargaining table. Rather, we show that top managers can neutralize the incentive to blow the whistle *ex ante* – by providing lower level managers with short-term incentives. Short-term incentives align insider incentives with those of top managers and ensure that sensitive information does not reach the outside world. Our theory hence contributes to a better understanding of why many firms provide even lower-level employees with stock options in times of booms (see Oyer and Schaefer, 2005, and Jensen and Murphy, 2005).

From the point of view of initial shareholders, the trade-off is as follows. On the one hand, if top

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measure earnings manipulation through the value of discretionary current accruals and find that it is related to stock holdings and options of executives. Interventions by the SEC are another measure: Johnson et al. (2003) find that in 43 firms that committed fraud, stock-based compensation and vested options were higher than in a matched control sample. Erickson et al. (2003) control for endogeneity of stock-based compensation and find similar effects. Peng and Roell (2004) themselves use yet a different measure, namely, allegations of executive misbehavior in shareholder class actions. They show that the incidence of such lawsuits are positively related to stock option components in executive compensation.

managers manipulate earnings, stocks can be sold at inflated prices. On the other hand, earnings manipulation weakens internal incentives and reduces firm value in the long run. We show that in some parameter range, shareholders may encourage short-termism and manipulation through the provision of short-term incentives. Then, in equilibrium, division managers face suboptimal incentives and less value is created.

Given the empirical evidence (see for instance, Odean, 1998), most scholars seem to agree that investor overconfidence has a substantial impact on stock market prices. Nonetheless, our results do not hinge on original shareholders' incentive to sell to outsiders. Any other reason for short-term incentives will have similar effects in our model. We discuss these other reasons in the next section. Also, while our model assumes that some investors are not fully rational, the results hold in a game with fully rational investors as well. If there is asymmetric information and some bad firms pool with better firms, then, investors buy stocks based on reported earnings. In the Appendix of the paper, we present a version of our theory in such a setting that is based on the papers by Bebchuk and Bar-Gill (2003) and Povel et al. (2003).

To illustrate the results of our theory, consider the quintessential example of corporate governance troubles: *Enron*, once the world's seventh largest company, now bankrupt, with several top managers facing legal charges. Earnings manipulation in *Enron* was so widespread, that CFO Andy Fastow (backed by CEO/COO Jeff Skilling) perceived his job being mostly, if not exclusively, about arranging "structured finance": the use of aggressive accounting to deliver high earnings quarterly reports (Maclean and Elkind, 2003, ch. 10).<sup>3</sup> *Enron's* ubiquitous book-cooking resulted in the inability to monitor projects even internally. A deputy CEO once complained about Fastow's aggressive accounting: "With Fastow, you could never tell whether [individual] deals were clean because they were too complicated" (Maclean and Elkind, 2003, p. 152). Healy and Palepu (2003) document how widespread earnings manipulation induced *Enron* managers to take unfounded and often excessively risky decisions. This may explain why despite very talented staff and profitable core business, *Enron* ended up not only having its value below the reported numbers but simply destroyed (Maclean and Elkind, 2003, Partnoy 2002, 2003).

*Enron's* top management had substantial equity stakes or options. Allegedly, the top executives managed to cash stock options for \$35-250 million each (Maclean and Elkind, 2003), and hence had little incentives to communicate earnings truthfully. But, there were a few attempts of blowing

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<sup>3</sup>The sheer scale of Fastow's activities is striking. Between 1997 and 2000 he created about 3000 corporate entities, including more than 800 of which were offshore (Maclean and Elkind, 2003, p. 310).

the whistle by those who were not enjoying the stock option bonanza. The famous “smoking gun memo” by Vice President Sherron Watkins to the Chairman Kenneth Lay opens with “Has *Enron* become a risky place to work? For those of use who *didn't get rich over the last few years*, can we afford to stay?” (Watkins, 2001, our italics.) Even though it appears that Sherron Watkins had been aware of the scale of Enron’s earning manipulation, she did not insist on disclosing to public; the memo never reached outsiders before the collapse (Ackman, 2002).

Another, *post* Sarbanes-Oxley, example of (the threat of) whistle-blowing is the case of *Coca Cola*. After being laid off, executive Whitley asked his former employer for a settlement payment of \$44.4 million. He argued he had been fired in retaliation for raising concerns about accounting fraud (*CFO Magazine*, 2003). *Coca Cola* dismissed the settlement proposal, the case became public and *Coca Cola* faced SEC charges (*CFO Magazine*, 2004a). In the meantime, *Coca Cola* settled both with Whitley (for \$100,000, a \$140,000 severance package and Whitley’s attorney’s fees of \$300,000) and with the SEC, agreeing to take unspecified remedial actions in corporate compliance and disclosure (*Washington Post*, 2005).

Many firms seem to be quite vulnerable to whistle-blowing. New York’s attorney general, Eliot Spitzer, built his case against Wall Street firms doctoring their reports on hundreds of pieces of (e-mail) information from insiders. (*Time Magazine*, 2002). These pieces of information have certainly helped to increase the transparency and efficiency of the financial system. Moreover, our theory shows that even if whistle-blowing is not carried out in equilibrium, it may have substantial impact on coprorate governance.

The paper proceeds as follows. Section I presents related literature. In Section II we set up a simple model. Section III, the theoretical centerpiece, establishes the main result and contains a discussion of robustness. Section IV discusses how the model can be extended to investigate organisational structure and monitoring intensity. In particular, we argue that at given size, it is harder for insiders to provide evidence of earnings manipulation in flatter hierarchies. We also look at the implications of *Sarbanes-Oxley Act* in light of our theory. We argue that the Act will reduce the frequency of earnings manipulation, because it decreases insiders’ costs of whistle-blowing and induces auditors to monitor more carefully. As they have to share with a larger number of firm insiders and auditors, top management then benefits less from earnings manipulation. Section V concludes.

## I Related literature

There is a growing literature that investigates the effects of short-termism and earnings manipulation on managerial incentives. In Stein (1989), both short-termism and earnings manipulation emerge in a non-cooperative equilibrium between managers and rational investors. Bebchuk and Stole (1993) show ambiguous effects of short-term incentives on managerial effort depending on the structure of asymmetric information. Bolton et al (2004) show that in the presence of overconfident shareholders, managers may choose sub-optimal projects with higher variance. Jensen (2004) argues that overvalued equity aggravates the agency problems between investors and managers.

While these papers point to the agency relationship between the outside world and corporate management, we explicitly analyze the effect of earnings manipulation on the agency relationship *inside* firms. Our model of a corporate hierarchy highlights the potential role of corporate insiders as gatekeepers; it shows how distortions propagate throughout the hierarchy and how earnings manipulation obstructs value creation by undermining internal incentives. It also highlights the importance of organisational structure for the feasibility of earnings manipulation.

Jensen and Murphy (2005) argue that the main reason why CEOs were granted excessive compensation based on stock market prices was that shareholders did not fully account for the costs of such incentives. Our – formal – theory is to a large extent complementary, except that in our theory initial shareholders are fully rational. However, we could readily reinterpret our model in a way that the shareholders who design (directly or indirectly) the compensation of CEOs may make mistakes. Then, the problem would be further amplified, but the value of insider information would be quite similar. If an inside manager realizes that something goes wrong in the company, the CEO would still not want them to reveal it, because CEO compensation depends on stock market price.

In our theory, top management has short-term incentives to manipulate earnings because outside investors value the company on the basis of accounting reports. There are at least two explanations why full unraveling of earnings manipulation does not occur. First, in the presence of short-sale constraints and some overconfident investors, the stock price will to some extent reflect the company's valuation by investors that rely on the most optimistic signals (Harrison and Kreps, 1978, Scheinkman and Xiong, 2003, Bolton et al, 2004). The other prominent explanation is based on rational but uninformed investors (Bebchuk and Bar-Gill, 2003, Povel et al., 2003). The equilibrium in an asymmetric information game may involve partial pooling and therefore rewards for companies overreporting earnings. If overreporting is costly, investors know that the worst companies will not

report the highest possible outcome. This is why they do value positive reports even though they know that the pool of companies with good reports include both good and intermediate firms. For the sake of simplicity, we choose a setting with overconfident investors. The asymmetric information framework produces quite similar results; we provide a sketch of such a model in the Appendix.

Managerial short-termism can also be driven by the costs of long-term arbitrage (Shleifer and Vishny, 1990), and managerial risk aversion and demand for liquidity (Holmstrom and Tirole 1998, Aghion et al, 2004, Axelson and Baliga, 2004). Whatever the source of CEO short-termism, our theory would still imply weaker incentives for his subordinates.

To the extent that we look at rent-seeking and incentives inside a firm, our model has some similarity to the model in Scharfstein and Stein (2000). However, in our model, the potential rents for division managers are created by CEO's earnings manipulation. Moreover, we allow for cash compensations inside the firm; our main interest is information diffusion to the outside world rather than allocation of capital between divisions. Also related is the paper by Faure-Grimaud and Gromb (2004) who study the role of large shareholders as a different type of insiders in providing information about a firm.

Earnings misreporting may also be carried out for tax optimization purposes (Misai, 2003). In this case, managers tend to underreport rather to overreport the earnings. Desai and Dharmapala (2004) build a model of interaction between managers, owners and government. The effect of high-powered incentives on tax avoidance is ambiguous; tax sheltering is complementary to diversion of profits from shareholders. On the other hand, by paying less taxes, managers may increase shareholder value. Hence, the effect of incentives on reported earnings depends on corporate governance, namely to what extent management is controlled by shareholders. Desai and Dharmapala do not model corporate hierarchy, but our analysis suggests that tax avoidance need not distort internal incentives. Indeed, as management tends to underreport earnings, keeping two sets of books is incentive compatible. The potential whistle-blowers are the successful rather than failing divisions; these divisions get a bonus on top of their official compensations and are happy not to report the fraud.

This is similar to the result in Chen and Chiu (2005, Proposition 1). They look at a principal-agent model of tax evasion, in which having two sets of books is feasible. In their model, managerial effort can be distorted in both directions: relative to the second-best, there is too much (too little) effort, when the manager has decreasing (increasing) absolute risk-aversion. In our model, however, effort is always distorted downwards, because insiders learn more about the true state of the firm

(or have higher incentives to learn about it) when they themselves have underperformed.

Our paper contributes to literature on whistle-blowing (Miceli and Near, 1992) that discusses costs and benefits of blowing the whistle. This literature has been largely descriptive except for Leppamaki (1998) who studies whistle-blowing in a rather specific context of bilateral monitoring, and for Friebel and Raith (2004) who look at whistle-blowing and conflicts between different layers in the hierarchy. Our paper complements this literature by modelling the effect of potential whistle-blowing on corporate governance. The prediction that potential leakage of inside information is prevented by profit sharing is not new in the literature on innovation and unpatentable knowledge (see Anton and Yao, 1994, Baccara and Razin, 2002, Bhattacharya and Guriev, 2004). Yet, it has not been explicitly modelled in the framework of corporate governance. While testing the alternative explanations of provision of stock options to employees, Oyer and Schaefer (2005) reject the argument that stock options are given to provide incentives to work harder. They do, however, not discuss stock options as incentives to prevent leakage of sensitive information.

Finally, our paper is related to the problem of leniency programmes as deterrence device for cartels and other criminal associations, see for instance Spagnolo (2000) and Aubert et al (2005). However, our whistle-blower problem is more common as it also concerns legal organisations, and it looks at a complex interplay between efficiency and whistle-blowing which is not present in criminal organisations.

## II The model

We consider a publicly traded firm that is held by initial shareholders (“ $S$ ”). The firm is run by a CEO (“ $M$ ”) who reports to  $S$ , and there are two division managers,  $A$  and  $B$ , who report to  $M$ . There are also potential new investors (“ $I$ ”). Agents  $M$ ,  $A$  and  $B$  are risk-neutral, but have limited liability; their reservation payoffs are normalized to zero. Both initial investors  $S$  and overconfident potential investors  $I$  are financially unconstrained and, in dealing with  $M$ , risk-neutral.

### A Production and information

The division managers exert effort  $e_i$ ,  $i = A, B$ , which increases the expected value of the firm. Output of each division  $y_i$  can take two values: 1 (with probability  $e_i$ ) and 0 (with probability

$1 - e_i$ ). The aggregate output of the divisions is

$$y = y_A + y_B.$$

Effort is private information of the respective division manager. The cost of effort is  $c(e_i)$ , which is an increasing, convex function. For simplicity, we assume that  $c(e) \sim e^{1+\sigma}$ , so that the elasticity of the marginal cost of effort  $\sigma = ec''(e)/c'(e)$  is positive and independent of the level of effort. Division manager  $i$  observes her own output, but not that of the other division manager. In what follows, we assume that division managers cannot engage in any side-contracting and, in particular, that they cannot share information.<sup>4</sup>

The CEO observes both divisions' outputs, while the outside world –  $S$  and new investors  $I$ , who may buy stocks from  $S$  – cannot observe the true value of the firm. Rather, they have to rely on  $M$ 's report, which may or may not be truthful. This setting captures the idea that certain pieces of information are only available within the boundaries of a firm. The role of auditors, who at some cost can generate additional information about the true value of the firm by investigating the performance of a firm's divisions, is discussed in subsection B.

Besides gathering and reporting information,  $M$  also exerts effort  $E = \{0, 1\}$  which is complementary to that of division managers. For simplicity we make an extreme assumption of perfect complementarity: the firm's gross output is  $yE$ . If  $M$  chooses high effort,  $E = 1$ , the output of divisions adds value  $y$ . If the top manager shirks, the firm's value is nil. The top manager's cost of exerting  $E = 1$  is  $c_M$ . We shall assume throughout the paper that this cost of effort is sufficiently low and that shareholders will provide the top manager with incentives (short-term, long-term, or both) such that  $M$  never shirks. Thus we will solve the model for the case  $E = 1$ , and then check for  $M$ 's incentive not to deviate to  $E = 0$ .

## B Timing

There are three dates:  $t = 0$  (contracting stage),  $t = 1$  (short run), and  $t = 2$  (long run). At  $t = 0$ ,  $S$  hold 100% shares. They keep at least  $\alpha_{S2} \geq 0$  shares in the long run (e.g. for risk management purposes, or for preserving non-pecuniary benefits of control). In our model,  $\alpha_{S2}$  is an exogenous parameter. The initial shareholders offer  $M$  a contract; then  $M$  offers a contract to  $A$  and  $B$ . The compensation package of  $M$  includes a fixed salary and bonuses that are contingent on earnings

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<sup>4</sup>We discuss this issue further in III.H.

reported at  $t = 1$  and  $t = 2$ . These bonuses can be interpreted as stock grants or stock options to be exercised at  $t = 1$  (short term) and  $t = 2$  (long term). For simplicity, we assume that the manager receives  $\alpha_{M1}$  shares that can be sold in the short term (to new investors  $I$ ), and  $\alpha_{M2}$  shares that must be kept until the end;  $\beta$  is the present value of all fixed salaries  $M$  receives. The division managers' contracts are contingent on their individual output  $y_{A,B}$ . We assume that either  $M$  or a division manager can verify the division's output before a court if they wish to. Date  $t = 1$  has several stages:

1. The CEO chooses  $E$ .
2. Division managers  $A$  and  $B$  choose their effort levels  $e_A, e_B$  and division outputs realize.
3. The CEO observes  $y_A$  and  $y_B$ , and prepares a report about aggregate earnings. The reported earnings  $x$  may or may not be manipulated by  $M$ . Given  $W$ , the sum of all wage payments to  $M, A$  and  $B$ , the reported short-term value of the firm is

$$V_1 = x - W.$$

Here  $x = y$  if there is no overreporting, and  $x > y$  otherwise. Obviously,  $W$  depends on whether or not there is earnings manipulation. We assume that inflating short-term earnings by  $x - y$  units has costs  $C_{x-y}$  with  $C_2 > C_1 > 0 = C_0$ . These costs reduce the firm's long-run  $V_2$ , but do not affect short-run value  $V_1$ .<sup>5</sup>

4. The division managers learn about the report before it is sent to potential investors.<sup>6</sup> Subsequently, if they believe that there is some overreporting, they can bargain individually with  $M$  for a wage raise. The bargaining power of either division manager (vis-a-vis the CEO) is  $\gamma \in [0, 1]$ . If  $M$  and one or several of the division managers disagree, they can make available to the public verifiable information about their division output. This whistle-blowing drives down the stock price that the potential investors are willing to pay. We further specify the whistle-blowing game in Section III.

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<sup>5</sup>This may be considered as a reduced form of the net present value of stochastic costs of earnings manipulation. Second, there is a modelling choice here: the costs may be incurred by the firm, for instance, as consulting fees to auditors or misallocation of resources, or by the manager, for instance, as an effort cost or the expected costs of potential imprisonment. We take the former route, as it is more in line with the literature, e.g. Stein (1989), but the alternative would imply similar results.

<sup>6</sup>We could also allow for  $A$  and  $B$  to receive noisy signals about the report.

5. The CEO can sell up to  $\alpha_{M1}$  shares to the new investors at a price based on reported output  $x$ . Initial shareholders can sell a total of  $1 - \alpha_{S2} - (\alpha_{M1} + \alpha_{M2})$  to new investors. Potential new investors are overconfident, so that they value the firm based on the reported earnings. This allows an alternative interpretation for the parameter  $\alpha_{S2}$  as a measure of market sophistication. If some of the new investors are overconfident while others figure out the true value of the firm, an increase in the proportion of smart investors is equivalent to higher  $\alpha_{S2}$  in our model. Further, we assume that new investors observe wages, but cannot infer from wages on whether or not earnings manipulation has occurred. This is not an important assumption; we discuss it in subsection III.H.
6. Finally,  $A$ ,  $B$  and  $M$  receive their first-period wages according to the initial contract and whatever additional revenues accrue through exercise of short-term options or through bargaining.

At  $t = 2$  (long run) the true value becomes public information. The market value at this point is based on  $y$ . There is no additional production. The firm is liquidated and all remaining shareholders (including managers and original shareholders if holding long-term stock) receive their part of the true value,  $V_2 = y - W - C_{x-y}$ .

## C Contracts and payoffs

Contracts between  $M$  and  $A$ ,  $B$  are simple. There is a wage in case of success,  $w_1$ , and a wage in case of failure,  $w_0$ . Owing to limited liability,  $w_{0,1} \geq 0$ . For simplicity, we consider a linear contract for  $M$ ; the contract is a triple  $\langle \beta, \alpha_{M1}, \alpha_{M2} \rangle$ . The CEO's payoff is

$$U^M = \beta + \alpha_{M1}V_1 + \alpha_{M2}V_2 - c_M E. \quad (1)$$

Here,  $E$  is either 1 or nil. Limited liability implies  $\beta = 0$ . The contract between shareholders and  $M$  must deal with a two-dimensional moral hazard problem:  $M$  chooses effort  $E$  and decides what to report. Incentives for high effort are provided by a sufficiently high *total* of short-term and long-term stakes. Incentives for earnings manipulation depend on the contract's *structure*, that is, the ratio of short versus long-term incentives. The more short-termist the contract, the more likely  $M$  is to inflate earnings. If the contract only includes long-term compensation,  $M$  will file truthful reports. Notice that new investors, who buy shares at  $t = 1$ , do not renegotiate  $M$ 's long-term contract, because all choices and decisions have already been made at that point.

### III Equilibrium earnings manipulation and internal incentives

We here establish the main result of the paper: earnings manipulation may undermine incentives within the firm and thus obstruct the creation of value. We solve the model backwards.

#### A Market valuation

At  $t = 2$ , the price of the firm's equity is  $V_2 = y - \beta - W - C_{y-x}$ , where  $y = y_A + y_B$  is total output by two divisions,  $W$  is the total wage paid to divisions, and  $C_{y-x}$  is the cost related to earnings manipulation. At  $t = 1$ , the price of the firm's equity is  $V_1 = x - \beta - W$  where  $x$  is the total *reported* output.

#### B Threat of whistle-blowing and bargaining

We assume that  $C_2$  is very high so that the manager never manipulates earnings by two units.<sup>7</sup> We also use the limited liability constraint ( $w_0 = \beta = 0$ ). Suppose that the manager has chosen to report  $x = y + 1$  whenever  $y \leq 1$ . This costs him  $\alpha_{M2}C_1$  in the long-run, and provides him with short-run benefits according to the table below.

| $y_A$ | $y_B$ | Prob.                | $y$ | $x$ | $M$ 's payoff $\alpha_{M1}V_1 + \alpha_{M2}V_2$                                     |
|-------|-------|----------------------|-----|-----|---|
| 0     | 0     | $(1 - e_A)(1 - e_B)$ | 0   | 1   | $\alpha_{M1} - \alpha_{M2}C_1$  |
| 1     | 0     | $e_A(1 - e_B)$       | 1   | 2   | $\alpha_{M1} - \alpha_{M2}C_1 + (\alpha_{M1} + \alpha_{M2})(1 - \tilde{w}_0 - w_1)$ |
| 0     | 1     | $e_B(1 - e_A)$       | 1   | 2   | $\alpha_{M1} - \alpha_{M2}C_1 + (\alpha_{M1} + \alpha_{M2})(1 - \tilde{w}_0 - w_1)$ |
| 1     | 1     | $e_Ae_B$             | 2   | 2   | $(\alpha_{M1} + \alpha_{M2})(2 - 2w_1)$   |

(2)

Under the assumption (taken on page 8) that division managers cannot side-contract, the threat of whistle-blowing is only relevant when  $x = 2$  and  $y = 1$ . Only then, one division – the one that produced nil – has evidence of manipulation. This division threatens  $M$  with reporting the evidence to the market. The wage  $\tilde{w}_0$  is the result of bargaining between  $M$  and this division manager, as explained below. In subsection III.H, we discuss the effect of relaxed assumptions concerning output.

Consider the second row in the table. Here,  $B$  has evidence about earnings manipulation. We assume the division manager to receive a part  $\gamma \in (0, 1)$  of the joint surplus for not blowing the whistle. At the time of bargaining,  $C_{y-x}$  has been realized,<sup>8</sup> so if  $B$  blows the whistle, the market

<sup>7</sup>In Section IV we investigate the situation where this is not the case.

<sup>8</sup>Considering that  $C_{y-x}$  is not sunk at the bargaining stage would not make any qualitative difference.

value will be based on  $y = 1$ , and the sum of utilities of  $M$  and  $B$  is

$$(\alpha_{M1} + \alpha_{M2})(1 - w_1) - \alpha_{M2}C_1.$$

If  $B$  does not blow the whistle, the market value will be based on  $y = 2$ , so the sum of utilities is

$$\alpha_{M1}(2 - 1) + (\alpha_{M1} + \alpha_{M2})(1 - w_1 - \tilde{w}_0) - \alpha_{M2}C_1 + \tilde{w}_0.$$

The CEO and the division manager share the surplus, that is the difference between the latter and the former expression. As  $B$  receives a share of  $\gamma$ , we find

$$\tilde{w}_0 = \frac{\gamma\alpha_{M1}}{1 - \gamma(1 - \alpha_{M1} - \alpha_{M2})}. \quad (3)$$

As expected, this wage increases in  $\gamma$  and  $\alpha_{M1}$  and decreases in  $\alpha_{M2}$ . If the threat of whistle-blowing were not important ( $\gamma = 0$ ), then  $\tilde{w}_0$  would be nil.

### C Earnings manipulation

When  $M$  observes  $y_A = y_B = 0$ , he chooses to report  $x = 1$ . This involves no cost – neither division can blow the whistle. When  $M$  observes  $y_A + y_B = 1$ , then, he compares the benefit of misreporting  $\alpha_{M1} - (\alpha_{M1} + \alpha_{M2})\tilde{w}_0$  to the cost of misreporting  $\alpha_{M2}C_1$ . Using (3), we find that CEO chooses to misreport whenever

$$\alpha_{M2}C_1 < \frac{(1 - \gamma)\alpha_{M1}}{1 - \gamma(1 - \alpha_{M1} - \alpha_{M2})} \quad (4)$$

i.e., whenever cost of manipulation  $C_1$ , bargaining power  $\gamma$ , and long-term incentives  $\alpha_{M2}$  are sufficiently low and short-term incentives  $\alpha_{M1}$  are sufficiently high.

### D Choice of effort by division

In any subgame perfect equilibrium, the earnings manipulation decision depends on the respective realized output  $y_A, y_B$  and on whether condition (4) holds. Suppose that the latter is the case. Then  $A$  expects to receive  $\tilde{w}_0$  if she produces nil and the other division produces 1. A division that succeeds always receives  $w_1$ . If both divisions fail, they receive nil. Given the effort  $e_B$  by  $B$ ,

manager  $A$  chooses her effort level  $e_A$  to solve:

$$\max_{e_A} [e_A w_1 + \tilde{w}_0(1 - e_A)e_B - c(e_A)].$$

$B$  solves a symmetric problem and the FOCs are:

$$c'(e_A) = w_1 - e_B \tilde{w}_0 \text{ and } c'(e_B) = w_1 - e_A \tilde{w}_0.$$

There is a unique symmetric equilibrium  $e_A = e_B = e$ , where  $e$  satisfies the incentive compatibility constraint:<sup>9</sup>

$$c'(e) + e \tilde{w}_0 = w_1. \tag{5}$$

The equation above shows what bonus  $w_1$  should be paid to a successful division if  $M$  wants to implement a given effort level  $e$ .

Now consider the case where (4) does not hold. The division is only paid  $w_1$  if she is successful and  $w_0 = 0$  otherwise. Thus, the effort solves

$$c'(e) = w_1. \tag{6}$$

## E Optimal contract for division managers

When  $M$  designs contracts for the division managers, he takes into account whether or not he will manipulate the earnings later, see (4).

**Truthful reporting:** If (4) does not hold,  $M$  expects that he will have incentives to report truthfully  $x = y$ . He chooses a contract  $w_1$  that maximizes

$$(\alpha_{M1} + \alpha_{M2}) [(2 - 2w_1) e^2 + 2e(1 - e)(1 - w_1)]$$

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<sup>9</sup>For some  $c(\cdot)$  there may also be asymmetric equilibria  $e_A \neq e_B$ . However, for power functions  $c(e) \sim e^{1+\sigma}$  as well as for any cost function with either concave or convex marginal cost  $c'(e)$  the equilibrium is unique and symmetric. The only exception is the non-generic case  $c(e) = \tilde{w}_0 e^2 / 2$  where there is a continuum of equilibria  $e_A + e_B = w_1 / \tilde{w}_0$ .

subject to the incentive compatibility constraint (6). The FOC is  $c'(e^*) = 1/(1 + \sigma)$ . In this case

$$\begin{aligned} w_1^* &= c'(e^*) = \frac{1}{1 + \sigma}; \\ V_1^* &= V_2^* = 2e^*(1 - c'(e^*)) = \frac{2e^*\sigma}{1 + \sigma}. \end{aligned} \tag{7}$$

The effort  $e^*$  is below the first-best level that would solve  $c'(e) = 1$ . However,  $e^*$  is the optimal effort chosen in the conventional principal agent model with limited liability. Even if the divisions' contract were set up by shareholders  $S$  directly, (7) would still be the case.

**Earnings manipulation:** If (4) holds,  $M$  expects to manipulate earnings, so he maximizes his expected payoff according to (2):

$$(\alpha_{M1} - \alpha_{M2}C_1)(1 - e^2) + (\alpha_{M1} + \alpha_{M2})[(2 - 2w_1)e^2 + 2e(1 - e)(1 - \tilde{w}_0 - w_1)]$$

subject to the incentive compatibility constraint (5). Substituting  $w_1$  from (5), we obtain the first order condition:<sup>10</sup>

$$\frac{\alpha_{M1} - \alpha_{M2}C_1}{\alpha_{M1} + \alpha_{M2}}e = 1 - \tilde{w}_0 - c'(e) - ec''(e).$$

The equilibrium effort is  $e = \tilde{e}$  where  $\tilde{e}$  solves

$$\frac{\alpha_{M1} - \alpha_{M2}C_1}{\alpha_{M1} + \alpha_{M2}}\tilde{e} + c'(\tilde{e})(1 + \sigma) = 1 - \tilde{w}_0. \tag{8}$$

The left-hand side is increasing in  $\tilde{e}$ . Hence, there is a unique solution. Our main result follows from (8): the equilibrium level of effort  $\tilde{e}$  is decreasing in  $\tilde{w}_0$ , and in  $\alpha_{M1}$  (keeping  $\alpha_{M1} + \alpha_{M2}$  constant). This shows that  $M$ 's short-termism – induced by the initial shareholders who want to benefit from inflated share prices – undermines incentives within the hierarchy and involves less effort and less value creation.

Eq. (8) also describes how short-term incentives propagate through the hierarchy. Even if whistle-blowing were not important (e.g. if divisions had no bargaining power  $\gamma = 0$ , and  $\tilde{w}_0 = 0$ ), the effort level would still be distorted,  $\tilde{e} < e^*$ . The distortion is driven by the first term in (8) which

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<sup>10</sup>We use the standard first-order approach to solving principal-agent problem. The principal knows the agent's IC constraint, and therefore can calculate how much it costs to implement a given level of effort  $e$ . Then the principal's problem is to choose the effort level that involves maximum payoff. Notice that (4) implies  $\frac{\alpha_{M1} - \alpha_{M2}C_1}{\alpha_{M1} + \alpha_{M2}} > 0$ .

is large whenever the top manager's incentives are predominantly short-term. In this case,  $M$  is not willing to pay much for higher effort, because he is going to overreport the earnings anyhow.<sup>11</sup> Since rewarding high effort is costly for  $M$ , he will prefer to provide weaker incentives.

The respective market values in case of earnings manipulation for the second and first period are:

$$\tilde{V}_2 = 2\tilde{e} - 2\tilde{e}w_1 - 2\tilde{e}(1 - \tilde{e})\tilde{w}_0 - C_1, \text{ and } \tilde{V}_1 = 2\tilde{e} - 2\tilde{e}w_1 - 2\tilde{e}(1 - \tilde{e})\tilde{w}_0 + (1 - \tilde{e}^2). \quad (9)$$

## F Optimal contract for the CEO

The initial shareholders  $S$  choose  $\alpha_{M1}$  and  $\alpha_{M2}$  in order to maximize their payoff

$$U^S = [\alpha_{S2}V_2 + (1 - \alpha_{M1} - \alpha_{M2} - \alpha_{S2})V_1] E.$$

subject to CEO's optimal response to  $\alpha_{M1}$  and  $\alpha_{M2}$ .

The shareholders want to (i) provide incentives for manager's effort  $E = 1$ ; (ii) make sure that the CEO reports or misreports earnings in their interests. To solve (i),  $S$  has to increase both  $\alpha_{M1}$  and  $\alpha_{M2}$  so that  $M$ 's overall contingent compensation exceeds his cost of effort  $c_M$ . As under limited liability the fixed salary is nil, this requires that  $M$ 's equilibrium wage is at least  $c_M$ . To solve (ii), the shareholders should increase  $\alpha_{M1}/\alpha_{M2}$  if they prefer overreporting or decrease  $\alpha_{M1}/\alpha_{M2}$  otherwise. In particular, the shareholders can choose to discourage earnings manipulation by setting  $\alpha_{M1} = 0$ . In this case (4) does not hold, so  $M$  reports truthfully. Shareholders set  $\alpha_{M2} = c_M/V_1^*$  and receive the following payoff:

$$\alpha_{S2}V_2^* + (1 - \alpha_{M1} - \alpha_{M2} - \alpha_{S2})V_1^* = V_1^* - c_M.$$

Shareholders benefit from misreporting if  $\tilde{V}_1 - V_1^*$  is sufficiently large, and  $\alpha_{S2}$  is small. That is, even though manipulation reduces the long-term value ( $\tilde{V}_2 < V_2^*$ ), shareholders may be mostly interested in selling to the overconfident investors in the short-term at a higher price  $\tilde{V}_1$ .

Using (7) and (9) we can check when this is possible:

$$\tilde{V}_1 - V_1^* = (1 - \tilde{e}^2) + 2\tilde{e}^2 \frac{\alpha_{M1} - \alpha_{M2}C_1}{\alpha_{M1} + \alpha_{M2}} + 2\sigma [\tilde{e}c'(\tilde{e}) - e^*c'(e^*)].$$

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<sup>11</sup>It is crucial that  $M$  cannot boost earnings in the high states by as much as in the low states. Investors are overconfident but not stupid. They know that  $y > 2$  can never occur. This is certainly an implication of the specific setup but the underlying logic extends to more general settings as well. We discuss this further in Section III. H.

The first two terms are benefits of manipulation while the last term is the loss owing to lower incentives ( $\tilde{e} < e^*$ ). For some parameter values  $\tilde{V}_1 - V_1^*$  is positive, so earnings manipulation occurs in equilibrium if the market is sufficiently overconfident.

**Proposition 1** *There exists  $\bar{\alpha} \geq 0$  such that for all  $\alpha_{S2} \leq \bar{\alpha}$  the equilibrium involves earnings manipulation. The threshold level  $\bar{\alpha}$  (weakly) decreases in  $\gamma$  and  $C_1$ .*

As we already mentioned, higher  $\alpha_{S2}$  is tantamount to longer-term orientation of initial shareholders, and to a lower share of uninformed outside investors. Proposition 1 implies that earnings manipulation is more likely to occur if initial shareholders are more short-term-oriented, if there are many overconfident investors around, and if the costs of earnings manipulation are not too high. It is also worth noting that earning manipulation occurs when the bargaining power of division managers,  $\gamma$ , is low. In particular, if there is no internal incentive cost of earnings manipulation ( $\gamma = 0$ ), earnings manipulation is more likely to improve  $S$ 's welfare, especially if the shareholders want to sell all the shares as soon as possible (low  $\alpha_{S2}$ ) and/or negative long-term consequences  $C_1$  of earnings manipulations are low. It is interesting that even if the direct cost of manipulation  $C_1$  is small or nil, the implicit cost of distorted incentives may be sufficiently large to make shareholders prefer no earnings manipulation as the Example shows.

**Example 1** *Suppose  $c(e) = e^2/2$ ,  $\gamma = 0.5$ ,  $C_1 = 0.3$ ,  $c_M = 0.1$ . Shareholders  $S$  can choose between two options:*

- (i) *To discourage earnings manipulation and to provide  $M$  with long-term incentives only ( $\alpha_{M1} = 0, \alpha_{M2} = 0.2$ ). Then, each division manager's effort is  $e_i^* = 0.5$  and the market value is  $V_1^* = V_2^* = 0.5$ . The CEO receives a payoff of 0.1, and  $S$  receives 0.4.*
- (ii) *To provide  $M$  with short-term incentives. The optimal contract is independent of  $\alpha_{S2}$  and involves  $\alpha_{M1} = 0.078, \alpha_{M2} = 0$ . Then effort is lower  $\tilde{e} = 0.31$ , and the market values in short- and long-term differ:  $\tilde{V}_1 = 1.287, \tilde{V}_2 = 0.083$ . Shareholders receive  $\tilde{V}_1(1 - \alpha_{M1} - \alpha_{M2}) - (\tilde{V}_1 - \tilde{V}_2)\alpha_{S2} = 1.187 - 1.204\alpha_{S2}$ .*

*Comparing  $S$ 's payoffs with and without earnings manipulation we find that  $S$  will prefer earnings manipulation whenever  $\alpha_{S2} < \bar{\alpha} = 0.65$ .*

*If  $C_1 = 0$ , then  $\bar{\alpha}$  increases to 0.87. Hence, even if the direct costs of manipulation are nil, the implicit cost of distorted incentives makes shareholders prefer long-term incentives whenever  $\alpha_{S2} \in (0.87, 1)$ .*

The analysis above shows the role of CEO's effort  $E$ . If the effort cost  $c_M$  is very low, then CEO's total incentives  $\alpha_{M1} + \alpha_{M2}$  are very small: it does not payoff for shareholders to motivate the manager. However, changes in  $c_M$  do not directly affect incentives to manipulate earnings. These incentives depend on relative importance of short-term and long-term compensation  $\alpha_{M1}/\alpha_{M2}$  rather than on the total equity stake  $\alpha_{M1} + \alpha_{M2}$ .

## G Silencing potential whistle-blowers: alternative instruments

In the model, potential whistle-blowers are silenced after the fact, through a bribe from top management. There are other, equally effective and probably more realistic ways to silence potential whistle-blowers. First, top management can align the contractual incentives of division managers with their incentives by offering division managers a renegotiation-proof contract signed *ex ante*:

“The division's compensation is a sum of (i) a bonus contingent on the division performance  $y_i$  and (ii) a bonus contingent on the short-term stock price. The former is  $w_1 - \tilde{w}_0$  whenever the division's output is high ( $y_i = 1$ ), and 0 otherwise. The latter is  $\tilde{w}_0$  if the short-term price is high (based on  $x = 2$ ), and 0 otherwise.”

It is straightforward that this contract involves the same outcome as the *interim* bargaining game we have analyzed before. This contract gives employees short-term incentives contingent on *reported* earnings. It is important that these short-term incentives emerge endogenously:  $M$  makes division managers accomplices by aligning their incentives not to tell the truth to the public in a way similar as the initial shareholders do with  $M$ . Put differently, the potentially harmful short-term incentives propagate through the hierarchy.

Top management can use incentive contracts, or short-term stock grants and options to align the incentives of insiders. Our theory therefore provides an explanation for provision of stock-based incentives for middle- and lower-level managers. While Oyer (2004) finds that this was for reasons of retention of employees, Jensen and Murphy (2005, page 37) have another explanation. They argue that it was the incorrect belief among board members and executives that options were a low-cost compensation strategy that triggered widespread use within companies. This argument makes sense for the compensation of CEOs, who may be able to convince their board about options being a cheap compensation method, but it seems less compelling in the case of lower-level employees. These have no influence on compensation committees and should find it hard to convince their CEOs that options have less costs than other compensation methods.

A second way top managers can avoid bargaining at the *interim* stage is by promoting potential whistle-blowers to better jobs. This has similar consequences on internal efficiency. To see this, consider a model of adverse selection in which the probability of a division to produce high output depends on the type of the manager. In the absence of the whistle-blowing threat, output is an informative signal about the type, and bad managers get promoted only if they are lucky. However, it is exactly the bad managers who more often have the information needed to blow the whistle. If they are silenced through promotion, the internal labor market's capacity to screen managers is reduced, with similar consequences on productivity as in the moral hazard model we have laid out above.

Finally, top management may decide to monitor division managers less intensively in order to prevent them from blowing the whistle. It is an empirical fact that manipulations happen on many levels in firms (see Leone et al, 1999). In the light of our model, top management may actually be willing to allow misconduct at the division level, as it is an efficient protection against the threat of whistle-blowing. A division manager who lies or steals cannot credibly threaten to blow the whistle on the CEO. Otherwise, she would reveal her own wrong-doing. Therefore, the CEO can align incentives within the hierarchy by exerting less monitoring effort. Earnings manipulation then has the additional cost of more diversion of company revenues in equilibrium. The above can be readily modelled, but does not offer additional insights compared to our model in which only the CEO can cheat and the efficiency losses are measured in terms of weaker incentives.

## **H Robustness**

We here discuss alternative modelling strategies some of which we have referred to before. They concern i) pooling between good and bad firms, rather than overconfident investors, ii) the observability of wages by shareholders, iii) the costs of earnings manipulation, iv) technology and the generation of evidence on earnings manipulation, v) ownership structure and allocation of bargaining power.

*i) Overconfident shareholders:* The Proposition and the example illustrate why our theory does not have to rely on the assumption that some shareholders are overconfident. Notice first that earnings manipulation may or may not occur in equilibrium depending on the parameters. Suppose then that investors are rational but uninformed, and that there is continuum of heterogeneous firms. Then, exactly as in Bebchuk and Bar-Gill (2003) or Povel et al. (2004), the equilibrium may involve partial pooling of firms. In the Appendix, we discuss a simple model that describes the equilibria with over-reporting. Investors reward good reports, but they do not buy them at face value. The

most successful firms truthfully report high profits. The intermediate firms may want to pool with the best firms via overreporting. As manipulation is costly, the least productive firms over-report only by a limited amount and do not catch up with the best firms' reports. While investors rationally expect over-reporting, they will also know that the firms with good reports (i.e. best and intermediate) are still on average better than the firms with worse reports (the worst firms). In this setting, our results obtain.

*ii) Observability of wages by shareholders:* We have assumed that outside investors observe wages but cannot infer whether or not earnings have been manipulated. This may appear an extreme assumption, but it is not crucial for our results. Suppose that outside investors would indeed infer from observing certain wages that earnings manipulation has occurred and that division managers have been bribed. Then top management could decide to pay only two wages: nil in case there is low output and no credible threat to blow the whistle, and some other wage if either the division has performed well or when it has a whistle-blowing threat. Notice that this would not destroy incentives entirely, because the division managers still do better *ex post* with a high rather than with a low output (as they receive a wage of nil in case they have both produced an output of nil).

*iii) Costs of manipulation:* We have solved the model taking  $C_2$  to be prohibitively high. This ruled out a situation where the manager reports  $x = 2$  even though the true state is  $y = 0$ . In this case, the cost of earnings manipulation is even higher. First, the firm bears a long-term cost  $C_2$ . Second, the manager has to negotiate with *both* divisions since either of them can blow the whistle. Therefore the CEO gets to keep a smaller share of the surplus. Indeed, as there is no side-contracting, each division bargains with  $M$  separately. The share of  $A$ ,  $\xi^A$ , is  $\gamma$  per cent of the joint surplus of coalition  $M, A$ :  $\xi^A = \gamma(1 - \xi^B)$ . Similarly,  $\xi^B = \gamma(1 - \xi^A)$ , hence  $\xi^A = \xi^B = \gamma/(1 + \gamma)$ , so  $M$  only keeps  $1 - 2\gamma/(1 + \gamma) = (1 - \gamma)/(1 + \gamma)$  per cent of the surplus which is below  $1 - \gamma$ .<sup>12</sup>

*iv) Technology and evidence on manipulation:* We have assumed that there is no coordination between division managers and that in some states of the world, a division manager may gain, costlessly, evidence about manipulation. We have looked at a more general model<sup>13</sup> in which output is continuous and division managers do not automatically obtain hard information on earnings manipulation. Rather, they have to pay a cost to learn the aggregate output, for instance, by inquiring about the true earnings with their colleagues. In this model of costly state verification,

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<sup>12</sup> A similar effect is present in Aubert et al (2005) who look at whistle-blowing in cartels.

<sup>13</sup> Formal setup and proofs of results are available upon request.

the incentives of division managers to generate evidence on earnings manipulation are inversely related to their individual performance. Each division observes its own output. Whether divisions' outputs are correlated (because of a common shock) or independently distributed, each division's output is by definition correlated with aggregate performance. Given the reported earnings, the division can infer the expected level of overreporting (based on her own individual performance) and decide whether it would like to pay the cost of checking out the aggregate performance and holding up the CEO. The higher the reported earnings, the higher the returns to inquiring. On the other hand, given the report, the higher the individual performance, the higher the expected aggregate performance, and the lower the incentives to find out. Therefore the better performing divisions will prefer not to inquire, while the failing divisions will certainly check out aggregate performance. Hence, our main argument holds: it is rather the underperforming divisions that threaten to blow the whistle, which results in weaker incentives in the firm.

*v) Ownership structure and bargaining power:* We have assumed above that the initial owners behave as a single principal. Allowing for ownership dispersion would have two implications for our analysis. First, if ownership is completely dispersed, it is hard to justify any positive long-term shareholding by original owners. Indeed, if original investors are atomistic, they will prefer cashing in short-term returns rather than holding a long-term stake for control or other non-pecuniary benefits, so  $\alpha_{S2} = 0$ . It hence follows from our theory that corporations with dispersed ownership are more likely to be involved in earnings manipulation. Second, we have ruled out *interim* renegotiation between CEO and initial investors. Even if this involves a cost for himself, a CEO can threaten original shareholders with disclosing true information and undermining their short-term payoffs. If the CEO had some bargaining power *vs.* owners, such renegotiation could bring him additional benefits. Thus our analysis above assumes implicitly that owners have all the bargaining power or, alternatively, that there is complete ownership dispersion, which would make such interim renegotiation very costly. Consider the case where the CEO has some bargaining power and owners can coordinate their reactions to the CEO's offers (e.g. via Board representation). Then the CEO may be able to negotiate an additional share of joint surplus on top of  $\alpha_{M1}$ . Hence, in equilibrium, the incentives to manipulate earnings will increase in the CEO's bargaining power.

## IV Extensions

### A Organisational structure

Our analysis also contributes to the literature on the advantages of steep *vs* flat hierarchical structures. Early research studied optimal information processing (e.g. Radner, 1993), more recent work has emphasized the trade-off between incentives and loss of control in settings.<sup>14</sup> Our model can be readily extended to show that management’s incentives to manipulate earnings are stronger in a flat hierarchy.

Suppose that the firm consists of four production units. Then if the hierarchy is flat, the CEO faces no threat of whistle-blowing when he reports a total output of  $x = 3$ , even if the true value is nil – neither division has enough information to challenge the report. Consider now the case of a steep hierarchy with two intermediate supervisors, each in charge of two units. In a steep hierarchy, if each division fails, the CEO has to pay the potential whistle-blowers for any report above  $x = 2$ .

This result holds in the more general setting considered in Section III.G (iv). Again, suppose that there four units and each can learn output of others at a cost. If the hierarchy is flat and each unit reports directly to  $M$ , each unit knows that it observes only 1/4 of aggregate output. Hence, there may be not enough ground to undertake the cost of learning other divisions’ performance. In a nutshell, in this flat hierarchy, there is a coordination failure that allows the management to appropriate all the surplus without sharing with the subordinates. This effect is similar to Rajan and Zingales (2001) where flat hierarchies allow the management to ‘divide and conquer’ in order to establish control and appropriate a larger share of (quasi-)rents.

Consider now the steeper hierarchy with two intermediate supervisors, each in charge of 2 lower-level units. Here, each of the supervisors observe 1/2 of the firm’s business. Therefore if the supervisor knows that his divisions failed, learn about the other divisions’ output is more likely to pay off. Hence,  $M$ ’s costs of earnings manipulation are higher. Effectively, the intermediate supervisors aggregate information and overcome the coordination failure among subordinates. Here, the supervisors provide checks and balances on  $M$ ’s urge to inflate earnings – they play the role of internal gatekeepers (Jensen, 2004). Notice also that the other effect – propagation of weak incentives through the hierarchy – makes earnings manipulation more expensive in steeper hierarchies.

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<sup>14</sup>Qian (1994) builds a model where this trade-off determines the optimal structure of the hierarchy. Aghion and Tirole (1997) show how the formal structure of the hierarchy (span of control) affects real authority. Rajan and Zingales (2001) show that the choice of structure may be driven by appropriability considerations. Flat hierarchies should be expected to perform better in human capital intensive industries, while firms in industries with more physical assets should be organized as steeper hierarchies.

Indeed, the more layers of potential agency costs, the greater the ultimate incentive distortion at the level of production units. Also, the costs of finding out the aggregate performance certainly increase with the number of CEO's subordinates (see III.H, point iv). The smaller each division, the more costly for its manager to learn the aggregate performance in a flatter hierarchy.

The above points are consistent with *Enron's* strategy to foster the new corporate culture of 'entrepreneurial' corporation. *Enron's* CEO Jeff Skilling wanted to empower human capital via flatter hierarchies and was "openly scornful of steady, asset-based businesses" (Maclean and Elkind, 2003). As Rajan and Wulf (2003) show, *Enron* was certainly not the only firm that made its hierarchy flatter. However, for many human resource management gurus, *Enron* was a role model (Michaels et al., 2001). While it is hard to deny the benefits of flatter structures, our theory suggests that this flattening has created more scope for earnings manipulation.

Our analysis is also relevant for organizational structure of clandestine hierarchies such as espionage networks or organized crime. In these cases the hierarchy is designed to minimize the risk of leaking sensitive information to outsiders. Each division manager should only be informed about her own unit even if potential benefits of horizontal cooperation were large. Thus leakage results in lower damage; moreover as the whistle-blower would be able to deliver less valuable information to the outsiders, they have lower returns to whistle-blowing.

*Dynamic extensions.* In a dynamic setting, manager's incentives to manipulate earnings depend on his previous choices. Jensen (2004) suggests that overvalued equity can have the effect of a "managerial heroin". A manager who inflated earnings today may have to overreport even more tomorrow to cover up today's manipulation. Essentially, managers can embark on the gambling-for-resurrection strategy, increasing overreporting over time and hoping for a miracle (a "Big Enchilada", in *Enron's* internal jargon) to rescue the company. Our model helps to understand the internal life of an "addicted" company. As top management engages in more and more manipulation, they have to compensate subordinates for not blowing the whistle. The amount of compensation grows over time (as potential disclosure becomes more costly for the manager). Since this compensation suppresses incentives to exert effort and therefore destroys value, the manager's need for manipulation grows even faster. In other words, once the internal hierarchy is explicitly modeled, the addiction to "managerial heroin" is even more irreversible than it would seem.

## B Sarbanes-Oxley and earnings manipulation

The *Sarbanes-Oxley Act* of 2002 has introduced a number of new regulations concerning the corporate governance of publicly listed companies. The ultimate goals of the Act are to restore investor confidence by increasing corporate transparency. The Act regulates the compensation of top management in order to avoid short-termism; it requires higher monitoring standards; and it increases the responsibilities of managers and auditors for corporate transparency. It also imposes stricter penalties in the case of misconduct of managers and auditors. As there are many good discussions of the *Sarbanes-Oxley Act* (e.g. Holmstrom and Kaplan, 2003), we here only discuss a small number of implications that are directly related to our theoretical analysis. They concern whistle-blowing and the effects of better auditing on earnings management and incentives in firms.

### B.1 Whistle-blowing

The *Sarbanes-Oxley Act* entails a number of prescriptions that are supposed to make whistle-blowing easier and less risky for the whistle-blower.<sup>15</sup> In particular, Sec. 806 increases protection for employees who provide evidence about violations of regulations of the Securities and Exchange Commission or other regulations relating to fraud against shareholders. We can readily extend the setting of the model to investigate the potential effects of decreasing costs and better protection for whistle-blowers.

In principle, whistle-blowing may both have costs *ex ante* (preparing the evidence) and *ex post*. We believe the *ex ante* costs to be small: the evidence needed to blow the whistle may accumulate more or less as a side product of day-to-day work. Whistle-blowers may, however, fear the *ex post* costs of lost reputation if they erroneously blow the whistle, or the costs associated with retaliation by top management. Sarbanes-Oxley makes the threatpoint of potential whistle-blowers who bargain with top management more attractive. Hence, top management appropriates a smaller share of the surplus. The mere risk of whistle-blowing decreases top management's incentives to manipulate earnings. The welfare effect is not clear: while earnings manipulation becomes less widespread, it is, when it occurs, more costly, as more value is destroyed.

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<sup>15</sup>See Block and Hoff (2003) for a summary.

## B.2 Auditing

Auditors play an important role whenever there is a separation of ownership and control. They constitute an important interface between what happens within the firm and outside investors. If auditors do their job well, investors are subject to less risks of earnings manipulation, but global corporate scandals have shed doubt on the trustworthiness of auditors. The *Sarbanes-Oxley Act* strengthens auditor independence and makes it harder to strike side deals (Section 201); auditors are not allowed to provide consulting services to their clients. It requires higher quality standards of auditing, and imposes new and more effective sanctions against auditors that fail to supervise their clients, both “intentionally or in repeated instances of negligent conduct, resulting in a violation of the applicable statutory, regulatory, or professional standard” (Sec. 105.) These changes may indeed increase the effort of auditors and, in turn, improve incentives within the firm.

This becomes clear from the following modified framework of our model. Prior to the bargaining stage between CEO and division managers, an auditor receives the report that CEO plans to send to investors. The auditor either rubberstamps it or checks whether division outputs are in line with the report. Presume that the auditor learns the true division output with some probability and that this probability is concave in the auditor’s effort, which is unobservable. Hence the auditor may shirk, and just cash in the auditing fee without doing their job. At the end of the second period, the true value of the firm is revealed. This allows imperfect inference on whether there has been earnings manipulation in the first period; even an auditor who exerts high effort, may be unlucky and learn nothing. Clearly, when penalties are more severe, auditors have better incentives to monitor. Furthermore, when the effort of auditors increases, the odds to penalize an innocent auditor decrease. Hence, higher quality standards and harsher penalties reinforce each other. This also implies that, *ceteris paribus*, the costs of auditing increase, a point that has been made before, for instance, by Holmstrom and Kaplan (2003) and by practitioners.<sup>16</sup> Higher auditor effort can increase the incentives in the firm. If the auditor exerts high effort and learns the true output, he joins the bargaining table between top management and the division manager. But, as we discussed above (see III.H), it becomes more likely that bargaining collapses when there is an additional party

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<sup>16</sup>According to a study reported in CFO Magazine (2004b), “compliance costs of going public for smaller firms with annual revenue under \$1 billion climbed from \$1.24 million before the passage of Sarbanes-Oxley to \$2.13 million in 2002 and \$2.86 million in 2003.” It is beyond the scope of our paper to evaluate whether or not the improvements in transparency and corporate governance are worth this price. A complete welfare analysis should include among others the implication for the market for human capital. As firms that manipulate earnings offer higher compensation, they are able to attract better talent (‘guys with spikes’, as Enron’s CEO used to put it). As the talent is not used efficiently, this reduces aggregate labor productivity in the economy.

that needs to be pacified. In that case, the auditor will always be interested in reporting earnings manipulation to the outside world in order to avoid being penalized. Beyond the simple fact that an informed auditor adds an additional person to the bargaining problem, auditors will demand a higher bribe than division managers because of the very fact that they can be penalized by law (while this may be harder to do in the case for division managers) and because the side payments to auditors are now more costly.

Thus, we can expect that Sarbanes-Oxley increases auditor effort both through its higher quality standards and harsher penalties that reinforce each other, and by inducing collapse of bargaining between informed insider parties, which in turn reduces returns to earnings manipulation and leads to better information for outside parties. However, we should also expect an increase in regulatory burden so the net welfare effects are not clear.

## V Concluding remarks

Earnings manipulation does not only redistribute value and raises the cost of capital; it also destroys value. Whenever a CEO has short-term incentives and inflates earnings, there is a risk of whistleblowing. Hence, top management may have to share with subordinates to reduce the risk of information leakage to the outside world. This may take a form of bargaining over a monetary or non-pecuniary bribe, like promotions, or propagation of short-term incentives throughout the hierarchies. As the subordinates are more likely to obtain sensitive information when their own performance is low, earnings manipulations distort internal incentives.

The model has a number of implications on regulatory design and the structure of organisations. In particular, we show that earnings manipulation is easier to undertake in flat hierarchies. If top management supervises many units, each unit has too little information to threaten blowing the whistle. If there is a steeper hierarchy with fewer middle level managers, they aggregate information across their subordinates and can serve as internal gatekeepers for the fraudulent management. In equilibrium, top management may then decide not to manipulate earnings, as the returns to this behavior are too low when the surplus must be shared with other insiders. Hence, while flatter hierarchies may have many benefits that are outside of the scope of our theory, we show that they come at the cost of making it harder for insiders to blow the whistle on corporate fraud.

## Appendix: Earnings manipulation with rational investors

We here provide a sketch of a model of earnings manipulation with rational investors along the lines of Stein (1989), Bebchuk and Bar-Gill (2003) and Povel et al. (2004). The analysis below shows that even when investors have rational expectations, managers may have incentives to manipulate earnings and this in turn weakens incentives for the division managers.

The reporting technology is as follows. If the CEO overreports (i.e. reports  $x = 2$  when  $y = 1$ ), the investors learn the true state only with probability  $1 - \delta$ . This feature is present in both Povel et al. and Bebchuk and Bar-Gill (we use the latter's notation, in the former paper, it is  $1 - \lambda$  instead of  $\delta$ ). In Povel et al.,  $1 - \delta$  is the endogenous probability of monitoring by investors. At a cost  $m$ , they investigate and learn the true value of the company. In the most interesting equilibrium, the probability of monitoring is between 0 and 1. It is important for their results that investors hold bargaining power, otherwise the free-rider problem would destroy incentives to monitor. In Bebchuk and Bar-Gill (2003),  $\delta$  is also endogenous depending on ex ante investment in earnings manipulation technology by the management. For our results below, it is crucial that  $\delta$  is positive.

The investors value each outcome  $y = 0, 1, 2$  at  $v_y = y - w_y$ , where  $w_y$  is the equilibrium wage bill. The investors calculate the choice of effort  $e$  by each division in (a symmetric) equilibrium, and therefore can calculate the probabilities of the three outcomes  $y = 0, 1, 2$  ( $(1 - e)^2$ ,  $2e(1 - e)$ , and  $e^2$ , respectively).

Introduce  $\phi_y \in [0, 1]$ , the probability of overreporting in the state  $y$ . If  $y = 1$ , the CEO reports  $x = 2$  with probability  $\phi_1$ , and reports the true value  $x = y = 1$  with probability  $1 - \phi_1$ . If  $y = 0$ , the CEO reports  $x = 1$  with probability  $\phi_0$ , and reports the true value  $x = 0$  with probability  $1 - \phi_0$ . As above we assume that overreporting by 2 units is too costly.

Assuming equilibrium probability of manipulation  $\phi_y$ , we can calculate the equilibrium beliefs of the investors. With probability  $1 - \delta$  the investors learn the true outcome, with probability  $\delta$  they only observe  $x$  and calculate the expected value of the firm  $\bar{v}_x$  :

$$\bar{v}_2 = \frac{e^2 v_2 + 2e(1 - e)\phi_1 v_1}{e^2 + 2e(1 - e)\phi_1}; \bar{v}_1 = \frac{(1 - e)^2 \phi_0 v_0 + 2e(1 - e)(1 - \phi_1)v_1}{(1 - e)^2 \phi_0 + 2e(1 - e)(1 - \phi_1)}; \bar{v}_0 = v_0.$$

Once the outcome  $y$  is realized, the CEO rationally expects the values of  $\bar{v}_x$  above and solves

$$\phi_y \in \arg \max_{\phi \in [0,1]} \{(\alpha_{M1} + \alpha_{M2}) v_y + \phi [\alpha_{M1} \delta (\bar{v}_x - v_y) - \alpha_{M2} C_{x-y}]\}$$

In particular, consider the case  $y = 1$ . The equilibrium in the overreporting subgame is as follows:

$$\phi_1 = \begin{cases} 1, & \text{if } \alpha_{M1} \delta \frac{e^2(v_2 - v_1)}{e^2 + 2e(1-e)} > \alpha_{M2} C_1; \\ 0, & \text{if } \alpha_{M1} \delta (v_2 - v_1) < \alpha_{M2} C_1; \\ \frac{e}{2(1-e)} \left( \frac{\alpha_{M1} \delta (v_2 - v_1)}{\alpha_{M2} C_1} - 1 \right) \in [0, 1], & \text{otherwise.} \end{cases}$$

Similarly,

$$\phi_0 = \begin{cases} 1, & \text{if } \alpha_{M1} \delta \frac{2e(1-e)(1-\phi_1)(v_1 - v_0)}{(1-e)^2 + 2e(1-e)(1-\phi_1)} > \alpha_{M2} C_1; \\ 0, & \text{if } \alpha_{M1} \delta (v_1 - v_0) < \alpha_{M2} C_1; \\ \frac{2e(1-\phi_1)}{(1-e)} \left( \frac{\alpha_{M1} \delta (v_1 - v_0)}{\alpha_{M2} C_1} - 1 \right) \in [0, 1], & \text{otherwise.} \end{cases}$$

As in our initial model, the original shareholders can provide the CEO with incentives to manipulate the earnings or to report truthfully by choosing high or low  $\alpha_{M1}/\alpha_{M2}$ , respectively. If the  $\alpha_{M1}/\alpha_{M2}$  is sufficiently high, the division managers expect overreporting and know that they will be receive a piece of CEO's returns to overreporting when they fail. Hence the effect described above holds; the earnings manipulation reduces incentives to exert effort.

Indeed, we can reproduce the analysis of Section III for the equilibrium with  $\phi_1 = 1$ . In this case,  $v_2 = 2 - w_1 - \tilde{w}_0$ ,  $v_1 = 1 - w_1 - \tilde{w}_0$ . Compensation  $\tilde{w}_0$  to the potential whistle-blower is to provide the latter with  $\gamma$  per cent of the joint surplus. The CEO's returns to overreporting are  $\alpha_{M1} \delta \frac{e^2(v_2 - v_1)}{e^2 + 2e(1-e)}$ ; at the same time, the compensation costs him  $(\alpha_{M1} + \alpha_{M2}) \tilde{w}_0$ . Hence

$$\tilde{w}_0 = \frac{\gamma \alpha_{M1}}{1 - \gamma(1 - \alpha_{M1} - \alpha_{M2})} \times \delta \times \frac{e^2}{e^2 + 2e(1-e)}$$

which is similar to (3) except for the factor  $\delta$  (probability of investors' failure to monitor) and the last term which is the rational investors' belief of  $y = 2$  given that they observe  $x = 1$ . The former is an exogenous parameter introduced to relate our model to those of Povel et al and Bebchuk and Bar-Gill. The latter reflects the rationality of investors. In our main model investors are overconfident and believe the reports; once they are rational, they update their beliefs and discount the positive reports according to Bayes rule.

The remaining analysis goes through. A positive  $\tilde{w}_0$  weakens the divisions' incentives: (5) still holds.

For simplicity, we here do not complete the analysis of equilibria. The latter is very involved as

we need to study mixed strategies  $\phi_{0,1}$  for all constellations of parameters. With rational investors, the mixed strategy equilibria are quite essential. Suppose that  $\alpha_{S2}$  is very low, and the original shareholders want to encourage earnings manipulation to inflate share prices in the short-run. When choosing the incentives for the management  $\alpha_{M1}/\alpha_{M2}$ , they may actually prefer an equilibrium with  $\phi_1 < 1$  to the one with  $\phi_1 = 1$ . Indeed, as investors are rational,  $\phi_1 = 1$  implies  $\phi_0 = 0$ . If the investors expect all firms with intermediate output  $y = 1$  to report high output  $x = 2$ , they know that firms reporting intermediate output  $x = 1$  must be the ones with very low output  $y = 0$ . Therefore, firms with  $y = 0$  cannot fool anybody. This is why original shareholders may prefer certain overreporting in both low and intermediate states to substantial overreporting in the intermediate state only.

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