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WHISTLE-BLOWING AND INCENTIVES IN FIRMS

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Whistle-blowing is an important mechanism of corporate governance. We show that whistle-blowing has negative effects on productive efficiency by undermining the incentives within a corporate hierarchy. In our model, a top manager intends to overreport earnings; a division manager may have evidence about the intended overreporting. We show that the division manager is more likely to have such evidence when the performance of his own division is low. Top management may offer a bribe to prevent the manager from blowing the whistle. This provides the division manager with an additional payoff when his division's output is low. Therefore, potential whistle-blowing undermines the division manager's incentives to exert effort, which results in a less efficient outcome.

1. INTRODUCTION

Corporate governance is a set of mechanisms supposed to resolve collective action problems in corporations and to provide incentives to corporate managers. Although the corporate governance literature has extensively analyzed interactions between outsiders and top managers, the role of lower level insiders in corporate governance has been somewhat neglected. This is surprising as insiders have detailed knowledge about the firm they work in and can hence be a crucial source of information for the outside world about corporate wrongdoing. We

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present a theory of whistle-blowing, that is, information disclosure by lower level insiders. Our theory focuses on the case of earnings manipulation, a widespread phenomenon.¹ Whistle-blowing has the appealing feature of providing owners of capital with information that makes them less vulnerable against the wrongdoing of better informed but potentially fraudulent managers.

Dyck et al. (2007) find that employees have indeed been the single most important group for revealing corporate scandals. The investigations of former New York State Attorney General Elliot Spitzer against investment firms were triggered by a whistle-blower who informed Spitzer that her fellow employees were engaging in late trading (Peterson, 2010). Some whistle-blowers have become celebrities and even “Persons of the Year” of *Time Magazine* (2002). Regulators included a special section on protection of corporate whistle-blowers in the Sarbanes–Oxley Act. Luigi Zingales suggested in an influential article published in the *Washington Post* (2004) that whistle-blowers should receive a 10% cut from the fines collected from fraudulent corporations.²

We here show that although whistle-blowing is an important instrument for protecting investors against corporate fraud, it may come at the cost of lower productive efficiency. We argue that whistle-blowing undermines incentives inside corporate hierarchies.³ In our model, the top management of a corporation intends to overreport earnings. A lower level insider, say, a division manager, can prove earnings manipulation. Top management may offer a bribe to prevent information leakage. The prospect of receiving this bribe distorts the division manager’s incentives to work carefully *ex ante*. (Importantly, we do not doubt that in places like *Enron* employees were working long and often hectic hours, but it seems that they were often lacking the effort and care to make their decisions sound.) In our theory, division managers are more likely to know about earnings manipulation when

1. Earnings manipulation goes beyond household names such as *Enron*, *Tyco*, *World-Com* (in the United States) 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 5 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).

2. This would be tantamount to extending to the private sector the stipulations of the False Claim Act according to which people blowing the whistle on fraudulent contractors have helped to save billions for the government, whereas many whistle-blowers have received two digit million US dollar bonuses. For a wide array of cases, see <http://www.whistleblowersblog.org/articles>.

3. Frivolous whistle-blowing is another risk, but is usually taken care of by putting the burden of proof on the whistle-blower.

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3 their own division has underperformed; in this case the low output
4 of their own division is not consistent with the high earnings that top
5 management plans to report. The possibility of whistle-blowing, then,
6 reduces the wedge between division manager's payoffs in the case of
7 high and low performance, which undermines the incentives for careful
8 work.

9 This theory implies that making whistle-blowing easier or more
10 rewarding, e.g., through regulatory reforms or by providing a bonus
11 for whistle-blowers, may have counterproductive effects. We show that
12 effort incentives will be the weaker, the more bargaining power the
13 division manager has when negotiating with top management. Hence,
14 unless the bonus offered to the whistle-blower by society is so large
15 that top management will not be able to bribe him, effort incentives will
16 suffer.

17 Our theory thus also adds to explaining the puzzle of why many
18 firms provide middle managers with stock options in times of booms
19 (see Jensen et al., 2004; and Oyer and Schaefer, 2005, who find evidence
20 that stock options can be helpful for retention of talent). Applying our
21 logic, top management may not want to solve the problem *ex post* at
22 the bargaining table, but can nullify the incentives of potential whistle-
23 blowers *ex ante* by providing lower level managers with short-term
24 incentives based on stock prices. This aligns insiders' incentives with
25 the ones of top managers and assures that sensitive information does
26 not reach the outside world.

27 The *Enron* case provides a useful illustration of our the-
28 ory. Earnings manipulation was widespread. CFO Andy Fastow
29 (backed by CEO Jeff Skilling) perceived his main task to be "arranging
30 structured finance" and using aggressive accounting to deliver high
31 quarterly earnings reports (McLean and Elkind, 2003, ch. 10).⁴ Healy
32 and Palepu (2003) document how earnings manipulation induced
33 *Enron* managers on many levels to take unfounded and excessively risky
34 decisions. Hence, despite talented staff and a profitable core business,
35 *Enron* ended up having its value wiped out (Maclean and Elkind, 2003;
36 Partnoy, 2002, 2003). *Enron's* top management had substantial equity
37 stakes or options, and equity stakes were widespread in lower levels of
38 the hierarchy as well. Top executives alone cashed stock options worth
39 35–250 million dollars each (McLean and Elkind, 2003); many insiders
40 kept selling their stock right up until the collapse and hence had little
41 incentives to communicate earnings truthfully.

42
43
44 4. The sheer scale of Fastow's activities is striking. Between 1997 and 2000, he created
45 about 3000 corporate entities, more than 800 of which were offshore (McLean and Elkind,
2003, p. 310).

Some of those who were benefiting less from the stock option bonanza considered blowing the whistle. The famous “smoking gun memo” by Vice President Sherron Watkins to Chairman Kenneth Lay opens with “Has *Enron* become a risky place to work? For those of us who *didn't get rich over the last few years*, can we afford to stay?” (Watkins, 2001, our italics.) Sherron Watkins was aware of the scale of *Enron's* earnings manipulation but she did not insist on disclosing it to the public; her memo did not reach the outside world until after the collapse (Ackman, 2002). Rather, after talking to Lay, Watkins asked to be transferred to the Human Resource department and “went back to her business which included selling her own [Enron] stock and keeping quiet again” (Curver, 2003, p. 293).

In Section 3, we provide some anecdotal evidence indicating that the people who had information about the true state of the firm were regularly bribed. In that section, we also discuss a number of implications and extensions, in particular, we ask to what extent the organizational structure may be a determinant of whistle-blowing. In recent times, organizations have become flatter (see Rajan and Wulf, 2006). When hierarchies are flatter, that is, top management's span of control increases, each division manager observes less of the total output of the firm. Less information about what is going on in the entire firm makes whistle-blowing less likely. *Enron's* CEO Jeffrey Skilling flattened hierarchies supposedly to foster the initiative of managers and create an entrepreneurial corporate culture. Our model would imply that this may have also reduced the accountability of top managers to the corporate insiders who could potentially blow the whistle.

Our theory builds on Tirole's (1986) collusion model and much of the related literature. We also look at a three-tier structure in which an agent has some hard information⁵ about another agent, which is valuable for a principal. However, we consider a reversed collusion problem: lower level insiders (the division managers) may learn some information about the behavior of their superiors, top management. This information can be leaked to the outside world. As the leakage may harm top managers, insiders can benefit from withholding this information. However, this distorts the insider's incentives to produce: even if output is low, she still gets paid—by top management who wants to avoid the leakage.

The model has a second building block—the earnings manipulation game between top managers and the outside world. There are two types of theories that explain why corporate managers benefit

5. That is, the information cannot be forged but can be suppressed. Under this assumption, we do not have to consider the case of frivolous whistle-blowing.

2
3 from earnings manipulation. One builds on short-sale constraints and
4 overconfident investors (Harrison and Kreps, 1978; Scheinkman and
5 Xiong, 2003; Bolton et al., 2006); the other is based on rational but
6 uninformed investors (Bebchuk and Bar-Gill, 2003; Povel et al., 2007;
7 Axelson and Baliga, 2009). We follow the latter approach, but a modified
8 framework with overconfident investors produces quite similar results
9 (these results are available on request, see also Friebe and Guriev, 2005).
10 What matters for our theory is that there is a mechanism which provides
11 the top managers with incentives to overreport—and to be afraid of the
12 disclosure of the truthful information.

13 There is a small related literature on whistle-blowing which has
14 been mainly descriptive (see, for instance, Miceli and Near, 1992), except
15 for Leppämäki (1998) who looks at whistle-blowing in the specific con-
16 text of bilateral monitoring, and for Friebe and Raith (2004). The main
17 difference compared to Friebe and Raith is that information disclosure
18 by a lower level insider does not provoke the higher level manager to
19 undertake costly defensive actions. Rather, collusion between the two
20 distorts the effort incentives of the lower level agent.

21 The paper is also related to the accounting literature, which
22 investigate the effects of firms' disclosure policies on efficiency (see
23 Verrecchia, 2001 for an overview). Our paper is different because it
24 looks at information disclosure by lower level insiders and how it affects
25 productive efficiency (rather than allocative efficiency).

26 Our prediction that a potential leakage of inside information is
27 prevented by profit sharing is not new in the literature on innovation
28 and unpatentable knowledge (see Anton and Yao, 1994; Bhattacharya
29 and Guriev, 2006; Baccara and Razin, 2007). Yet, it has not been explicitly
30 modeled in the framework of corporate governance. Our paper is
31 also related to the problem of leniency programs as a deterrence
32 device for cartels and other criminal associations, see, for instance,
33 Spagnolo (2000) and Aubert et al. (2006). We believe, however, that
34 the whistle-blowing problem we look at is more widespread as it
35 also concerns legal organizations. Furthermore, it looks at a complex
36 interplay between efficiency and whistle-blowing which is not present
37 in criminal organizations.

38 Landier et al. (2009) also study the role of insiders in corporate
39 governance. They show that a conflict of interest between different levels Q2
40 of a hierarchy may be efficient, because it can keep higher level managers
41 from choosing their own pet projects. The mechanism underlying their
42 theory is quite different from ours: a lower level manager may choose
43 not to implement orders, rather than deciding to communicate with
44 the outside world as in our paper. The empirical evidence in Landier
45 et al. (2005) —firms, in which executives had been in place before the Q3

CEO was appointed are more profitable—is both in line with their and with our explanation. Insiders with longer tenure in the firm will have better information and hence a more effective whistle-blowing threat; this, in turn, keeps managers from engaging in inefficient and opportunistic behavior. We see the two theories as complements in explaining the role of insiders as elements of the corporate governance system.⁶

The mechanism we are highlighting is also related to the literature on tax evasion (Desai, 2003). Here, managers tend to underreport rather than overreport their firms' earnings as in Desai and Dharmapala (2006). Our analysis suggests, however, that tax avoidance should not distort internal incentives, because management will underreport, not overreport earnings. Hence, the potential whistle-blowers would be the managers of the more successful rather than failing divisions; these divisions would then get a bonus on top of their official compensation and would be happy not to report the fraud.⁷

The scope of our whistle-blowing theory goes well beyond earnings manipulation. In many situations, insiders do have information about fraudulent behavior of their superiors, but they may be bribed through many instruments, which then dull their incentives to perform. One example is the development of new products, e.g., drugs. A firm's top management may be tempted to market a new drug with exaggerated promises; the insiders who may be best informed about the true value of the drug may be bribed through a promotion or a bonus. Whenever they anticipate such rewards for keeping quiet, they will work less hard on breakthroughs, just as in our theory. Insiders with information about dangers for the environment are in a similar situation. As it is difficult to build a one-size-fits-all model for such situations, we will throughout the paper phrase our theory in the language of earnings manipulation.

The paper proceeds as follows. In Section 2, we set up the model and derive the first result: when whistle-blowing is possible, earnings manipulation undermines incentives within the corporate hierarchy. In Section 3, we discuss the robustness of the main result and potential extensions of the basic model. Section 4 concludes.

6. Faure-Grimaud and Gromb (2004) study the role of large shareholders as insiders who provide information about a firm.

7. This is similar to the result of Chen and Chu (2005, Proposition 1) who show that 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. However, in our model the effort is always distorted downward, because the insiders learn more about the true state of the firm (or have higher incentives to learn about it) when they themselves have underperformed. In our model, managers are risk-neutral with limited liability.

2 **2. EARNINGS MANIPULATIONS AND INCENTIVES**3 **2.1 THE SETUP**

4
5
6 We consider a publicly traded firm that is owned by some initial
7 shareholders who control the CEO; in what follows, we will not
8 distinguish between interests of these agents and denote them as one
9 agent “F” (for “firm”). The firm considers selling shares to new investors
10 “I” (for “investors”).

11 We will also refer to F as the “manager” or “top management,”
12 because the model is relevant both where F is the manager–owner of a
13 firm with concentrated ownership and where F is a CEO of a firm with
14 dispersed ownership. In the latter case, the original shareholders can at
15 least partially provide the CEO with incentives to pursue their interests.

16 There is one division or worker W (for “worker”) who reports to F.
17 All agents are risk-neutral. The worker is liquidity-constrained and all
18 reservation payoffs are normalized to zero. Hence, the worker’s payoff
19 must be nonnegative.
20

21 **2.1.1 PRODUCTION AND MANIPULATION TECHNOLOGY**

22 The divisions’s output is either high $y = 1$ (with probability a) or low
23 $y = 0$ (with probability $1 - a$). For instance, through her effort a the
24 worker influences the quality of an investment project. The more care
25 she takes, the more likely, she identifies a good project. The cost of effort
26 is $c(a)$, an increasing and convex function.

27 Outside investors cannot observe the output y . Rather, they rely on
28 F’s report x , which may be truthful or manipulated. We assume that the
29 opportunity to overreport the earnings (i.e., report $x > y$) arises with an
30 exogenous probability π that is common knowledge. However, only F
31 knows whether the opportunity for manipulation is present. This setting
32 is tantamount to assuming that earnings manipulation is costly and that
33 the cost is either low (with probability π) or prohibitively high (with
34 probability $1 - \pi$). Costs of manipulating may include the labor cost of
35 adjusting the accounts, indictment risks, moral costs, etc.; the realization
36 of these costs is F’s private information. Using the language of Tirole
37 (1996), we label a firm that can manipulate earnings *opportunistic*, and
38 one that cannot *honest*.
39

40 **2.1.2 TIMING**

41 There are two dates: $t = 1$ (short run), and $t = 2$ (long run). In the
42 beginning of the first period $t = 1$, the firm F (original owners and the
43 CEO) holds 100% of its shares. We assume that F’s utility is like in
44 Diamond and Dybvig (1983): with probability θ , F only cares about
45 its consumption in period 1 and with probability $1 - \theta$ it cares only

about its consumption in period 2.⁸ In other words, the firm may be subject to a liquidity shock. The shock occurs with probability θ ; then, F must sell the shares in the first period. If the liquidity shock does not occur, the firm may sell its shares either in the first period or in the second period. We thus assume that cash is perfectly storable and that gross return on cash is normalized to 1. We assume that liquidity shock is independently distributed from the opportunity to manipulate the earnings and is the firm's private information.

Date $t = 1$ has several stages:

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- F offers W a contract $\{w_0, w_1\}$, that is, the schedule of wages contingent on the output: the worker is paid w_0 if $y_i = 0$ and w_1 if $y_i = 1$. If the worker turns the offer down, the game ends.
- W chooses effort level a ; output y is realized. F learns whether it can manipulate the earnings. F observes y , and prepares a report x on the firm's earnings.
- W observes the draft report x and decides whether to blow the whistle. W can also ask the manager to pay a silence fee for not whistle-blowing.
- The contracts between F and W are executed.
- Investors receive report x . They then calculate the value of the firm V_1 based on the available information, which determines the first-period stock price.
- F may or may not experience a liquidity shock. With probability θ , it sells all the shares in the first period; with probability $1 - \theta$ it may choose to hold the shares until the second period.

At $t = 2$, the true value y becomes public information. Market value V_2 is based on publicly observed y . There is no additional production. The firm is liquidated and all remaining shareholders receive their part of the true value, $V_2 = y$.

2.1.3 PAYOFFS AND INFORMATION

The payoff of F is the value of stock sold in the short- and in the long run $\theta V_1 + (1 - \theta)[\xi V_1 + (1 - \xi)V_2]$ net of payments to the worker. Here, $\xi \in [0, 1]$ is the share of equity sold in the first period by those insiders who do not experience a liquidity shock. Investors do not observe the liquidity shock. Therefore, when they see the sales of shares by insiders in the first period, they do not fully understand whether F sells the

8. Formally, with C_1, C_2 the consumption in periods 1 and 2, respectively, the utility function is

$$U(C_1, C_2) = \begin{cases} C_1, & \text{with probability } \theta \\ C_2, & \text{with probability } 1 - \theta. \end{cases}$$

stock to meet liquidity needs or to benefit from overvalued stock prices due to earnings manipulation. This is a setup similar to Axelson and Baliga (2009); our contribution lies in the focus of whistle-blowing and incentives within the hierarchy rather than incentives of top managers.

The worker maximizes the payments from the manager net of the effort cost $c(a)$. The worker's limited liability constraint $w_{0,1} \geq 0$ immediately implies $w_0 = 0$. Whenever the worker threatens to blow the whistle, her bargaining power versus the firm is γ .

We assume that if the worker blows the whistle, F loses all the short-run payoff V_1 but holds on to the long-run payoff V_2 . This assumption is made to simplify the analysis; alternative scenarios of punishing the manipulators give rise to similar results. Second, each worker only observes her output y and the report x . She therefore knows that the report is certainly manipulated if $y = 0$ and $x = 1$. An implication of our assumption that information is hard is that whistle-blowing only occurs if the worker can prove the wrongdoing by F.

2.2 BENCHMARK OUTCOMES

2.2.1 FIRST BEST

The socially optimal choice of effort solves $\max_a (a - c(a))$. The first-order condition is as follows:

$$c'(a_{FB}) = 1. \quad (1)$$

2.2.2 SECOND BEST

We here determine the effort level with moral hazard by the worker, but without earnings manipulation. When the firm always reports the truth (i.e., $\pi = 0$), F solves $\max_{w_1} [a(1 - w_1)]$ subject to the agent's incentive compatibility constraint $c'(a) = w_1$. We will denote this level of effort a_{SB} .

$$a_{SB} = \arg \max_a a(1 - c'(a)). \quad (2)$$

Monotone comparative statics directly imply $a_{SB} < a_{FB}$.

2.3 EQUILIBRIUM WITH EARNINGS MANIPULATION

In this section, we establish that earnings manipulation undermines incentives within the firm and hence obstructs value creation. We will solve for a Perfect Bayesian Equilibrium via backward induction. The setting above immediately implies four important features of the equilibrium. First, the contract $\{w_0, w_1\}$ does not depend on the firm's type as the firm learns its type after it offers the contract.

Second, when choosing her effort a the worker does not know the firm's type either. Hence, the effort a also does not depend on the firm's type.

Third, an opportunistic firm always manipulates earnings in equilibrium. Indeed, suppose that there is no manipulation in equilibrium $x = y$. Then, investors price the reported earnings at the face value $V_1 = x$. Let us consider the outcome $y = 0$. If the firm reports truthfully, its payoff is 0. If it deviates and reports $x = 1 > y = 0$ then it obtains additional payoff $V_1 > 0$; even after it pays a silence fee γV_1 to the worker, there is a net positive return to earnings manipulation $(1 - \gamma)V_1$. Therefore, in equilibrium an opportunistic firm reports $x = 1$ whatever the true value is. As an honest firm reports $x = 1$ only when output is high $y = 1$, investors pay higher prices when reported values are higher.

Fourth, when $y = 1$, F will hold the shares until the second period, unless F experiences a liquidity shock. On the contrary, when $y = 0$ and manipulation of earnings is possible (so F is opportunistic, and $y = 0$ and $x = 1$), F will prefer to sell shares in the first period. If F is honest and outcome is low ($x = y = 0$), it is indifferent between selling in the short or in the long run.

These four features result in the game tree illustrated in the Figure 1.

2.3.1 VALUATION IN THE SHORT RUN

In equilibrium, all honest firms report the truth $x = y$ and all opportunistic firms report $x = 1$. Investors understand that the firms selling shares with low reported earnings $x = 0$ must be the honest firms with the true value $y = 0$. At least θ of such firms have to sell their shares in the first period even though the investors price their shares at nil.

If the report is high, $x = 1$, then the investors understand that they are buying shares either from a firm with high output and a liquidity shock (which occurs with probability θa^*) or from a firm with low output who manipulates earnings and wants to sell its stock before the truth is uncovered (which occurs with probability $(1 - a^*)\pi$). Here, a^* is the worker's effort in equilibrium. Therefore, if the investors observe a high report $x = 1$ they price such shares at

$$v = E[y \mid (x = 1 \text{ and shares are sold at } t = 1)] = \frac{\theta a^*}{\theta a^* + \pi (1 - a^*)}. \quad (3)$$

We arrive at the general expression for the valuation of the firm at $t = 1$:

$$V_1 = xv = \frac{x\theta a^*}{\theta a^* + \pi (1 - a^*)}. \quad (4)$$

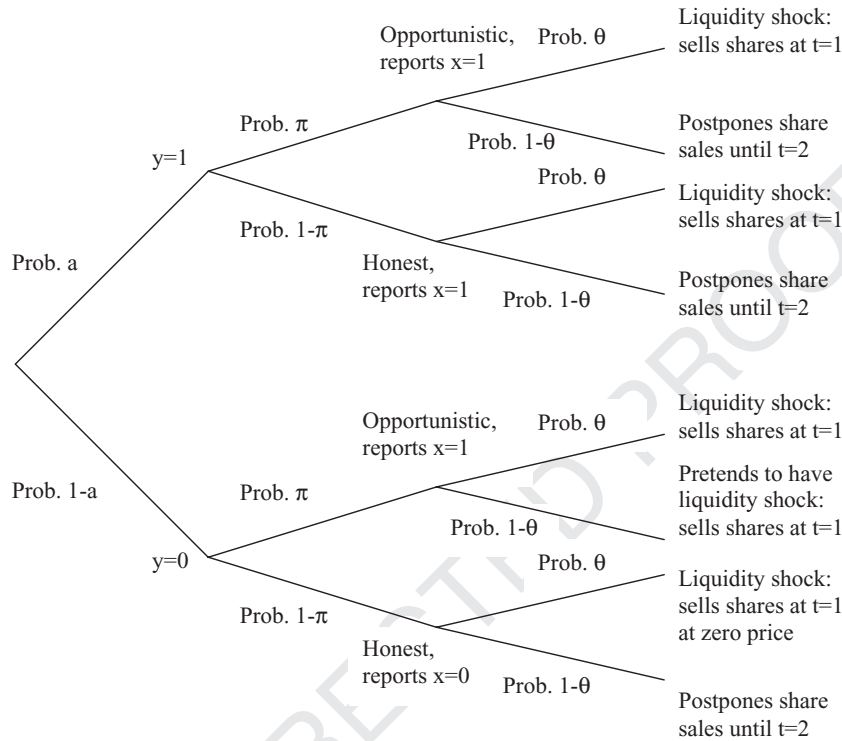


FIGURE 1. THE GAME TREE

Given that $v < 1$, the firms with $y = 1$ will prefer to hold their shares until $t = 2$ —unless they have to sell because of the liquidity shock. Similarly, $v > 0$ provides the firms who manipulate the earnings with strong incentives to sell at $t = 1$ even if they do not have a liquidity shock.

2.3.2 WHISTLE-BLOWING DECISION

If $y = 1$ (that is, W succeeds) and W observes a high report $x = 1$, she knows that there is no earnings manipulation. But when she fails and $y = 0$, W knows with certainty that the high report is false. In this case, she can threaten the manager (e.g., by credibly revealing her own performance to investors). As the manager's value at stake is $V_1 = v$ and the worker's bargaining power is γ , the worker receives γv for not blowing the whistle. Notice that this payment does not depend on the liquidity shock—the manipulating firm will prefer to overreport earnings and sell shares at the price v even though $y = 0$ whatever the liquidity shock is.

2.3.3 EFFORT CHOICE

The worker expects to succeed (and receive a salary w_1) with probability a . If she fails $y = 0$ (with probability $1 - a$), and if the manager is opportunistic (with probability π), then she receives the silence fee γv . Therefore, the worker chooses her effort to maximize

$$a w_1 + (1 - a)\pi \gamma v - c(a).$$

Notice that the contract essentially provides the failing workers with a share $\pi \gamma \alpha_1$ in the company's equity that they can vest in the short run; that is, workers actually receive a nontrivial reward for bad performance. The first-order condition implies

$$c'(a) = w_1 - \pi \gamma v. \quad (5)$$

2.3.4 OPTIMAL CONTRACT

We now determine the optimal contract chosen by the firm. When choosing the contract w_1 , the firm expects to be able to manipulate earnings with probability π and to receive the liquidity shock with probability θ . Therefore, it maximizes

$$U^F = (1 - \pi) [a (\theta v + 1 - \theta) - w_1 a] + \pi [a (\theta v + 1 - \theta) - w_1 a + (1 - a)(1 - \gamma)v] \quad (6)$$

subject to (5) and the equilibrium condition $a^* = a$. Therefore, the firm chooses the contract so that the effort level solves

$$\max_a \left\{ (a - c'(a))a - \frac{\pi \gamma \theta a}{\theta a + \pi (1 - a)} \right\}. \quad (7)$$

Denoting the solution to (7) as a_{EM} , the worker's incentive compatibility constraint directly implies $w_1 = c'(a_{EM}) + \frac{\pi \gamma \theta a_{EM}}{\theta a_{EM} + \pi (1 - a_{EM})}$.

How can we compare the effort level in equilibrium with earnings manipulation with the benchmark outcomes? The last term in (7) is $\frac{\pi \gamma \theta a}{\theta a + \pi (1 - a)} = \frac{\gamma}{\frac{1}{\pi} + \frac{1 - a}{\theta a}}$ which is obviously an increasing function of π , γ , θ , and a . Therefore, monotonic comparative statics immediately implies that the equilibrium level of effort is not only below the first-best level; it is also below the second-best level of effort: $a_{EM} < a_{SB}$.

The following proposition describes the equilibrium.

PROPOSITION 1: *In equilibrium, opportunistic firms manipulate their earnings: they always report $x = 1$ and silence potential whistle-blowers through side payments. Opportunistic firms sell all their shares in the short run. Effort solves equation (7). The equilibrium level of effort is below the second-best level $a_{EM} < a_{SB}$. The equilibrium effort level a_{EM} decreases in the potential*

2
3 *whistle-blower's bargaining power γ , probability of earnings manipulation π ,*
4 *and the probability of liquidity shock θ .*
5

6 The intuition for the Proposition follows from the equation (7).
7 When the firm determines the contract and therefore the worker's effort
8 level, it takes into account two terms: the term $(a - c'(a)a)$ which is
9 exactly the same as in the second-best optimization problem (2) and the
10 distortion $\frac{\pi\gamma\theta a}{\theta a + \pi(1-a)}$ which emerges due to the earnings manipulation.
11 The distortion reduces the firm's *ex ante* payoff—as it is related to
12 the additional bribe the firm has to pay to a potential whistle-blower.
13 This distortion increases in the effort level a . Indeed, the distortion is
14 proportional to the benefit of the overreporting firms. This benefit, in
15 turn, is high when investors know that in the pool of firms reporting
16 high output there are many good firms with high output; the expected
17 value of the latter increases in a . The fact that distortion increases in a
18 directly implies that the optimal choice of effort that solves (7) is below
19 the second-best level.

20 The magnitude of the distortion also increases in the worker's
21 bargaining power γ and in the capacity for earnings manipulation π .
22 It is also increasing in the probability of the liquidity shock θ —as the
23 more sales of shares by the successful firms in the short run, the higher
24 the investors' valuation and the greater the returns for share sales by
25 the overreporting firms. Figure 2 illustrates the main result.
26

27 **3. DISCUSSION**

28 **3.1 IMPLICATIONS**

29
30 Our model implies that a top manager who inflates earnings today will
31 have strong incentives to overreport even more tomorrow. Jensen (2005)
32 coined the term “managerial heroin” to describe this phenomenon.
33 As top managers of an “addicted” company engage in more and
34 more manipulation, they have to compensate their subordinates for
35 not blowing the whistle. Because this compensation suppresses the
36 incentives to exert effort and, therefore, destroys value, the manager's
37 need for manipulation tomorrow grows even faster. In other words,
38 when the internal incentives are modeled explicitly, it becomes clear
39 that the addiction to “managerial heroin” is self-perpetuating and
40 irreversible.
41

42 The model also predicts that earnings manipulation is more likely
43 if the original ownership is not concentrated. If the original ownership
44 is completely dispersed, it is hard to justify any positive long-term
45 share-holding by the original owners. Original investors prefer cashing

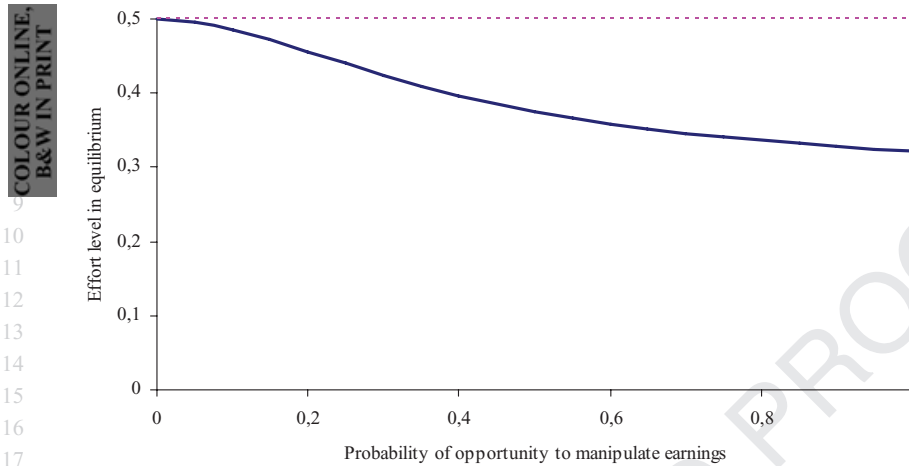


FIGURE 2. NUMERICAL EXAMPLE: $c(a) = a^2/2$, $\theta = 1/2$, $\gamma = 1/2$. THE GRAPH SHOWS THE RELATIONSHIP BETWEEN THE PROBABILITY OF OPPORTUNITY TO MANIPULATE EARNINGS π (HORIZONTAL AXES) AND THE EQUILIBRIUM LEVEL OF EFFORT a_{EM} (VERTICAL AXIS). IN THIS EXAMPLE, $a_{FB} = 1$, $a_{SB} = 1/2$

in the short-term returns rather than holding a long-term stake for control or other nonpecuniary benefits. In other words, corporations with dispersed ownership are more likely to be involved in earnings manipulation.

3.2 EARNINGS MANIPULATION AND HIERARCHICAL STRUCTURE

An open question is to what extent different hierarchical structures may be more or less conducive to the effects we have highlighted.⁹ Suppose that a firm has n workers, divided into k divisions of equal size each employing m workers, that is, $n = m * k$. For simplicity, we abstract from conflicts of interests within divisions, that is, between division managers and workers. Hierarchies with large k are *flat* hierarchies; the ones with small k are *tall* hierarchies. Each division manager D_j (where $j = 1, \dots, k$) has information on the output of m units. This implies that the taller the hierarchy, the larger is the share of the total output observable for any given division manager. Loosely speaking,

9. Spelling out a full model on the interaction of hierarchical structure and earnings manipulation in the Diamond and Dybvig (1983) setting used above would be tedious. We hence here just sketch the main ideas about this interaction, that we have analyzed in a setting with simplified market belief formation, which is available on request.

2
3 the smaller k , the better each division manager's information about the
4 firm as a whole. If $k = n$ and $m = 1$, any division manager has as little
5 information as each worker, whereas in the case of $k = 1$ and $m = n$, the
6 (only) division manager knows everything about the firm.

7 Division manager D_j can prove overreporting when the reported
8 value of the firm is above the possible total firm output, given the output
9 of his own division j (e.g., the firm value to be reported is above $n - m$
10 and all units of D_j have produced nil). Then the firm must bribe the
11 potential whistle-blower to avoid information leakage.

12 To analyze comparative statics with respect to organizational
13 structure, consider a hierarchy with k divisions and $m = n/k$ workers
14 first, and then merge every h divisions in this hierarchy into one larger
15 division. We now have a taller hierarchy with $k' = k/h$ larger divisions
16 and $m' = mh$ workers in each of these divisions. What are the incentives
17 to manipulate earnings in these two hierarchies?

18 In the tall hierarchy, division managers have better information
19 than in the flat one. This makes it more likely to blow the whistle on
20 CEOs who manipulate reports. Consider the situation where the true
21 value of output is low, and the CEO intends to report a high value. In the
22 flat hierarchy, the division managers have information on m workers
23 only, and do not know how the other $n - m$ units performed. So if
24 $x = n - m + y_{D_j}$ is reported, division manager j cannot rule out that all
25 other units were successful, and will hence not whistle-blow for reports
26 smaller or equal x . In the tall hierarchy, however, the (super)division
27 managers have information on m' workers. Therefore, for a set of
28 given true values of output, there is a range of reports for which a
29 division manager in a tall hierarchy will blow the whistle, whereas the
30 division manager in a flat hierarchy will not. Therefore, a taller hierarchy
31 generates more possibilities for whistle-blowing.

32 Let us consider a simple illustrative example. Suppose $n = 4$; let
33 us compare a tall hierarchy where there are two divisions with two
34 workers each ($m = 2$) and a flat hierarchy with four divisions with one
35 worker each ($m = 1$). Consider the worst realization when all workers
36 fail $y_i = 0$ so that $y = 0$. If the firm reports $x = 4$ then it will be challenged
37 by all division managers in either case and will have to pay bribes to
38 all division managers. However, the situation is different if the firm
39 wants to report $x = 3$. In a flat hierarchy, no single worker or division
40 manager can challenge the report. In the tall hierarchy, reporting $x = 3$
41 will require silencing both division managers; indeed, each division
42 manager observes his own output of 0 and knows that the other division
43 can at most produce 2; hence $x = 3$ is certainly a lie. Thus, in a tall
44 hierarchy the firm will report $x = 2$ (at least for some parameter values)
45 whereas in the flat hierarchy it would report $x = 3$.

Certainly, the hierarchical structure chosen by a firm will be driven by many other benefits and costs of flat versus tall hierarchies that we neglected in our analysis. Yet, our conclusions seem to be line with the anecdotal evidence: for example, *Enron* fostered a corporate culture of the “entrepreneurial” corporation and *Enron’s* CEO Jeff Skilling wanted to empower human capital via flatter hierarchies (McLean and Elkind, 2003). As Rajan and Wulf (2003) show, *Enron* was not the only firm that made its hierarchy flatter, but for many human resource management gurus, *Enron* was a role model (Michaels et al., 2001).

Evidence from *Tyco*, yet another of the big corporate scandals of the early 21st century, supports the idea that restricting information by means of organizational structure was important in order to limit the risks of whistle-blowing, and that bribes had to be paid to those who had sensitive knowledge. Bianco et al. (2002) put it as follows: “*Tyco’s* highly centralized (that is ‘flat’ in our understanding, GF and SG) structure served to severely limit the people truly in the know . . . Kozlowski also used *Tyco’s* extraordinarily generous bonus system to co-opt many key executives at headquarters and in the field. In effect, he twice bought the loyalty of the most strategically positioned employees, cutting at least 50 of them in on his under-the-table largesse.” This quote also lends itself to the interpretation that a flat organization involves that more people need to be dealt with, although any of them may have less good information.¹⁰ We find this a quite intriguing trade-off, but modeling it is out of the scope of this paper.

Finally, an interesting parallel should be noted between our analysis and the organizational structure of clandestine hierarchies such as espionage networks or organized crime investigated by Baccara and Bar-Isaac (2008). Here, hierarchies are explicitly designed to minimize the risk of leaking sensitive information to outsiders. The manager of each cell (division) should only be informed about her own unit even if the potential benefits of horizontal cooperation are large. In our terms, this is a flatter structure where whistle-blowing is less likely to occur, a structure that implies lower damage associated with any leakage. Moreover, as the whistle-blower would be able to deliver less valuable information to the outsiders, he/she has lower returns to whistle-blowing; therefore there is a less destructive effect on incentives.

3.3 ROBUSTNESS AND EXTENSIONS

We assumed above that the CEO acts in the interests of initial shareholders, and that he does not exert any effort. We have investigated

10. We thank a referee for pointing this out.

2
3 the CEO's incentives in an extended version of the model (see, for
4 example, Friebe and Guriev 2005) in which, for reasons of tractability,
5 the formation process of market beliefs is simplified. In that model, there
6 is another layer of agency problems (initial shareholders offer a contract
7 to CEO who, in turn, offers a contract to subordinates). Depending on
8 their need to sell shares in the short or long term, initial shareholders
9 put emphasis either on the short- or long-term value of the company.
10 Emphasis on short-term performance results in earnings manipulation,
11 which in turn undermines the incentives of the CEO's subordinates.
12 Therefore, the result that whistle-blowing eventually undermines the
13 subordinates' incentives to exert effort is robust. However, such an
14 extended model raises a new set of issues: in a model where CEO also
15 exerts effort, whistle-blowing acts as a check on the CEO's wrongdoing.
16 Whistle-blowing makes the outcome where the CEO's performance is
17 low less attractive for the CEO. Indeed, if the CEO fails he has at least to
18 pay for the potential whistle-blower's silence. Unfortunately, we have
19 no evidence to argue whether the whistle-blowing's (intuitive) positive
20 effect on CEO's incentives is stronger or weaker than the negative effect
21 on the subordinates' incentives (on which we focus in this paper).

22 Another assumption of our basic model is that the worker obtains
23 evidence on manipulation at no cost. We have considered a costly state
24 verification model (again with a simplified modeling of market belief
25 formation) that produces similar results.¹¹ Consider that there are many
26 divisions and each division manager can pay to learn the true aggregate
27 output, for instance, by looking for financial statements or memos or
28 by collecting information from colleagues. Assuming that the outputs
29 are continuous rather than binary, the incentives of division managers
30 to generate evidence on earnings manipulation are inversely related
31 to their individual performance. Whether the divisions' outputs are
32 correlated (because of a common shock) or independently distributed,
33 each division's output is by definition correlated with the aggregate
34 performance. Given the report of the CEO, the division can hence
35 infer the expected level of overreporting. The higher the reported earn-
36 ings, the higher the returns to inquiring. For a given report, the higher
37 the individual performance, the higher the expected aggregate perfor-
38 mance, and the lower the incentives to find out the truth. Therefore,
39 the better-performing divisions will prefer not to inquire, whereas the
40 failing divisions will more likely inquire about aggregate performance.
41 Hence, the main argument holds: it is the underperforming divisions
42 that threaten to blow the whistle, resulting in weaker incentives in the
43 firm.

44
45 11. Again, these results are available for the interested reader.

One may also ask to what extent our results robust with respect to the timing and observability assumptions. First, we have assumed that the firm learns its type after it offers the contract to the worker. If F learned its type *before* the contract is offered, the model produces similar results. We have carried out this analysis in a previous version of the paper (Friebel and Guriev, 2005). Yet, we believe that our assumption above is more realistic. Second, we have assumed that outsiders do not observe top manager's liquidity shock. This assumption is important as it creates a mechanism that provides opportunistic firms with incentives to inflate reported earnings. If F 's liquidity shock were perfectly observed by outsiders, the honest firms would be able to credibly signal their type.

We have established that when there is a risk of earnings manipulation, the possibility of whistle-blowing undermines effort incentives. Our focus was on the provision of incentives through wage contracts, but these should be seen as representative of the wide range of compensation practices in organizations. Most importantly, a top manager may promote a potential whistle-blower to a better job in exchange for his silence. This has additional severe consequences for the internal efficiency of organizations. To see this, consider a model of adverse selection, in which the probability that a division produces high output depends on the manager's type. In the absence of the whistle-blowing threat, the division's 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 frequently have the information needed to blow the whistle. If promotions are given in exchange for silence, the internal labor market's capacity to screen managers is reduced.

In our model, there is no monitoring of division managers by top managers. One could consider an extension in which top management may decide to monitor the division managers less intensively (effectively tolerative lower performance by the divisions) in order to prevent them from blowing the whistle. It is an empirical fact that manipulation occurs at many levels of corporate hierarchies (see Leone et al., 1999). In the light of our model, the top management may actually be willing to allow misconduct at the division level, as a 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 wrongdoing. Therefore, the CEO can align the incentives within the hierarchy by exerting less monitoring effort. Then, earnings manipulation has the cost of diverting company revenues at different places in the corporate hierarchy.

4. CONCLUDING REMARKS

Whistle-blowing can protect investors against the risk of expropriation by top managers, but it undermines the incentives of lower level insiders to exert effort. Whenever a firm's top management has short-term incentives and inflates earnings reports, there is a risk of whistle-blowing. Hence, top management may want to share their payoffs with subordinates to reduce the risk of information leakage to the outside world. This can take various forms: bargaining over a monetary or nonpecuniary bribe, promotions, or propagation of stock-price-based incentives throughout the corporate hierarchy. As subordinates are more likely to obtain sensitive information about earnings overreporting when their own performance is low, the threat of whistle-blowing increases the payoffs associated with low outcomes and thus distorts internal incentives. Our theory has a number of implications, in particular, it predicts a lower rate of whistle-blowing in flat hierarchies, where each division manager is less informed about the aggregate earnings than in tall hierarchies.

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