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Abstract

Several standard components of managerial compensation contracts have been criticized for encouraging managers to manipulate short-term information about the firm, thereby reducing transparency. This includes bonus schemes that encourage earnings smoothing, and option packages that allow managers to cash out early when the firm is overvalued. We show in an optimal contracting framework that these components are critical for giving long-term incentives to managers. The lack of transparency induced by the features of the contract makes it harder for the principal to engage in ex post optimal but ex ante inefficient liquidity provision to the manager.

JEL codes: G34 Corporate Governance, J33 Compensation Packages, Payment Methods

Keywords: Executive Compensation, Earnings Management, Transparency.

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1 Introduction

How can effective executive compensation be set up when managers can manipulate short-term information? Although a long-standing question in corporate governance, public attention to this issue reached new heights at the beginning of the millennium after governance scandals at, for example, Enron and WorldCom. A common thread in these scandals was accounting manipulations to increase stock-prices. In a number of cases, allegations have been made that managers profited from short-term increases by their substantial stock compensation packages that had relatively short-term maturity and so were easy to unwind before the manipulation became apparent.¹

There is also more systematic evidence that managers utilize and hide information to increase their compensation at the expense of shareholders. Bartov and Mohanram (2004) examine 1200 public companies from 1992-2001 and show that large stock option exercises by top executives are followed by abnormally low stock returns. Furthermore, in the period preceding exercise, discretionary earnings are abnormally high, and fall to abnormally low levels after exercise, suggesting that managers opportunistically pump up the stock price by managing earnings prior to exercise.

In the wake of the scandals, a number of economists have drawn at least two conclusions about how corporate governance must be improved: Companies should make it harder for executives to unwind stocks and options, and transparency should be increased to make manipulation more difficult.² The Sarbanes-Oxley act of 2002 contains provisions mainly to thwart manipulation by increasing transparency, but also to make insider trading and early cashing out harder.³

¹For example, Enron used at least two questionable ways to inflate earnings. First, they booked the net present value of future income from contracts as earnings in a given year, giving them substantial freedom in assumptions about future cash flows and discount rates. Second, they set up affiliates called “Special Purpose Entities” to remove debt from their balance sheet (see, for example, Healy and Palepu (2003)).

Officers at Enron engaged in heavy selling before revealing third quarter loss of \$638M on October 17, 2001. Amalgamated Bank contended in a lawsuit that Enron officers and directors made misleading statements about the company and sold about \$1 billion worth of stock in the three years leading up to the time the scandals broke. (N.Y. Times, Dec. 16, 2001). Furthermore, In the year before the bankruptcy, top executives withdrew a combined \$32 million from their deferred compensation accounts, even though there was a 10% penalty for doing so. (WSJ, Nov. 10, 2002). (We thank David Yermack for pointing this article out to us.)

²See, for example, Holmström and Kaplan (2003), Jensen and Murphy (2004), Bebchuk and Fried (2004), and Bolton, Scheinkman, and Xiong (2005).

Bolton, Scheinkman and Xiong (2004) show that managers have an incentive to increase earnings to inflate short-term stock prices, and that in fact an optimal contract may encourage this, when irrational overconfident investors get fooled. They conclude that longer vesting periods may be socially desirable, but not necessarily for current shareholders.

Bebchuk and Fried (2004) state that the early vesting of options is one of the problems of corporate governance. They argue that CEOs should be limited from selling stocks once the option has been exercised: “...firms have given executives broad freedom to unload options and shares, a practice that has been beneficial to executives but costly to shareholders”.

³Examples of restrictions that make unwinding harder include Section 305, which states that officers must reimburse the firm for any bonuses or gains on stock- or option-sales gained during a year for which accounting was later

These commonsensical prescriptions are in accordance with standard agency theory. The “informativeness principle” (coined by Holmström (1979)) states that managers’ pay should be tied to a measure that is as informative as possible about managerial effort. Then, if long-term measures of performance are harder to manipulate and are more informative, the manager’s pay should be long-term. Also, it should be beneficial to make signals as informative as possible by making manipulation harder, or by increasing transparency in other ways. This is also the natural conclusion that can be drawn from the signal-jamming model of Stein (1989), who shows that managers will spend costly effort to distort short-term signals when they are compensated on the short-term stock price, even when the market is not fooled by the distortions.

In this paper we argue that this reasoning is incomplete and sometimes wrong when ex post Pareto-improving renegotiation cannot be ruled out. We show that there is an inherent conflict between increasing transparency and increasing the maturity of compensation. Indeed, increasing transparency by, for example, making manipulation harder can make the firm strictly worse off because of the negative effects on long-term incentives.

Our basic argument is that when managers have some preference for early consumption, it is hard to commit to long-term contracts even when they are ex ante optimal. After a manager has put down the effort induced by a long-term contract, the contract no longer serves any incentive purpose. Because the manager is impatient, it is therefore in the interest of both the principal and the manager to accelerate payments. We show that if short-term signals are observed by both the manager and the principal (the case of no manipulation), there is nothing preventing such renegotiation, so contracts must be short-term.

Now suppose the manager can manipulate the short-term signal, making it even less informative to the principal. This has the disadvantage of making it even harder to incentivize the manager with short-term contracts. The advantage is that it may now be possible to commit to long-term contracts. The reason is that manipulation introduces a lemons problem at the renegotiation stage that reduces the scope for trade. To induce optimistic managers to take an early payment, the principal must make the payment big. But this means that pessimistic managers will gain at the expense of the principal, so he may be better off not renegotiating. If the short-term signal is not

found to be non-compliant, and Section 403, which requires directors and officers to disclose trading in company stock within two days.

Examples of measures designed to increase transparency include increased requirements on financial accounting, independence of auditors, and requirements on financial sophistication of directors.

very informative and the manager is not too impatient, a long-term contract with manipulation will dominate a short-term contract with full transparency.

The optimal contracts we derive are consistent with several observed features of compensation packages that are remarkably consistent over time and across firms, but that are hard to explain with existing theories.

For example, although most executive stock options tend to have expiration times of around 10 years from the grant date, they all have vesting schedules that allow managers to start exercising options often as soon as one year after the grant date.⁴ This seems puzzling from the perspective of the informativeness principle. Not only does it make the contract relatively short-term, but the maturity of compensation is decided by the manager himself, *after* he has observed his own private information about how the firm is doing. This gives managers an incentive to increase short-term earnings and cash out early when they know the stock is overvalued, thereby reducing the link between pay and performance.

We show that such vesting clauses are always part of an optimal long-term contract. The reason is that, although asymmetric information at the renegotiation stage can make it credible for the principal not to pay *all* managers early, it is impossible to prevent him from giving an offer of a low early payment that only the most pessimistic managers will accept. From this perspective, early vesting by managers who have inflated the stock price is an unfortunate but unavoidable consequence of lack of commitment, but the alternative where manipulation is ruled out would be no long-term incentives at all.

Another example is standard bonus packages that are contingent on some accounting measure such as earnings. These still constitute a large fraction of compensation in most companies, and arguably create even larger incentives to destroy information than executive stock options. As documented by Murphy (1999), the size of the yearly bonus is typically zero below a lower target threshold of the performance measure and caps out at a higher threshold.⁵ This gives incentives to exaggerate earnings if the lower threshold is not expected to be met, and decrease earnings (for example by shifting the reporting of sales to next year) if the earnings are expected to be above

⁴A typical plan would allow one quarter of the options to be exercised after one year, and an extra quarter in each of the following three years (see Kole (1997)). Kole (1997), examining the 1980 S&P 500 firms, calculates that the average time before any options are allowed to be exercised is 13.5 months, and that the average option can be exercised after 23.6 months.

⁵Long term incentive plans based on accounting measures over several years have the same structure (see Murphy (1999)).

the higher threshold to make it easier to meet next years bonus.⁶ Thus, earnings will appear to be relatively smooth and contain little information on which to base rewards for the manager.

We show that these thresholds can be used in an optimal contract to induce the “right” amount of transparency. Our argument builds on the assumption that it is easier to hide good information, by for example pushing sales into the next period, than to fabricate good information when there is none. By setting a cap on the bonus at a certain threshold of the performance measure, managers are encouraged to smooth earnings. The lower the threshold is, or the less high-powered the short-term pay-for-performance is, the easier it is to hit the target earnings, and the less transparent the firm will be. The optimal contract will set the bonus region to trade off the commitment advantage of lower transparency with the better incentive effects of higher pay-for-performance.

Our analysis casts some doubts on the merits of legislation geared at forcefully increasing transparency or in other ways restricting contracting opportunities in firms. If firms can influence transparency by structuring contracts in the right way, ruling out manipulation might have the unintended consequence of eliminating beneficial long-term contracts. Although it is hard to claim that Enron and WorldCom had good corporate governance, it may be even more of a stretch to argue that *all* companies are run by self-serving or incompetent boards of directors. Yet virtually all firms use the type of contracts described above, even when they create more manipulation and less transparency than contracts that standard agency theory would prescribe.

1.1 Related Literature

Our work builds on the literature on renegotiation proof contracts developed in Dewatripont (1989), Hart and Tirole (1988) and Fudenberg and Tirole (1990). Dewatripont (1989) shows in the context of a labor model that in a renegotiation proof optimal contract, information is resolved slowly through time relative to a full commitment level. Fudenberg and Tirole (1990) have a moral hazard model closer to ours with a risk neutral principal and a risk-averse manager. Although they do not study optimal contracts under manipulation and do not explicitly focus on transparency, they show that asymmetric information is essential to provide incentives in a renegotiation proof contracts. The asymmetric information in their model arises through managers choosing a mixed strategy in their effort provision, and the optimal contract has option-like characteristics just as

⁶See Healy (1985), Holthausen, Larcker, and Sloan (1995), and Gaver, Gaver, and Austin (1995) for empirical evidence that bonus packages induce this type of manipulation.

ours.⁷

More directly concerned with the optimal level of transparency is Cremer (1995), who shows in a symmetric information environment that less but *common* information at an ex post stage may help a principal commit not to renegotiate. We show that *asymmetric* information can curtail renegotiation and hence create a commitment mechanism.

Our paper is also related to the literature on soft budget constraints, where a similar conflict between ex post and ex ante efficiency appears. Dewatripont and Maskin (1995) show that a lender without deep pockets can commit not to bail out failing firms and hence create better ex ante incentives for effort. In our setting, where the lender does have deep pockets, asymmetric information is the vehicle for preventing renegotiation.

Myers and Rajan (1998) suggest that if assets are too liquid, it is easy for a manager to steal them. However, they do not study the impact of liquidity on ex ante incentives. They also take an incomplete contracts approach where liquidity is exogenously specified, whereas we use a mechanism design approach.

The structure of the paper is the following. In Section 2, we lay out the model. In Section 3, as a benchmark, we study the case where the firm can commit ex ante to a contract, and verify the conclusions from the informativeness principle. In Section 4 we study renegotiation-proof contracts. Section 5 concludes.

2 Model

A firm has a project which costs a dollar to finance. The manager does not have funds to finance the project and must look to outsiders for the necessary capital.

The timing of the model is shown in Figure 1. There are three periods, 0, 1, and 2. A contract between an investor and the manager is set up at period 0. Between period 0 and 1, the manager exerts unobservable effort $e \in \{W, S\}$. Profit is realized in period 2. Working ($e = W$) leads to profit $y = R$ with probability p and profit $y = 0$ with probability $1 - p$; shirking leads to profit 0 with certainty. Working has a private cost d to the manager. Therefore, the expected gross profit

⁷In our model, contracts that induce asymmetric information through manipulation typically dominate contracts that induce it through mixed strategy equilibria, since mixing creates inefficiently low effort. We discuss mixing further in Section 4.2.1 and in the appendix.

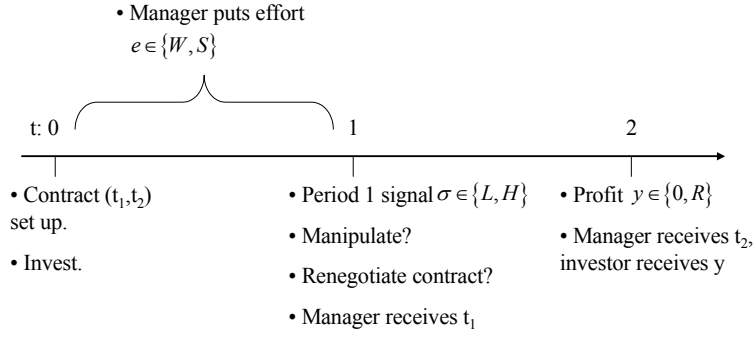


Figure 1: Timeline for the model.

of the project is

$$\begin{aligned} pR & \quad e = W \\ 0 & \quad e = S \end{aligned}$$

The manager privately observes an early profit forecast $\sigma \in \{L, H\}$ in period 1. Conditional on profits, profit forecasts are distributed as follows:

$$\begin{aligned} P(H|y = R) &= \theta > \frac{1}{2} \\ P(H|y = 0) &= 1 - \theta < \frac{1}{2}. \end{aligned}$$

A high signal H is more likely if future profits are high. A manager with an H (resp. L) signal is *optimistic* (resp. *pessimistic*). Since profits are informative about effort, and period 1 signals are informative about profits, the signal in period 1 is also informative about effort but less so than profits.⁸

While the manager observes the early profit forecast, he can engage in manipulation to distort the signal of *earnings* received by investors. However, manipulation has no effect on the long-term profit signal. We view manipulation as a way to temporarily mislead investors, but eventually the true state of the company will be revealed. This captures salient features of the financial scandals

⁸To see that σ is a weaker signal about effort than profits, note that

$$P(H|W) = p\theta + (1 - p)(1 - \theta) < P(R|W) = p$$

and

$$P(H|S) = 1 - \theta > P(0|W) = 0$$

Therefore, even though a high period 1 signal is more likely when the manager works, it is noisier than profits and can happen even if she shirks.

at Enron and WorldCom where managers succeeded in hiding information in the short-term but the firms' fundamentals became clear eventually.

The public signal of earnings observed by investors in period 1 is a continuous variable $\phi \in [l, h]$. If the manager does not manipulate, the signal the investor receives fully reveals the manager's profit forecast: $\phi = l$ if $\sigma = L$ and $\phi = h$ if $\sigma = H$. However, a high earnings signal h can be freely manipulated downward to any $\phi < h$, while a low earnings signal l can be manipulated upward with some probability. We view this asymmetry between understating and overstating earnings as realistic. For example, it may not be very difficult to omit or postpone the reporting of some orders to lower an initial high earnings signal, but it is probably harder to fabricate false orders without detection. Denote the likelihood that pessimistic managers can state earnings ϕ by $m(\phi)$. We assume $m(\phi)$ is decreasing, so that it is less likely that a pessimistic manager is able to produce a bigger overstatement. If the manipulation fails, the pessimistic manager reports earnings l .

The investor gets the profit, in return for financing the project and transferring t_1 and t_2 to the manager in period 1 and 2. The manager has limited liability, so the transfers have to be non-negative. The contract is set up to give the manager the incentive to work, and can be contingent on two variables: The earnings statement ϕ and the final profit. The manager's strategy is a choice of whether to work or shirk, and a choice of earnings manipulation contingent on his early profit forecast. We denote the earnings report of an optimistic manager by ϕ^* and of a pessimistic manager who successfully manipulates by ϕ^L .

The investor is risk-neutral and indifferent between consumption and hence transfers at period 1 and 2:

$$u_I(c_1, c_2) = c_1 + c_2$$

where c_T is consumption at period $T \in \{1, 2\}$. The manager on the other hand always prefers to be paid at period 1 rather than period 2:

$$u_M(c_1, c_2) = c_1 + \lambda c_2 \text{ where } 0 \leq \lambda < 1.$$

For a similar assumption on managerial impatience, see for example Aghion, Bolton, and Tirole (2000) or Holmström and Tirole (1997). The discount parameter λ can be interpreted as the cost of having managerial wealth tied up in long-term compensation, rather than being able to smooth income perfectly intertemporally. Alternatively, it can represent an opportunity cost of capital for

the manager, for example if the manager comes up with new ideas as a result of running the current project. These projects also require seed money and inside money is easier and quicker to utilize than outside money.⁹

We assume that $pR - 1 - d > 0$, so that the first best is to finance the project, implement high effort and pay the manager in period 1. Given that contracts cannot be written directly on effort, the first best may not be achievable. The contract must trade off the better incentive effects from paying the manager based on the strong profit signal against the loss from paying the manager late.

The plan for the rest of the paper is as follows: First, as a benchmark, we describe optimal contracts in the case of full commitment. Then, we add a renegotiation stage in period 1.

3 Full commitment

A contract $\{t_1(\phi), t_2(y, \phi)\}_{\phi, y}$ is a payment $t_1(\phi)$ to the manager in period 1 as a function of earnings, and a payment $t_2(y, \phi)$ in period 2 as a function of the period 2 profit and earnings. We solve for contracts that maximize the manager's payoff and give him the incentive to work, subject to the break-even constraint of the investor and the limited liability constraint for the manager. Any contract that gives the manager the incentive to work while satisfying the limited liability and break-even constraints is *feasible*. If it also maximizes the manager's payoff, it is *optimal*.

Many properties of the optimal contract follow from the informativeness principle. First, as period 1 earnings is a more garbled signal of effort than period 2 profit, it is optimal to make period 2 payments dependent on period 2 profit alone. Second, as zero output in period 2 is more likely when the manager shirks, it is optimal to set payments to zero in this case. Third, to make the earnings report as informative as possible, it is optimal never to pay for anything other than the highest signal h . A high early earnings report is the hardest signal to create when the manager has shirked and hence paying for this report alone maximizes his incentive to work. These observations are collected in the following Lemma which is proved in the Appendix:

Lemma 1 *An optimal solution can be implemented by setting a payment schedule $t_1(h) \geq 0$ and $t_2(R, \cdot) \equiv t_2(R) \geq 0$ with all other payments zero.*

These conclusions are in line with the prescriptions suggested by policymakers and academics

⁹We conjecture that our results would be qualitatively unchanged if we instead assumed that investors and managers discount at the same rate but managers are risk averse, as in Fudenberg and Tirole (1989). However, the analysis would be much less tractable and make for a more cluttered exposition.

alike: Requiring that early payments be made for high earnings reports maximizes transparency as it is difficult to falsify such reports.

The Lemma allows us to state the full program as

$$\max_{t_1(h), t_2(R)} P(h|W)t_1(h) + \lambda P(R|W)t_2(R) \quad (\text{P1})$$

subject to the moral hazard constraint:

$$P(h|W)t_1(h) + \lambda P(R|W)t_2(R) - d \geq P(h|S)t_1(h),$$

the break even constraint:

$$P(h|W)t_1(h) + P(R|W)t_2(R) \leq pR - 1,$$

and limited liability:

$$t_1(h), t_2(R) \geq 0,$$

where

$$P(h|e) = P(H|e) + m(h)P(L|e)$$

Note that the break even constraint must always bind at the optimum, since otherwise increasing either $t_1(h)$ or $t_2(R)$ will increase the maximand while relaxing the moral hazard constraint.

We first find the lowest expected cost to the investor to make the manager work. To make the manager work with a *short-term contract* with $t_1(h) > 0$ and $t_2(R) = 0$, the lowest cost to the investor is $cost(short, h) \equiv P(h|W)t_1(h) = E(t_1)$. From the moral hazard constraint, we can write the cost as

$$cost(short, h) = \frac{P(h|W)d}{P(h|W) - P(h|S)} = \frac{d}{1 - \frac{P(H|S) + m(h)P(L|S)}{P(H|W) + m(h)P(L|W)}} \quad (1)$$

If such a short-term contract is feasible, it maximizes social surplus as it pays the manager only in period 1. Hence, a short-term contract is optimal if $cost(short, h) \leq pR - 1$.

To make the manager work with a *long-term contract* with $t_1(h) = 0$ and $t_2(R) > 0$, the lowest cost to the investor is $cost(long) \equiv P(R|W)t_2(R) = E(t_2)$, and is given from the moral hazard constraint as

$$cost(long) = \frac{d}{\lambda}.$$

Note that $cost(short, h)$ and $cost(long)$ are both higher than the manager's private cost d of working. Inducing the manager to work with a short-term contract is costly because, if the manager shirks, he still gets a positive payoff if the short-term signal is high. Therefore, he has to be paid an efficiency wage to give him the incentive to work. The long-term contract is costly because it pays in period 2, when the manager values consumption less. We are especially interested in the case where long-term pay is cheaper to the investor, so we assume:

$$\lambda \geq 1 - \frac{P(H|S) + m(h)P(L|S)}{P(H|W) + m(h)P(L|W)}.$$

In this case $cost(long) \leq cost(short, h)$. Hence, if a long-term contract is infeasible (i.e. $cost(long) > pR - 1$), so is a short-term contract and it is impossible to give the manager the incentive to work.

Finally, suppose a long-term contract is feasible but a short-term contract is not (i.e. $cost(short, h) > pR - 1 > cost(long)$). Since the social surplus is higher when the manager can be made to work with a short-term contract, the moral hazard constraint is binding at the optimal contract in this case. Otherwise, it is possible to reduce the second period payment, increase the first period payment, and increase the manager's payoff without violating the moral hazard constraint. Hence, in this case, both first and second period payments are positive.¹⁰ The following proposition collects our results and gives the solution to the problem under full commitment:

Proposition 1 *If a short-term contract is feasible, then at the optimal contract $t_1(h) > 0$ and all other payments are zero. If a long-term contract is not feasible, then it is impossible to implement full effort. If a long-term contract is feasible but a short-term contract is not, then at the optimal contract $t_1(h) > 0$, $t_2(R) > 0$ and all other payments are zero.*

¹⁰Solving for $P(h|W)t_1(h)$ from the moral hazard constraint, we have

$$\begin{aligned} P(h|W)t_1(h) &= \frac{\lambda(pR - 1) - d}{\lambda - \left(1 - \frac{P(h|S)}{P(h|W)}\right)} \\ &= cost(short, h) \frac{(pR - 1) - cost(long)}{cost(short, h) - cost(long)} \end{aligned}$$

and solving for $P(R|W)t_2(R)$ from the break even constraint we have

$$\begin{aligned} P(R|W)t_2(R) &= pR - 1 - P(h|W)t_1(h) \\ &= cost(long) \frac{cost(short, h) - (pR - 1)}{cost(short, h) - cost(long)}. \end{aligned}$$

Two characteristics of full commitment contracts are worth pointing out.

First, the optimal contract only depends on the manipulated signal ϕ and the profit y . This rules out menus of payments where the manager self-selects into a payment schedule after observing his private information σ . The vesting schedules used for executive stock options, where the manager has the right to exercise his options early, is an example of such a menu. However, with full commitment, there is never any gain from allowing the manager to choose the maturity of compensation ex post.

Second, the contracts are always high-powered, that is, the remuneration is always increasing in the realization of the signal ϕ . This is what encourages the manager to maximally inflate earnings. A less high-powered contract which induces managers to smooth earnings by understating when they get a high signal and overstating when they get a low signal is never optimal, since it reduces incentives to work.

We now show how these conclusions change when we insist that the contract should be renegotiation proof.

4 Renegotiation Proof Contracts

Suppose now, at time $t = 1$, after the public signal ϕ is observed, the investor can propose a new contract which will be accepted if the manager is at least as well off as under the old contract.¹¹

As we will see that menus now turn out to be useful, we have to introduce some new notation. As we show in the appendix, it is enough to look at contracts that pay off only if the earnings target ϕ^* is reached. A contract is defined as a menu of payments that the manager can choose from by sending a report $r \in \{L, H\}$ after the target has been reached, and after the renegotiation stage is over. Let $t_1(\phi^*, r)$ and $t_2(y, \phi^*, r)$ be period 1 and period 2 payments for report $r \in \{L, H\}$ and output $y \in \{0, R\}$. Then, a contract is $t = \{t_1(\phi^*, r), t_2(y, \phi^*, r)\}_{y \in \{0, R\}, r \in \{L, H\}}$. A renegotiation-proof contract is now defined as follows:

Definition 1 *The contract $t = \{t_1(\phi^*, r), t_2(y, \phi^*, r)\}_{y \in \{0, R\}, r \in \{L, H\}}$ is renegotiation proof for high*

¹¹If the manager offers the new contract, there is a signaling problem as he knows his effort and is perhaps the only player to observe the period 1 signal. Therefore, there are more equilibria in the renegotiation game. However, the analysis of Maskin and Tirole (1992) suggests that if equilibria must be “strongly renegotiation-proof,” it does not matter which player makes the renegotiation offer.

effort if and only if it is the solution to the program:

$$\min_{\{t'_1(\phi^*, r), t'_2(y, \phi^*, r)\}_{y \in \{0, R\}, r \in \{L, H\}}} E(t'_1(\phi^*, r) + t'_2(y, \phi^*, r) | \phi^*, W)$$

such that:

$$t'_1(\phi^*, \sigma) + \lambda E(t'_2(y, \phi^*, \sigma) | \sigma, W) \geq t'_1(\phi^*, r) + \lambda E(t'_2(y, \phi^*, r) | \sigma, W) \quad \forall \sigma, r \neq \sigma \quad (IC)$$

$$t'_1(\phi^*, \sigma) + \lambda E(t'_2(y, \phi^*, \sigma) | \sigma, W) \geq t_1(\phi^*, \sigma) + \lambda E(t_2(y, \phi^*, \sigma) | \sigma, W) \quad \forall \sigma \quad (IR)$$

$$t'_1(\phi^*, r), t'_2(y, \phi^*, r) \geq 0 \quad \forall r, y \quad (LL)$$

The incentive compatibility condition (IC) ensures that managers self-select into the right contract on the menu. By the Revelation Principle, we can restrict attention to contracts such that it is incentive compatible for the manager to reveal his true signal σ in his report. The individual rationality constraint (IR) ensures that the manager is no worse off under the new contract t' than under the old contract t . Finally, (LL) is the limited liability constraint of the manager. If the old contract solves this program, it means that there is no way to make both the manager and the investor better off with a new contract.

We now solve for renegotiation-proof contracts. Note that no short-term payment can be renegotiated into a long-term payment, since this lowers the social surplus ex post and thus must make someone worse off. The issue is whether long-term payments can be made renegotiation-proof. We first show that any long-term contract must have a *vesting clause* such that the manager can cash out early, and does so if he is pessimistic. We then show that such a contract can be renegotiation proof if the investor faces sufficient adverse selection in the renegotiation game, in the sense that the probability of dealing with a pessimistic manager is high.

Suppose the earnings target ϕ^* is realized. Suppose that the initial contract is not a menu but specifies a single long-term payment $t_2(R, \phi^*, L) = t_2(R, \phi^*, H) \equiv t_2(R, \phi^*)$ if the profit is high, and no short-term payment. But then, the investor is better off by proposing a new contract $t'(\phi^*)$

with a short-term payment that only the pessimistic manager accepts:

$$\begin{aligned}
t'_2(R, \phi^*, H) &= t_2(R, \phi^*) \\
t'_1(\phi^*, H) &= 0 \\
t'_2(R, \phi^*, L) &= 0 \\
t'_1(\phi^*, L) &= \lambda t_2(R, \phi^*) P(R|L, W)
\end{aligned}$$

This is a vesting contract with an option to cash out early. Note that this contract is incentive compatible, since the pessimistic manager is indifferent between the early and late payment, while the optimistic manager values the late payment more: $\lambda t_2(R, \phi^*) P(R|H, W) > \lambda t_2(R, \phi^*) P(R|L, W)$. Managers are as well off as under the original contract, while the investor is better off since he saves on the long-term payment to the pessimistic manager, so the original contract is renegotiated. In fact, no contract that specifies a long-term payment to a pessimistic manager is renegotiation-proof.

Now we show that the vesting contract above can be renegotiation-proof. Suppose the investor proposes yet another contract $t''(\phi^*)$ to reduce $t'_2(R, \phi^*, H)$ and increase $t'_1(\phi^*, H)$ so that an optimistic manager is indifferent:

$$\begin{aligned}
t''_2(R, \phi^*, H) &= 0 \\
t''_1(\phi^*, H) &= \lambda t'_2(R, \phi^*, H) P(R|H, W) \\
t''_2(R, \phi^*, L) &= 0 \\
t''_1(\phi^*, L) &= t'_1(\phi^*, L)
\end{aligned}$$

But now the short-term payment $t''_1(\phi^*, H)$ to optimistic managers is higher than the originally promised short-term payment $t'_1(\phi^*, L)$ to pessimistic managers, so pessimistic managers will have an incentive to deviate and claim they have a high signal. Therefore, the investor will have to pay the pessimistic managers more than under the vesting contract. If this loss is high enough to eat up the gains from trade with the optimistic manager, the contract is renegotiation proof.

The intuition is equivalent to the classic lemon's problem analyzed by Akerlof (1970). Although there are gains from trade when the manager "sells" his long-term compensation for short-term compensation, pessimistic managers are more eager to sell, since they know that the long-term payment is a lemon. Therefore, the market for optimistic managers breaks down.

The following claim shows that any renegotiation-proof contract must consist of a mix between

such a vesting contract and a short-term bonus.

Claim 1 *Any long-term contract that pays when $y = R$ has to be in the form of a vesting contract $\{t_1(\phi^*, L), t_2(\phi^*, R, H)\}$ where*

$$t_1(\phi^*, L) = \lambda P(R|L) t_2(\phi^*, R, H)$$

and $t_2(\phi^*, R, H) > 0$. *This is renegotiation proof if and only if*

$$\frac{1 - \lambda}{\lambda} \leq m(\phi^*) \left(\frac{P(L|W)}{P(H|W)} - \frac{P(L|R)}{P(H|R)} \right) \quad (2)$$

Proof. In Appendix B. ■

The renegotiation-proofness condition (2) states that the adverse selection problem has to be sufficiently big to overcome the gains from trade. It is easier to provide long-term incentives if the manager is patient (λ high) so that the gains from accelerating payments is smaller. Also, it is easier the lower the earnings target is (higher $m(\phi^*)$), since this implies that more pessimistic managers can reach the target so that the adverse selection is bigger. Finally, the expression in brackets is a measure of the difference in expectation about the long-term pay between optimistic and pessimistic managers: If managers receiving a low signal in period 1 has the same expectation about high profits in period 2, it is impossible to separate managers, and the contract will be renegotiated.

One way to implement the vesting contract is to award the manager stock options if the earnings hurdle ϕ^* is met. Suppose there is one stock which is entitled to the gross profit of the company, and the manager gets an option on a fraction k of this stock at exercise price X per stock. The stock price S_t is given by

$$\begin{aligned} S_1(\phi^*) &= E(y|\phi^*) = P(R|\phi^*)R \\ S_2(R) &= R, S_2(0) = 0 \end{aligned}$$

To replicate the long-term pay off of optimistic managers, we should set k and X so that

$$k(S_2(R) - X) = t_2$$

, and to replicate the short-term pay off of pessimistic managers we should set

$$k(S_1(\phi^*) - X, 0) = \lambda P(R|L) t_2$$

which gives

$$X = R \frac{P(R|\phi^*) - \lambda P(R|L)}{1 - \lambda P(R|L)}$$

$$k = \frac{t_2}{R \left(\frac{1 - P(R|\phi^*)}{1 - \lambda P(R|L)} \right)}$$

There are other ways that firms set up this type of self-selection packages. Awarding stocks instead of options that also vest over time is one way, although it can be shown that a pure stock award cannot implement the optimal contract in our setting. Another common way is through deferred compensation plans, where managers are allowed to forego their current pay or bonus for future payments.

4.1 Optimal contracts

We now derive the optimal contracts under renegotiation. If a pure short-term contract can make the manager work, it implements the first best and so is optimal. The earnings target will then be set as high as possible at $\phi^* = h$. The contract is acceptable to the investor if

$$\text{cost}(\text{short}, h) \leq pR - 1$$

Otherwise, a vesting contract will also have to be used. In this case, the earnings target has to be set low enough to satisfy the renegotiation-proofness condition (2). The lowest cost to the investor for making the manager work with a pure vesting contract can be calculated from the moral hazard constraint:

$$P(L|W) m(\phi^*) t_1(\phi^*, L) + \lambda P(H|W) P(R|H, W) t_2(\phi^*, R, H) - d$$

$$\geq (P(L|S) m(\phi^*) + P(H|S)) \lambda t_1(\phi^*, L)$$

The left hand side is the expected pay-off from working. The first term is the case where a manager who works gets a low signal, but manages to manipulate it to ϕ^* and takes the early payment. The

second is the case where the manager gets a high signal and takes the late payment.

The right hand side is the manager's pay-off from shirking, in which case he takes the early payment whenever he reaches the earnings target. Solving for the lowest $t_2(\phi^*, R, H)$ that satisfies the moral hazard condition, the expected cost to the investor from this payment is

$$\text{cost}(\text{vesting}, \phi^*) = \frac{d}{1 - \frac{(1-\lambda)\theta}{\theta + \lambda m(\phi^*)(1-\theta)} - \lambda \left(\frac{(1-\theta) + m(\phi^*)\theta}{\theta + \lambda m(\phi^*)(1-\theta)} \right) \frac{(1-\theta)}{P(L|W)}}$$

The cost of the optimal vesting contract over and above the first best cost d now derives from two sources. First, optimistic managers are paid late, which is costly because of the discount parameter λ . Second, managers earn a rent even when shirking, since they can still get the early pay if they manage to produce earnings ϕ^* .

It is easy to check that the cost is increasing in $m(\phi^*)$, the ease of pessimistic managers to reach the target. This is because the pay-off from shirking goes up when the target is easier to reach. Therefore, the target will be set as high as possible, but cannot be set so high as to violate the renegotiation-proofness condition (2). The optimal solution with manipulation and renegotiation is given in the following proposition.

Proposition 2 *The optimal renegotiation-proof contract with manipulation is given by:*

a) *If $\text{cost}(\text{short}, h) \leq pR - 1$ the optimal contract is short-term with $t_1(h) > 0$ and all other payments zero such that*

$$E(t_1|W) = pR - 1$$

b) *If $\text{cost}(\text{short}, h) > pR - 1 \geq \text{cost}(\text{vesting}, \phi^*)$, the contract consists of a short-term bonus $t_1(\phi^*)$ and a vesting contract $\{t_1(\phi^*, L), t_2(\phi^*, R, H)\}$ with all other payments zero, where the earning target ϕ^* is set at*

$$\phi^* = \max \left[\phi \in [l, h] : \frac{1-\lambda}{\lambda} \leq m(\phi) \left(\frac{P(L|W)}{P(H|W)} - \frac{P(L|R)}{P(H|R)} \right) \right]$$

c) *If*

$$pR - 1 \geq \max(\text{cost}(\text{short}, h), \text{cost}(\text{vesting}, \phi^*))$$

the project cannot be implemented.

Proof. In Appendix C. ■

The interesting case is b), where the vesting contract is needed to incentivize the manager.

The contract resembles actual compensation packages. It can be implemented by a combination of stock options and a short-term bonus $t_1(\phi^*)$. Whenever the renegotiation condition (2) binds, the option and bonus are granted for a threshold below h , and the manager is not paid more if the threshold is exceeded. Note that this must hold not only for the granting of options, but also for the short-term bonus - even though a short-term contract has better incentive effects if the target is set as high as possible. This shows the value of encouraging the manager to smooth earnings - it makes earnings less informative so that long-term compensation is credible, albeit at the expense of short-term incentives.

By changing the target earnings, the firm can endogenously choose the level of transparency. It is easy to show that for λ high enough, the vesting contract has lower cost than the short-term contract with target h , so that there are ranges for which solution *b*) will result. We now show that, even if the firm had the choice of introducing full transparency, it would often be better to allow manipulation:

Proposition 3 *There always exists an R and a $\underline{\lambda} < 1$ such that, for all $\lambda \geq \underline{\lambda}$, the project cannot be implemented under full transparency but can be implemented with a positive level of manipulation.*

Proof. In Appendix D. ■

The result in Proposition 3 casts some doubt on the merits of legislation such as the Sarbanes Oxley act geared at forcefully increasing transparency or in other ways restricting contracting opportunities in firms. If firms can influence transparency by structuring contracts in the right way, ruling out manipulation might have the unintended consequence of eliminating beneficial long-term contracts. Our analysis suggests that it may be at least as or more important to create institutions that make it easier for firms to commit to long-term compensation contracts even under full transparency.

Figure 2 illustrates the comparative statics behind the choice of a long-term contract allowing manipulation versus a short-term contract with full transparency. When the discount parameter λ is higher than the critical value plotted in the graph, the long-term contract with manipulation is cheaper to implement than a short-term contract with full transparency. A higher λ has two effects that favor long-term contracts. First, the manager becomes less impatient, so that it is cheaper to pay him late. Second, renegotiation becomes less valuable, so that the optimal contract can allow for a higher level of transparency without triggering renegotiation. This in turn makes the short-term portion of the contract more efficient in providing incentives.

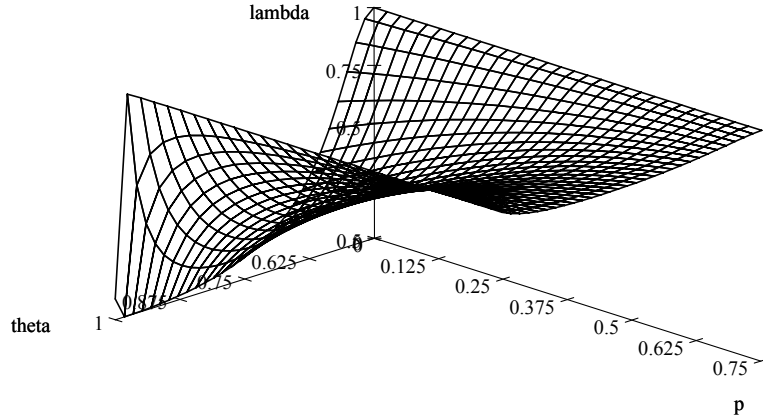


Figure 2: The picture shows, for given values of θ and p , the critical level of lambda above which it is easier to implement the long term contract with manipulation than the short term contract with full transparency.

Increasing the potential precision θ of the short-term signal has two opposing effects on the choice of contract, producing the non-monotonic comparative static in Figure 2. First, it increases the power of a short-term contract under full transparency. Indeed, as θ approaches 1, the short-term contract provides as powerful incentives as a long-term full commitment contract, and since the liquidity is higher, the short-term contract is optimal. Second, an increase in θ increases the potential for asymmetric information between the manager and the investor, and therefore makes it easier to commit to long-term contracts under manipulation. If θ is initially low (close to $\frac{1}{2}$), the second effect dominates, so that increases in θ favor long-term contracts and manipulation.

4.2 Discussion: Model

4.2.1 Mixed effort as a source of asymmetric information

In the paper, we concentrate on pure strategy equilibria in the choice of effort by the manager, and introduce asymmetric information through manipulation of earnings. It is also possible to have mixed strategy equilibria where the manager mixes over his choice of effort, as in Fudenberg and Tirole (1990). In a mixed strategy equilibrium, it may also be possible to commit to long-term contracts, as there will be asymmetric information about the effort at the renegotiation stage. We

solve for mixed strategy equilibria in Appendix E. The features of the contracts are similar to the optimal contracts in Proposition 2, except that any short-term bonus will only be awarded for the highest possible signal.

Generally, the solution with a mixed strategy equilibrium is less efficient than the one with manipulation we have studied. This is because mixing leads to suboptimally low effort provision. In contrast, with manipulation, the first best effort can be supported since the asymmetric information is created through (costless) manipulation.

4.2.2 Repeated effort

An important ingredient of the model is that renegotiation takes place after the effort of the manager is sunk. If the manager would continue to work after the renegotiation state, the temptation to provide him with liquidity will be muted by the necessity to give him further incentives to work. In a strict sense, our model therefore might apply best to situations where the manager is expected to quit, retire, or switch tasks. However, even if he continues to work on the same task, some of the effort will be sunk and so there is still an ex post incentive to modify the ex ante contract in the direction of providing more liquidity. Thus, many of the qualitative results we derive should not be sensitive to the (extreme) assumption of a completely sunk effort.

Furthermore, when renegotiation can take place before all the effort is sunk, other commitment problems appear. As pointed out by, among others, Acharya, John, and Sundaram (2000), it is often optimal ex post to provide fresh incentives to a manager even after bad initial performance. This can destroy ex ante incentives, as the manager knows that he will be given a valuable new compensation package even if he shirks in the first period. Therefore, introducing asymmetric information through manipulation might be helpful in preventing this type of renegotiation as well. We leave for future research the interesting but probably complicated analysis of a full dynamic effort model with renegotiation.

4.2.3 Repeated manipulation

For simplicity, we have also chosen to consider manipulation only of the first period earnings. If a manager can report earnings dynamically, and is capable of pushing off the booking of earnings today to a future date, or book earnings today that are expected to occur in the future, we conjecture that contracts would look largely similar to what we have derived. In particular, a bonus schedule with a minimum and maximum threshold would give the manager an incentive to smooth earnings

over time, thereby reducing the informational content of the accounts. Again, a full dynamic model is beyond the scope of this paper.

5 Conclusion

We have set up a model of optimal executive compensation with renegotiation when managers are more impatient than investors. We have shown that compensating the manager based on long-term information, even when it is much more informative than short-term information, is impossible if there is not enough opaqueness in the short-term. This is because after effort is sunk, investors always have an incentive to renegotiate any long-term contract when the manager is impatient. Only if there is enough private information early on can a long-term contract be credible. The private information creates a lemons problem at the renegotiation stage which can destroy the market for renegotiation. We show that allowing the manager to manipulate short-term earnings can be beneficial. The features of the compensation contract should be set to induce the manager to create just enough misinformation such that renegotiation is not optimal ex post. Our optimal contracts have the following features:

- The long-term portion of contracts can be viewed as a stock option that the manager has the right to exercise early. He does so if he feels the firm is overvalued.
- The short-term portion of contracts can be viewed as a bonus that is awarded only if a certain earning threshold is reached, with no additional payment if earnings are above the threshold. This encourages managers to smooth earnings: Optimistic managers understate earnings while pessimistic managers overstate them.

These results seem to conform well with observed practices in executive compensation.

Although we study manipulation as a source of asymmetric information, the logic extends to other dimensions of transparency that the firm can influence. One example is the choice of going public, with the extra demands on accounting and extra scrutiny from stock-markets it entails. Another way is to design the securities that investors hold in a way that induces the right amount of monitoring. Arms-length public debt would induce the least monitoring and thus the least transparency, while equity held by an active investor such as a venture capitalist would induce the most intense monitoring (see Rajan (1992) and Aghion, Bolton, and Tirole (2004) for related models).

Appendices

A Proof of Lemma 1

A general mechanism is a set of payments $\{t_1(\phi, r), t_2(y, \phi, r) | y \in \{0, R\}, \phi \in [l, \phi^L, \phi^*], r \in \{L, H\}\}$ with all other payments zero such that the manager works and it is incentive compatible for him to truthfully reveal his type (optimistic or pessimistic) and issue his prescribed earnings: Optimistic types issue earnings ϕ^* , and pessimistic types attempt to issue earnings ϕ^L . First note that without loss of generality, an optimal contract should assign pay 0 in both periods if the earnings report is not among those prescribed for the reported type r (that is, $\phi \notin [l, \phi^L]$ if $r = L$, or $\phi \notin \phi^*$ if $r = H$). If they are not, we can set them to 0 without affecting the program [OPT1] below. Therefore, the only relevant incentive compatibility constraints are those that correspond to the following misreports:

- $(\phi^*, H) \rightarrow (\phi^L, L), (\phi^*, H) \rightarrow (l, L)$: Optimistic managers misreport as pessimistic managers who either succeeded or failed to make their earnings report. To avoid this, we require

$$t_1(\phi^*, H) + \lambda E(t_2(y, \phi^*, H) | H, W) \geq t_1(\phi^L, L) + \lambda E(t_2(y, \phi^L, L) | H, W) \quad (3)$$

$$t_1(\phi^*, H) + \lambda E(t_2(y, \phi^*, H) | H, W) \geq t_1(l, L) + \lambda E(t_2(y, l, L) | H, W) \quad (4)$$

- $((m(\phi^L)\phi^L, (1 - m(\phi^L))l), L) \rightarrow ((m(\phi^*)\phi^*, H), ((1 - m(\phi^*))l), L)$: Pessimistic managers attempt to misreport as optimistic managers. To avoid this, we require

$$\begin{aligned} & m(\phi^L)(t_1(\phi^L, L) + \lambda E(t_2(y, \phi^L, L) | L, W)) + (m(\phi^*) - m(\phi^L))(t_1(l, L) + \lambda E(t_2(y, l, L) | L, W)) \\ & \geq m(\phi^*)(t_1(\phi^*, H) + \lambda E(t_2(y, \phi^*, H) | L, W)) \end{aligned} \quad (5)$$

- $((m(\phi^L)\phi^L, (1 - m(\phi^L))l), L) \rightarrow (l, L)$: Pessimistic managers attempt to issue earnings l instead of ϕ^L . To avoid this, we require

$$t_1(\phi^L, L) + \lambda E(t_2(y, \phi^L, L) | L, W) \geq t_1(l, L) + \lambda E(t_2(y, l, L) | L, W) \quad (6)$$

First, note that (5) and limited liability imply (6), and therefore we drop this constraint. Further, since the payments when the managers' earnings report is not prescribed for his reported type are 0, there is a redundancy in his reporting his type (his earnings report reveals it whenever $\phi^* \notin \{l, \phi^L\}$). Hence we drop the reported type from consideration from now on. The optimization program to solve then becomes:

$$\max_{\phi^L, \phi^* \in [l, h], \{t_1(\phi), t_2(y, \phi)\}_{y \in \{0, R\}, \phi \in [l, \phi^L, \phi^*]}} E(t_1(\phi)|W) + \lambda E(t_2(y, \phi)|W) \quad ([OPT1])$$

subject to the moral hazard constraint:

$$\begin{aligned} & E(t_1(\phi)|W) + \lambda E(t_2(y, \phi)|W) - d \\ \geq & P(H|S) \max_{\phi} \{t_1(\phi) + \lambda t_2(0, \phi)\} \\ & + P(L|S) \left\{ \max_{\phi} \{m(\phi)(t_1(\phi) + \lambda t_2(0, \phi)) + (1 - m(\phi))(t_1(l) + \lambda t_2(0, l))\} \right\}, \end{aligned}$$

the IC constraints (3-5),

the break even constraint:

$$E(t_1(\phi)|W) + E(t_2(y, \phi)|W) \leq pR - 1,$$

and limited liability:

$$t_1(\phi), t_2(y, \phi) \geq 0 \quad \forall \phi.$$

The right hand side of the moral hazard constraint can be understood as follows. If the manager deviates and shirks, he will not necessarily stick to the equilibrium prescribed manipulation. Given the payment schedule and his expectation about profits, he will first choose the best possible earnings manipulation strategy available to him. When the manager shirks, second period profits are bound to be zero.

We proceed to relax the IC constraints, and show that the solution to this relaxed program meets the IC constraints (3-5). We now establish the Lemma via a series of Claims. First, note that any contract that can be perturbed so that $E(t_1(\phi)|W)$ and $E(t_2(y, \phi)|W)$ are kept constant but the right hand side of the moral hazard constraint goes down weakly, can be disregarded as an optimal solution:

Claim 2 *Suppose a contract $t \equiv \{t_1(\phi), t_2(y, \phi)\}_{y \in \{0, R\}, \phi \in [l, \phi^L, \phi^*]}$ can be changed for a contract*

$t' \equiv \{t'_1(\phi), t'_2(y, \phi)\}_{y \in \{0, R\}, \phi \in [l, \phi^L, \phi^*]}$ satisfying limited liability such that

$$\begin{aligned} E(t'_1(\phi)|W) &= E(t_1(\phi)|W) \\ E(t'_2(y, \phi)|W) &= E(t_2(y, \phi)|W) \end{aligned}$$

and such that the right hand side of the moral hazard constraint goes down. Then, there is no loss of generality from ruling out the contract t as a solution to the program.

Proof. Any such change keeps the maximand, the break even constraint, and the left hand side of the moral hazard constraint unchanged. Since the right hand side of the moral hazard constraint goes down, the new contract is feasible if the old contract is and gives the same payoff to the manager. Thus, the new contract is no worse than the original contract, and there is no loss from ruling out t as a solution. ■

We use the claim above to prove the results below. We first show that the optimal contract never pays for low profits, since this decreases incentives to work:

Claim 3 *In an optimal contract, $t_2(0, \phi) = 0$ and $t_2(R, \phi) \equiv t_2(R)$ for all ϕ .*

Proof. Suppose $t_2(0, \phi) > 0$ for some ϕ . Then, construct t' by reducing $t_2(0, \phi)$ and increasing $t_2(R, \phi)$ to keep $E(t'_2(y, \phi)|W)$ constant:

$$dt_2(R, \phi) = -dt_2(0, \phi) \frac{P(0|W)}{P(R|W)}$$

This reduces the right hand side of the moral hazard constraint.

Suppose $t_2(R, \phi) \neq t_2(R, \phi')$ for some ϕ and ϕ' . Then, introduce a new contract t' equivalent to t except that $\forall \phi' \in \{l, \phi^L, \phi^*\}$,

$$t'_2(R, \phi') = E(t_2(R, \phi)|W)$$

Then, $E(t'_2(y, \phi)|W) = E(t_2(y, \phi)|W)$ and the right hand side of the moral hazard constraint is unchanged. ■

Using this result, the right hand side of the moral hazard constraint can be written as:

$$P(H|S) \max_{\phi \in \{l, \phi^L, \phi^*\}} t_1(\phi) + P(L|S) \max_{\phi \in \{l, \phi^L, \phi^*\}} \{m(\phi) (t_1(\phi)) + (1 - m(\phi)) t_1(l)\} \quad (7)$$

We now show that it is optimal to induce optimistic managers to issue the highest possible earnings h , since this makes it harder for pessimistic managers to mimic.

Claim 4 *In an optimal contract, $\phi^* = h$.*

Proof. Setting $\phi^* = h$ without changing ϕ^L does not change $E(t_1(\phi)|W)$ or the first term in (7). Suppose $t_1(\phi^*) \leq t_1(l)$. Then, setting $\phi^* = h$ does not change the second term in (7). Now suppose $t_1(\phi^*) > t_1(l)$. Then, setting $\phi^* = h$ (weakly) reduces the second term in (7) since

$$m(\phi^*)t_1(\phi^*) + (1 - m(\phi^*))t_1(l)$$

is increasing in $m(\phi)$ when $t_1(\phi^*) > t_1(l)$, and $m(\phi)$ is decreasing in ϕ . Thus, we should set $\phi^* = h$.

■

Using the above result, we proceed with $\phi^* = h$ in the proofs below.

Claim 5 *In an optimal contract, $t_1(h) \geq t_1(\phi^L) \geq t_1(l)$*

Proof. Suppose $t_1(h) < t_1(\phi^L)$. Then, (7) does not change if $t_1(h)$ is increased. If we increase $t_1(h)$ and decrease $t_1(\phi^L)$ to keep $E(t_1(\phi, \sigma)|W)$ constant, (7) falls. Thus, $t_1(h) \geq t_1(\phi^L)$ in an optimal contract. Now suppose $t_1(\phi^L) < t_1(l)$. Then, (7) does not change if $t_1(\phi^L)$ is increased. If we reduce $t_1(l)$ and increase $t_1(\phi^L)$ to keep $E(t_1(\phi, \sigma)|W)$ constant, (7) falls. So $t_1(\phi^L) \geq t_1(l)$ in an optimal contract. ■

We now show that without loss of generality, we can set $\phi^L = h$ so that pessimistic managers try to mimic optimistic managers in their manipulation of earnings.

Claim 6 *Without loss of generality, in an optimal contract, $\phi^L = h$.*

Proof. Suppose $\phi^L < h$. Using Claim 5, the right hand side of the moral hazard constraint now becomes

$$\begin{aligned} & P(H|S)t_1(h) \\ & + P(L|S) \max_{\phi \in \{\phi^L, h\}} \{ (m(h)t_1(h) + (1 - m(h))t_1(l)), (m(\phi^L)t_1(\phi^L) + (1 - m(\phi^L))t_1(l)) \} \end{aligned} \tag{8}$$

Using this, we now show that when $\phi^L < h$, an optimal contract should make a pessimistic manager indifferent between attempting to issue earnings ϕ^L and h . Suppose to the contrary that

$$m(h)t_1(h) + (1 - m(h))t_1(l) > m(\phi^L)t_1(\phi^L) + (1 - m(\phi^L))t_1(l).$$

Note that this implies that $t_1(h) > t_1(\phi^L)$, since $m(h) < m(\phi^L)$ when $\phi^L < h$. Then, we can decrease $t_1(h)$ and increase $t_1(\phi^L)$ to keep $E(t_1(\phi)|W)$ constant. This reduces (7).

Now suppose

$$m(h)t_1(h) + (1 - m(h))t_1(l) < m(\phi^L)t_1(\phi^L) + (1 - m(\phi^L))t_1(l)$$

Then, decrease $m(\phi^L)t_1(\phi^L) + (1 - m(\phi^L))t_1(l)$ and increase $t_1(h)$ to keep $E(t_1(\phi)|W)$ constant:

$$dt_1(h) = -\frac{P(L|W)}{P(H|W)}d(m(\phi^L)t_1(\phi^L) + (1 - m(\phi^L))t_1(l))$$

This changes (7) by a factor of

$$\frac{P(L|W)}{P(H|W)}P(H|S) - P(L|S) < 0$$

Thus, we should have

$$m(h)t_1(h) + (1 - m(h))t_1(l) = m(\phi^L)t_1(\phi^L) + (1 - m(\phi^L))t_1(l)$$

whenever $\phi^L < h$. But then, suppose we set $\phi^L = h$. This does not change the program and so can be done without loss of generality. Thus, we can set $\phi^L = h$ without loss of generality. ■

Using the result above, (7) becomes

$$(P(H|S) + P(L|S)m(h))t_1(h) + (1 - m(h))t_1(l). \quad (9)$$

Claim 7 *In an optimal contract, $t_1(l) = 0$.*

Proof. Suppose $t_1(l) > 0$. Then, reduce $t_1(l)$ and increase $t_1(h)$ to keep $E(t_1(\phi)|W)$ constant:

$$(P(H|W) + m(h)P(L|W))dt_1(h) = -(1 - m(h))P(L|W)dt_1(l)$$

This changes (9) by a factor of

$$\begin{aligned} & \frac{P(H|S) + m(h)P(L|S)}{P(H|W) + m(h)P(L|W)}(1 - m(h))P(L|W) - (1 - m(h))P(L|S) \\ & < (1 - m(h))P(L|W) - (1 - m(h))P(L|S) \\ & < 0 \end{aligned}$$

■

To conclude, the proposed optimal solution to [OPT1] is $\phi^L = \phi^* = h$, $t_1(h, \cdot)$ constant, $t_2(R, \cdot, \cdot)$ constant, and all other payments equal 0. It is easily verified that this solution to the relaxed program meets the IC constraints (3-5) and therefore solves [OPT1]. Finally, recall that we had assumed that $\phi^* \notin \{l, \phi^L\}$ in order to ignore the reported type. However, we now have that $\phi^* = \phi^L = h$. We hence need to show that we cannot improve on this solution by taking into account the reported type. Note that (3) and (5) are met at equality in our proposed solution, as is the break-even inequality. To improve on this solution, at least one of optimistic and pessimistic manager's payoff will have to increase strictly, and neither can decrease (since the ICs are met at equality). Since the break-even constraint is met at equality, this can only be done by transferring period 2 payoffs to period 1. However note that by the lead-up to Proposition 1, we have that either we implement a purely short-term contract (in which case such a transfer is impossible), or else the moral hazard constraint binds - in which case such a transfer would violate the moral hazard constraint.

B Proof of Claim 1

Recall the contract $t = \{t_1(\phi^*, r), t_2(y, \phi^*, r)\}_{y \in \{0, R\}, r \in \{L, H\}}$ is renegotiation proof for high effort if and only if it is the solution to the program:

$$\min_{\{t'_1(\phi, r), t'_2(y, \phi, r)\}_{y \in \{0, R\}, r \in \{L, H\}}} E(t'_1(\phi, r) + t'_2(y, \phi, r) | \phi, W)$$

such that:

$$\begin{aligned} & t'_1(\phi, H) + \lambda (P(R|H, W) t'_2(R, \phi, H) + P(0|H, W) t'_2(0, \phi, H)) \\ \geq & t'_1(\phi, L) + \lambda (P(R|H, W) t'_2(R, \phi, L) + P(0|H, W) t'_2(0, \phi, L)) \end{aligned} \quad (\text{ICH})$$

$$\begin{aligned} & t'_1(\phi, L) + \lambda (P(R|L, W) t'_2(R, \phi, L) + P(0|L, W) t'_2(0, \phi, L)) \\ \geq & t'_1(\phi, H) + \lambda (P(R|L, W) t'_2(R, \phi, H) + P(0|L, W) t'_2(0, \phi, H)) \end{aligned} \quad (\text{ICL})$$

$$\begin{aligned} & t'_1(\phi, H) + \lambda (P(R|H, W) t'_2(R, \phi, H) + P(0|H, W) t'_2(0, \phi, H)) \\ \geq & t_1(\phi, H) + \lambda (P(R|H, W) t_2(R, \phi, H) + P(0|H, W) t_2(0, \phi, H)) \end{aligned} \quad (\text{IRH})$$

$$\begin{aligned} & t'_1(\phi, L) + \lambda (P(R|L, W) t'_2(R, \phi, L) + P(0|L, W) t'_2(0, \phi, L)) \\ \geq & t_1(\phi, L) + \lambda (P(R|L, W) t_2(R, \phi, L) + P(0|L, W) t_2(0, \phi, L)) \end{aligned} \quad (\text{IRL})$$

$$t'_1(\phi, r), t'_2(y, \phi, r) \geq 0 \quad \forall r, y \quad (\text{LL})$$

We will prove a more general result than Claim 1 here. First, we show that for an earnings announcement ϕ that reveals the manager's type σ , a renegotiation-proof contract must be short-term:

Lemma 2 *If $P(\phi|\sigma, W) = 0$ for some σ , an optimal renegotiation-proof contract is short-term conditional on earnings realization ϕ with $t_1(\phi, L) = t_1(\phi, H)$.*

Proof. The only payoff relevant part of the contract when $P(\phi|\sigma, W) = 0$ are payments contingent on $\sigma' \neq \sigma$ where $P(\phi|\sigma', W) > 0$. Suppose contrary to the claim in the Lemma that $t_2(y, \phi, \sigma') > 0$ for some y in a renegotiation proof contract. Then, introduce a new contract $t'(\phi)$ such that

$$t'_1(\phi, \sigma') = t_1(\phi, \sigma') + \lambda E(t_2(y, \phi, \sigma') | \phi, \sigma', W)$$

and

$$t'_2(y, \phi, \sigma') = 0 \quad \forall y.$$

If

$$\begin{aligned} & t_1(\phi, \sigma) + \lambda (P(R|\sigma, W) t_2(R, \phi, \sigma) + P(0|\sigma, W) t_2(0, \phi, \sigma)) \\ & \geq t'_1(\phi, \sigma'), \end{aligned}$$

do not change payments contingent on σ , otherwise, set

$$t'_1(\phi, \sigma) = t'_1(\phi, \sigma')$$

and all other payments contingent on σ to zero. Then, no conditions are violated, but the minimand is reduced so a renegotiation proof contract must have $t_2(y, \phi, \sigma') = 0$ for all y . It is easy to see that in the ex ante problem, if the equilibrium prescribes $P(\phi|\sigma, W) = 0$, it is without loss of generality to make the expected payoff for a manager with signal σ as low as possible when he issues the off equilibrium earnings ϕ . Thus, we should set $t_1(\phi, \sigma) = t_1(\phi, \sigma') \equiv t_1(\phi)$. ■

Since $P(\phi|H, W) = 0$ for $\phi \neq \phi^*$, second period payments are only possible contingent on $\phi = \phi^*$. We now characterize renegotiation proof long-term contracts. We restrict attention to contracts that can have $t_2(R, \phi^*, \sigma) > 0$ for some σ . It is easy to show that a long-term contract

that pays only for low profits can never be optimal.

Lemma 3 *Conditional on earnings realization ϕ^* , the contract $t(\phi^*)$ is renegotiation proof if and only if $t_1(\phi^*, L), t_1(\phi^*, H), t_2(R, \phi^*, H) \geq 0$ and all other payments are zero, where:*

$$t_1(\phi^*, L) = t_1(\phi^*, H) + \lambda P(R|L) t_2(R, \phi^*, H)$$

and $t_2(R, \phi^*, H) = 0$ if

$$\frac{1-\lambda}{\lambda} > P(\phi^*|L, W) \left(\frac{P(L|W)}{P(H|W)} - \frac{P(L|R)}{P(H|R)} \right) \quad (10)$$

B.1 Proof of Lemma 3

Claim 8 *In a renegotiation-proof contract, it is optimal to set $t_2(R, \phi^*, L) = 0$.*

Proof. Suppose $t_2(R, \phi^*, L) > 0$. Then, lower $t_2(R, \phi^*, L)$ and increase $t_1(\phi^*, L)$ to keep the left hand side of *ICL* and *IRL* constant. This lowers the *RHS* of *ICH* as $P(R|H, W) > P(R|L, W)$, and leaves all other constraints unchanged. This decreases the minimand as $\lambda < 1$, a contradiction. ■

Claim 9 *In a renegotiation-proof contract, it is optimal to set $t_2(0, \phi^*, H) = 0$.*

Proof. Otherwise, lower $t_2(0, \phi^*, H)$ and increase $t_1(\phi^*, H)$ to keep the left hand side of *ICH* and *IRH* constant. This relaxes *ICL* as $1 - P(R|H, W) < 1 - P(R|L, W)$. As $P(H|\phi^*, W) > 0$, this strictly decreases the minimand as $\lambda < 1$, a contradiction. ■

Claim 10 *Suppose $\{t\}$ is renegotiation proof such that $t_2(R, \phi^*, H) > 0$. Then, $t_2(0, \phi^*, L) = 0$ and $t_1(\phi^*, L) = t_1(\phi^*, H) + \lambda P(R|L) t_2(R, \phi^*, H)$*

Proof. First, we show that if $t_2(R, \phi^*, H) > 0$, *ICL* must bind. Suppose to the contrary that *ICL* is slack and $t_2(R, \phi^*, H) > 0$. Then, lower $t_2(R, \phi^*, H)$ and increase $t_1(\phi^*, H)$ to keep the left hand side of *ICH* and *IRH* constant. This decreases the minimand since $\lambda < 1$, and does not

violate ICL since it is slack. Thus, ICL must bind. But then, ICH must be slack, since

$$\begin{aligned}
& t_1(\phi^*, H) + \lambda P(R|H, W) t_2(R, \phi^*, H) \\
> & t_1(\phi^*, H) + \lambda P(R|L, W) t_2(R, \phi^*, H) \\
= & t_1(\phi^*, L) + \lambda P(0|L, W) t_2(0, \phi^*, L) \\
\geq & t_1(\phi^*, L) + \lambda P(0|H, W) t_2(0, \phi^*, L)
\end{aligned}$$

where the first inequality follows from $P(R|H, W) > P(R|L, W)$ and the last from $P(0|L, W) > P(0|H, W)$. Therefore, ICH can be omitted from the program. Now we show that $t_2(0, \phi^*, L) = 0$. Otherwise, lower $t_2(0, \phi^*, L)$ and increase $t_1(\phi^*, L)$ to keep the left hand side of ICL constant. This weakly decreases the minimand and violates no constraints (ICH already having been shown redundant). From the binding ICL constraint, we therefore have $t_1'(\phi^*, L) = t_1(\phi^*, H) + \lambda P(R|L) t_2(R, \phi^*, H)$ ■

The above results establish that either the contract is short-term, in which case $t_1(\phi^*, L) = t_1(\phi^*, H)$ from ICL and ICH , or $t_2(R, \phi^*, H) > 0$ with $t_1(\phi^*, L) = t_1(\phi^*, H) + \lambda P(R|L) t_2(R, \phi^*, H)$ and all other payments are zero. We now establish the last part of the Lemma.

Claim 11 *If the manager works at time 0, $t_2(R, \phi^*, H) > 0$ is renegotiation proof if and only if Condition (10) does not hold.*

Proof. Suppose $t_2(R, \phi^*, H) > 0$. Then, any perturbation that increases $t_2(R, \phi^*, H)$ and reduces $t_1(\phi^*, H)$ while satisfying ICL , IRL and IRH , cannot increase the lender's payoff as $\lambda < 1$. Hence, the only possible gain is if $t_2(R, \phi^*, H)$ is lowered and $t_1(\phi^*, H)$ is increased. Such a perturbation that keeps the right-hand-side of ICL constant lowers the left-hand-side of IRH and hence cannot be feasible. Therefore, lower $t_2(R, \phi^*, H)$ and increase $t_1(\phi^*, H)$ to keep the left-hand-side of IRH constant. The change in the objective function is

$$\begin{aligned}
& P(H|\phi^*, W) (\lambda P(R|H, W) - P(R|H, W)) + P(L|\phi^*, W) \lambda (P(R|H, W) - P(R|L, W)) \\
= & P(L|\phi^*, W) \lambda (P(R|H, W) - P(R|L, W)) - P(H|\phi^*, W) (1 - \lambda) P(R|H, W) \\
= & P(\phi^*|L, W) \frac{P(L|W)}{P(\phi^*|W)} \lambda \left(P(H|R) \frac{P(R|W)}{P(H|W)} - P(L|R) \frac{P(R|W)}{P(L|W)} \right) \\
& - P(\phi^*|H, W) \frac{P(H|W)}{P(\phi^*|W)} (1 - \lambda) P(H|R) \frac{P(R|W)}{P(H|W)}
\end{aligned}$$

Note that $P(\phi^*|H, W) = 1$. Therefore, the expression above has the same sign as

$$P(\phi^*|L, W) \left(\frac{P(L|W)}{P(H|W)} - \frac{P(L|R)}{P(H|R)} \right) - \frac{1 - \lambda}{\lambda}$$

This is negative if and only if Condition (10) holds, in which case the minimand is decreased and $t_2(R, \phi^*, H) > 0$ cannot be renegotiation-proof. Thus, $t_2(R, \phi^*, H) > 0$ is renegotiation proof if and only if Condition (10) is violated. ■

This concludes the proof of the Lemma. Now, suppose $\phi^L = \phi^*$, so that $P(\phi^*|L, W) = m(\phi^*)$. Then, the Lemma coincides with Claim 1.

C Proof of Proposition 2

First, note that if a short-term contract can make the manager work while allowing the investor to break even, it is first best. Since short-term contracts are renegotiation proof, the optimal short-term contract coincides with the full commitment case $t_1(h) > 0$ and all other payments zero, and is feasible if

$$\text{cost}(\text{short}, h) \leq pR - 1,$$

which is the first part of the Proposition.

If the short-term contract is not feasible, the only other candidate is a long-term contract with $t_2(R, \phi^*, H) > 0$. From Lemma 3, the short-term payments at ϕ^* are given by $t_1(\phi^*, H) \geq 0$ and

$$t_1(\phi^*, L) = t_1(\phi^*, H) + \lambda P(R|L, W) t_2(R, \phi^*, H)$$

For $\phi \neq \phi^*$, Lemma 2 shows that the contract must be short-term. With slight abuse of notation, we denote the short-term payment at ϕ^L given to pessimistic managers by $t_1(\phi^L, L)$, where it is understood that for $\phi^L \neq \phi^*$, there is also an off-equilibrium pay-off $t_1(\phi^L, H) = t_1(\phi^L, L)$. Similarly, we denote the short-term payment given to pessimistic managers at l by $t_1(l, L)$, where it is understood that for $l \neq \phi^*$, there is also an off-equilibrium pay-off $t_1(l, H) = t_1(l, L)$. When $\phi^L = \phi^*$ or $l = \phi^*$, these payments are replaced by $\{t_1(\phi^*, L), t_1(\phi^*, H)\}$.

Using the results from Appendix B, the ex ante program becomes

$$\max_{\phi^*, \phi^L, t_1(\phi^*, H), t_2(R, \phi^*, H), t_1(\phi^L, L), t_1(l, L)} E(t_1(\phi, \sigma)|W) + \lambda P(R, H|W) t_2(R, \phi^*, H)$$

subject to the moral hazard constraint:

$$\begin{aligned} & E(t_1(\phi, \sigma)|W) + \lambda P(R, H|W)t_2(R, \phi^*, H) - d \\ \geq & P(H|S) \max_{\phi} t_1(\phi, L) + P(L|S) \max_{\phi} \{m(\phi) t_1(\phi, L) + (1 - m(\phi)) t_1(l, L)\}, \end{aligned}$$

the break even constraint:

$$E(t_1(\phi, \sigma)|W) + P(R, H|W)t_2(R, \phi^*, H) \leq pR - 1,$$

the renegotiation constraints:

$$t_1(\phi^*, L) = t_1(\phi^*, H) + \lambda P(R|L, W)t_2(R, \phi^*, H) \quad (ICL)$$

$$\frac{1 - \lambda}{\lambda} \leq P(\phi^*|L, W) \left(\frac{P(L|W)}{P(H|W)} - \frac{P(L|R)}{P(H|R)} \right),$$

incentive compatibility:

$$\begin{aligned} t_1(\phi^*, H) + \lambda P(R|H, W)t_2(R, \phi^*, H) & \geq t_1(\phi, L) \quad \forall \phi \\ m(\phi^L) t_1(\phi^L, L) + (1 - m(\phi^L)) t_1(l, L) & \geq m(\phi^*) t_1(\phi^*, L) + (1 - m(\phi^*)) t_1(l, L) \\ t_1(\phi^L, L) & \geq t_1(l, L) \end{aligned}$$

and limited liability:

$$t_1(\phi, \sigma), t_2(y, \phi, \sigma) \geq 0 \quad \forall y, \phi, \sigma.$$

To understand the right hand side of the moral hazard constraint, recall that output is always low when the manager shirks. Hence, the manager certainly prefers to always announce she has a low signal and get paid in period 1. The renegotiation constraints follow from Lemma 3 when $t_2(R, \phi^*, H) > 0$. The incentive compatibility constraints ensures that a manager sticks to the equilibrium manipulation and report.

We now show that in an optimal contract, pessimistic managers try to mimic optimistic managers in their earnings report:

Claim 12 $\phi^L = \phi^*$.

Proof. A necessary condition for the renegotiation condition to hold if $t_2(R, \phi^*, H) > 0$ is that

either $\phi^L = \phi^*$ or $\phi^L > \phi^* = l$ so that $P(\phi^*|L, W) > 0$. Thus, suppose contrary to the Claim that $\phi^L > \phi^* = l$. The right hand side of the moral hazard condition is then equal to

$$P(H|S)t_1(\phi^L, L) + P(L|S) \{m(\phi^L)t_1(\phi^L, L) + (1 - m(\phi^L))t_1(l, L)\}$$

Suppose we set $\phi^{L'} = \phi^* = l$ and $t'_1(l, L) = t_1(l, L) + \Delta$, $t'_1(l, H) = t_1(l, H) + \Delta$, where Δ is set to keep $E(t'_1(\phi, \sigma)|W) = E(t_1(\phi, \sigma)|W)$:

$$\begin{aligned} & P(H|W)(t_1(l, H) + \Delta) + P(L|W)(t_1(l, L) + \Delta) \\ = & P(H|W)t_1(l, H) + P(L|W)(m(\phi^L)t_1(\phi^L, L) + (1 - m(\phi^L))t_1(l, L)) \end{aligned}$$

$$\Delta = P(L|W)m(\phi^L)(t_1(\phi^L, L) - t_1(l, L)).$$

This does not affect the maximand, the break even constraint, or the left hand side of the moral hazard constraints. This (weakly) relaxes renegotiation and incentive compatibility conditions. The right hand side of the moral hazard constraint now becomes $t'_1(l, L)$, so it changes by

$$\begin{aligned} & t_1(l, L) + P(L|W)m(\phi^L)(t_1(\phi^L, L) - t_1(l, L)) \\ & - (P(H|S)t_1(\phi^L, L) + P(L|S)\{m(\phi^L)t_1(\phi^L, L) + (1 - m(\phi^L))t_1(l, L)\}) \\ = & (t_1(l, L) - t_1(\phi^L, L))(1 - P(L|W)m(\phi^L) - P(L|S)(1 - m(\phi^L))) \end{aligned}$$

Note that

$$t_1(l, L) - t_1(\phi^L, L) \leq 0$$

from the incentive compatibility constraints, and

$$\begin{aligned} (1 - P(L|W)m(\phi^L) - P(L|S)(1 - m(\phi^L))) & > 1 - P(L|S) \\ & > 0 \end{aligned}$$

Hence, the right hand side of the moral hazard constraint goes down (strictly). Using a similar argument to Claim 2, this solution is not optimal and we have the requisite contradiction. ■

Claim 13 *We can set $t_1(l, L) = 0$ if $\phi^* > l$.*

Proof. Otherwise, set $t'_1(l, L) = 0$, $t'_1(\phi^*, H) = t_1(\phi^*, H) + \Delta$ and $t'_1(\phi^*, L) = t_1(\phi^*, L) + \Delta$,

where Δ is set so that $E(t'_1(\phi, \sigma)|W) = E(t_1(\phi, \sigma)|W)$ constant:

$$(P(H|W) + P(L|W)m(\phi^*))\Delta = P(L|W)(1 - m(\phi^*))t_1(l, L)$$

where we have used $\phi^* = \phi^L$. This does not affect the maximand, the break even constraint, the left hand side of the moral hazard constraint, or the renegotiation constraints. The incentive compatibility conditions are relaxed. The right hand side of the moral hazard constraint changes by

$$\begin{aligned} & (P(H|S) + P(L|S)m(\phi^*))\Delta - P(L|S)(1 - m(\phi^*))t_1(l, L) \\ = & (1 - m(\phi^*))t_1(l, L) \left(\frac{P(H|S) + P(L|S)m(\phi^*)}{P(H|W) + P(L|W)m(\phi^*)} P(L|W) - P(L|S) \right) \\ < & 0, \end{aligned}$$

and hence once again we have the requisite contradiction. ■

Using the above claim, we can drop $t_1(l, L)$ from the program above. With these results, the program pays only for earnings ϕ^* , and pessimistic managers try to mimic optimistic managers. Together with the renegotiation constraints, this implies that the incentive compatibility conditions can be dropped from the program as they are always satisfied. Next, we show that ϕ^* should be set as high as possible, subject to not violating the renegotiation constraints:

Claim 14 *We should set*

$$\begin{aligned} \phi^* & \equiv \phi^{**} \\ & = \max_{\phi \in [l, h]} \phi : \frac{1 - \lambda}{\lambda} \leq m(\phi) \left(\frac{P(L|W)}{P(H|W)} - \frac{P(L|R)}{P(H|R)} \right) \end{aligned}$$

Proof. Suppose $\phi^* < \phi^{**}$ in a candidate optimal contract. Then, introduce a new contract with $\phi^{*'} = \phi^{**}$, $t'_R(R, \phi^{**}, H) = t_R(R, \phi^{**}, H)$, $t'_1(\phi^{**}, H) = t_1(\phi^*, H) + \Delta$ and $t'_1(\phi^{**}, L) = t_1(\phi^*, L) + \Delta$ where Δ is set so that $E(t'_1(\phi, \sigma)|W) = E(t_1(\phi, \sigma)|W)$:

$$\Delta = \frac{P(L|W)(m(\phi^*) - m(\phi^{**}))t_1(\phi^*, L)}{P(H|W) + P(L|W)m(\phi^{**})}$$

This does not change the maximand, the break even constraint, or the left-hand side of the moral hazard constraint and does not violate the renegotiation constraints. The right hand side of the

moral hazard constraint changes by

$$\begin{aligned}
& (P(H|S) + P(L|S)m(\phi^{**})) (t_1(\phi^*, L) + \Delta) \\
& - (P(H|S) + P(L|S)m(\phi^*)) t_1(\phi^*, L) \\
= & t_1(\phi^*, L) (m(\phi^*) - m(\phi^{**})) \left(P(L|W) \frac{P(H|S) + P(L|S)m(\phi^{**})}{P(H|W) + P(L|W)m(\phi^{**})} - P(L|S) \right) \\
\leq & 0
\end{aligned}$$

Hence, the program is relaxed. ■

Note that the program is only feasible if ϕ^{**} exists. Using the results above, and substituting for $t_1(\phi^{**}, L)$ in terms of $t_1(\phi^{**}, H)$ and $t_2(R, \phi^{**}, H)$ from the renegotiation constraint, the full program becomes:

$$\begin{aligned}
& \max_{t_1(\phi^{**}, H), t_2(R, \phi^{**}, H)} (P(H|W) + P(L|W)m(\phi^{**})) t_1(\phi^{**}, H) \\
& + \lambda (P(R, H|W) + P(R, L|W)m(\phi^{**})) t_2(R, \phi^{**}, H)
\end{aligned}$$

subject to the moral hazard constraint:

$$\begin{aligned}
& (P(H|W) + P(L|W)m(\phi^{**})) t_1(\phi^{**}, H) \\
& + \lambda (P(R, H|W) + P(R, L|W)m(\phi^{**})) t_2(R, \phi^{**}, H) - d \\
\geq & (P(H|S) + P(L|S)m(\phi^{**})) (t_1(\phi^{**}, H) + \lambda P(R|L, W) t_2(R, \phi^{**}, H))
\end{aligned}$$

the break even constraint:

$$\begin{aligned}
& (P(H|W) + P(L|W)m(\phi^{**})) t_1(\phi^{**}, H) \\
& + (P(R, H|W) + \lambda P(R, L|W)m(\phi^{**})) t_2(R, \phi^{**}, H) \\
\leq & pR - 1
\end{aligned}$$

and limited liability:

$$t_1(\phi^{**}, H), t_2(R, \phi^{**}, H) \geq 0 \quad \forall y, \phi, \sigma$$

Note that since we have assumed that an optimal short-term contract is not feasible, the program is not feasible for $t_2(R, \phi^{**}, H) = 0$. Now we check the condition for a contract with $t_2(R, \phi^{**}, H) > 0, t_1(\phi^{**}, H) = 0$ to be feasible. If there is no such contract, there is no contract at all for which

the program is feasible.

Setting $t_2(R, \phi^{**}, H)$ as small as possible while still satisfying the moral hazard constraint, we get

$$t_2(R, \phi^{**}, H) = \frac{d}{(\lambda(P(R, H|W) + P(R, L|W)m(\phi^{**})) - (P(H|S) + P(L|S)m(\phi^{**}))\lambda P(R|L, W))}$$

Substituting into the left hand side of the break even constraint, we get

$$\frac{(P(R, H|W) + \lambda P(R, L|W)m(\phi^{**}))d}{(\lambda(P(R, H|W) + P(R, L|W)m(\phi^{**})) - (P(H|S) + P(L|S)m(\phi^{**}))\lambda P(R|L, W))} \leq pR - 1$$

or

$$\text{cost}(\text{vesting}, \phi^{**}) \leq pR - 1$$

Thus, when

$$\text{cost}(\text{vesting}, \phi^{**}) \leq pR - 1 < \text{cost}(\text{short}, h)$$

, the optimal contract is found by a mix of the short-term component $t_1(\phi^{**}, H)$ and the long-term component $t_2(R, \phi^{**}, H)$ such that the break-even and moral hazard conditions are satisfied with equality. This is case b) of the Proposition. When

$$\min(\text{cost}(\text{vesting}, \phi^{**}), \text{cost}(\text{short}, h)) > pR - 1$$

the program is not feasible. This is case c) of the Proposition.

D Proof of Proposition 3

We have to show that there exists a $\underline{\lambda}$, R , and a function $\phi^*(\lambda)$ with $m(\phi^*(\lambda)) > 0$ such that, for all $\lambda \geq \underline{\lambda}$

$$\text{cost}(\text{vesting}, \phi^*(\lambda)) < \text{cost}(\text{short}, H)$$

and

$$\frac{1 - \lambda}{\lambda} \leq m(\phi^*(\lambda)) \left(\frac{P(L|W)}{P(H|W)} - \frac{P(L|R)}{P(H|R)} \right)$$

If that is the case, there must be an R such that

$$\text{cost}(\text{vesting}, \phi^*(\lambda)) < pR - 1 < \text{cost}(\text{short}, H)$$

so that the project is feasible with manipulation and a vesting contract but not without. We have

$$\begin{aligned} \text{cost}(\text{short}, H) &= \frac{d}{1 - \frac{P(H|S)}{P(H|W)}} = \frac{d}{1 - \frac{1-\theta}{\theta p + (1-\theta)(1-p)}} \\ \text{cost}(\text{vesting}, \phi^*) &= \frac{d}{1 - \frac{(1-\lambda)\theta}{\theta + \lambda m(\phi^*)(1-\theta)} - \lambda \left(\frac{(1-\theta) + m(\phi^*)\theta}{\theta + \lambda m(\phi^*)(1-\theta)} \right) \frac{(1-\theta)}{P(L|W)}} \\ &= \frac{d}{1 - \frac{(1-\lambda)\theta}{\theta + \lambda m(\phi^*)(1-\theta)} - \lambda \left(\frac{(1-\theta) + m(\phi^*)\theta}{\theta + \lambda m(\phi^*)(1-\theta)} \right) \frac{(1-\theta)}{\theta(1-p) + (1-\theta)p}} \end{aligned}$$

Set

$$m(\phi^*(\lambda)) = \frac{1-\lambda}{\lambda \left(\frac{P(L|W)}{P(H|W)} - \frac{P(L|R)}{P(H|R)} \right)} = \frac{1-\lambda}{\lambda \left(\frac{\theta(1-p) + (1-\theta)p}{\theta p + (1-\theta)(1-p)} - \frac{1-\theta}{\theta} \right)}$$

Note that $m(\phi^*(\lambda))$ is continuous in λ for $\lambda \in (0, 1]$ and $\text{cost}(\text{vesting}, m(\phi^*(\lambda)))$ is continuous in $m(\phi^*(\lambda))$, so that $\text{cost}(\text{vesting}, \phi^*(\lambda))$ is continuous in λ for $\lambda \in (0, 1]$. Therefore, if we show that for $\lambda = 1$, (where $m(\phi^*(\lambda)) = 0$) $\text{cost}(\text{vesting}, \phi^*(\lambda)) < \text{cost}(\text{short}, H)$, there must be some $\underline{\lambda} < 1$ such that this is still true for all $\lambda \in [\underline{\lambda}, 1] \geq \underline{\lambda}$, where $m(\phi^*(\lambda)) > 0$. Plugging in, we have

$$\text{cost}(\text{vesting}, \phi^*(1)) = \frac{d}{1 - \left(\frac{1-\theta}{\theta} \right) \frac{1-\theta}{\theta(1-p) + (1-\theta)p}}$$

Thus, if

$$\left(\frac{1-\theta}{\theta} \right) \frac{1-\theta}{\theta(1-p) + (1-\theta)p} < \frac{1-\theta}{\theta p + (1-\theta)(1-p)}$$

the result follows. Simplifying, the inequality above becomes

$$(1-\theta)^2 < \theta^2$$

which is always true since $\theta > \frac{1}{2}$.

E Mixed strategy equilibrium

Now we look at a mixed strategy equilibrium. We give an intuitive exposition here, the full proofs are available on request.

Suppose there is no manipulation of earnings, but the manager works with probability α and shirks with probability $1 - \alpha$. This potentially introduces a way to pay in period 2, since in the renegotiation, the agent with a low effort will want to consume early. We first assume the contract is given by $\{t_1(H), t_2(R, H)\}$ with all other payments zero. Note that a manager that shirks will never get t_2 since $P(R|S) = 0$.

E.1 Renegotiation stage

We first derive the conditions for a payment $t_2(R, H) > 0$ to be renegotiation proof. After the signal σ has been observed, the investor can offer a new contract $\{t'_1(\sigma), t'_2(y, \sigma)\}$. Note that if $\sigma = L$, there are no payments to the agent under the original contract, so there is no way to improve by offering a new contract. Now suppose $\sigma = H$. Suppose the investor offers a new contract that pays managers off early: $t' = \{t'_1(H) > t_1(H), t'_2(R, H) = 0\}$. For a manager who has worked to accept this new contract, we have to have

$$t'_1(H) \geq t_1(H) + \lambda P(R|H, W)t_2(R, H)$$

Suppose the investor sets $t'_1(H)$ such that a working manager just accepts the offer. The gain to the investor from renegotiating with working managers is then given by

$$(1 - \lambda) P(R|H, W)t_2(R, H)$$

However, shirking managers will now get a higher payment $t'_1(H)$. The loss to the investor on shirking managers is therefore

$$\lambda P(R|H, W)t_2(R, H)$$

Hence, the original contract is renegotiation proof if

$$\begin{aligned}
P(W|H) (1 - \lambda) P(R|H, W) t_2 (R, H) &\leq P(S|H) \lambda P(R|H, W) t_2 (R, H) \\
&\Leftrightarrow \\
\frac{1 - \lambda}{\lambda} &\leq \frac{P(S|H)}{P(W|H)}
\end{aligned}$$

where $P(W|H)$ denotes the probability the investor attaches to the manager having worked after a high signal has been observed. This probability is given by

$$P(W|H) = \frac{P(H|W)P(W)}{P(H|W)P(W) + P(H|S)P(S)}$$

Plugging this in to the inequality above, we get that the contract is renegotiation proof if

$$\frac{1 - \lambda}{\lambda} \leq \frac{1 - \alpha}{\alpha} \frac{P(H|S)}{P(H|W)} \quad (11)$$

E.2 Ex Ante Stage

We now solve the ex ante problem, using the renegotiation condition (11). The problem is

$$\begin{aligned}
&\max_{\alpha, t_1(H), t_2(R, H)} \alpha (P(H|W) (t_1 (H) + \lambda P (R|H, W) t_2 (R, H)) - d) \\
&+ (1 - \alpha) P(H|S) t_1 (H)
\end{aligned}$$

such that the agent is indifferent between working and shirking:

$$\begin{aligned}
&P(H|W) (t_1 (H) + \lambda P (R|H, W) t_2 (R, H)) - d \\
&= P(H|S) t_1 (H)
\end{aligned}$$

, the investor breaks even:

$$\begin{aligned}
&\alpha (P(H|W) t_1 (H) + P (R|H, W) t_2 (R, H)) + (1 - \alpha) P(H|S) t_1 (H) \\
&\leq pR - 1
\end{aligned}$$

, and the contract is renegotiation proof if $t_2(R, H) > 0$:

$$\frac{1 - \lambda}{\lambda} \leq \frac{1 - \alpha}{\alpha} \frac{P(H|S)}{P(H|W)}$$

First, note that the first best is achieved if a pure short-term contract with full transparency is feasible, that is if

$$\frac{d}{1 - \frac{P(H|S)}{P(H|W)}} \leq pR - 1$$

Then, we can set $\alpha = 1$ and $t_2 = 0$. Now, suppose the pure short-term contract is not feasible.

Then, it is easy to see that it is optimal to set α maximal from the renegotiation condition:

$$\alpha = \frac{\frac{P(H|S)}{P(H|W)}}{\frac{1-\lambda}{\lambda} + \frac{P(H|S)}{P(H|W)}}$$

The solution is feasible if the cost of inducing work with a pure long-term contract still allows the investor to break even. With a pure long-term contract, the manager is indifferent between working and shirking if

$$t_2(R, H) = \frac{d}{\lambda P(R, H|W)}$$

The cost to the investor is then given by

$$\alpha P(R, H|W) t_2(R, H) = \alpha \frac{d}{\lambda}$$

Therefore, the pure long-term contract is feasible if

$$\alpha \frac{d}{\lambda} \leq \alpha pR - 1$$

where $\alpha pR - 1$ is the expected gain to the investor gross of transfers to the manager. We can now characterize the solution as follows:

Proposition 4 *a) If $\text{cost}(\text{short}, H) \leq pR - 1$ the optimal contract is short-term with $t_1(H) > 0$ and all other payments zero such that*

$$E(t_1|W) = pR - 1$$

The managers works with probability 1.

b) If $\text{cost}(\text{short}, H) > pR - 1$ and $\alpha \frac{d}{\lambda} \leq \alpha pR - 1$, where

$$\alpha = \frac{\frac{P(H|S)}{P(H|W)}}{\frac{1-\lambda}{\lambda} + \frac{P(H|S)}{P(H|W)}}$$

, the contract consists of a short-term bonus $t_1(H)$ and a long-term payment $t_2(R, H)$, and the manager works with probability α .

c) If $\text{cost}(\text{short}, H) > pR - 1$ and $\alpha \frac{d}{\lambda} > \alpha pR - 1$, the project cannot be implemented.

Proof. Follows easily from the analysis above. ■

References

- Acharya, Viral V., Kose John, and Rangarajan K. Sundaram, 2000: "On the optimality of resetting executive stock options," *Journal of Financial Economics* 57, 65-101
- Aghion, Philippe, Patrick Bolton, and Jean Tirole, 2004: "Exit Options in Corporate Finance: Liquidity versus Incentives," *Review of Finance* 8, 1-27
- Akerlof, George A., 1970: "The Market for "Lemons": Quality Uncertainty and the Market Mechanism," *Quarterly Journal of Economics* 84:3, 488-500
- Bartov, Eli, and Partha Mohanram, 2004: "Private Information, Earnings Manipulations, and Executive Stock Option Exercises," *The Accounting Review* 79, 889-920
- Bebchuk, Lucian, and Jesse Fried, 2004: "Pay Without Performance," Harvard University Press
- Bolton, Patrick, Jose Scheinkman, and Wei Xiong, 2005: "Pay for Short-Term Performance: Executive Compensation in Speculative Markets," *European Corporate Governance Institute Finance Working Paper* 79/2005
- Cremer, Jacques, 1995: "Arm's Length Relationships," *Quarterly Journal of Economics* 110:2, 275-295
- Dewatripont, Mathias, 1989: "Renegotiation and Information Revelation over Time: The Case of Optimal Labor Contracts," *Quarterly Journal of Economics*, 104:3, 589-619
- Dewatripont, Mathias, and Eric Maskin, 1995: "Contractual Contingencies and Renegotiation," *RAND Journal of Economics* 26:4, 704-719
- Fudenberg, Drew, and Jean Tirole, 1990: "Moral Hazard and Renegotiation in Agency Contracts," *Econometrica* 58:6, 1279-1319
- Gaver, Jennifer J., Kenneth M. Gaver, and Jeffrey R. Austin, 1995: "Additional Evidence on Bonus Plans and Income Management," *Journal of Accounting and Economics* 19, 3-28
- Hart, Oliver D., and Jean Tirole, 1988: "Contract Renegotiation and Coasian Dynamics," *Review of Economic Studies* 55:4, 509-540
- Healey, Paul M., 1985: "The Effect of Bonus Schemes on Accounting Decisions," *Journal of Accounting and Economics* 7, 85-107
- Healey, Paul M., and Krishna G. Palepu, 2003: "The Fall of Enron," *Journal of Economic Perspectives* 17:2, 3-26
- Holmström, Bengt, 1979: "Moral Hazard and Observability," *Bell Journal of Economics* 10:1, 74-91
- Holmström, Bengt, and Steven N. Kaplan, 2003: "The State of U.S. Corporate Governance:

What's Right and What's Wrong," *Journal of Applied Corporate Finance* Spring 2003, 8-20

Holthausen, Robert W., David F. Larcker, and Richard G. Sloan, 1995: "Annual Bonus Schemes and the Manipulation of Earnings," *Journal of Accounting and Economics* 19, 29-74

Jensen, Michael C., and Kevin J. Murphy, 2004: "Remuneration: Where we've been, how we got to here, what are the problems, and how to fix them," *European Corporate Governance Institute Finance Working Paper 44/2004*

Kole, Stacey R., 1997: "The Complexity of Compensation Contracts," *Journal of Financial Economics* 43, 79-104
Stein, Jeremy C., 1989: "Efficient Capital Markets, Inefficient Firms: A Model of Myopic Corporate Behavior," *Journal of Finance* 104:4, 655-669

Maskin, Eric, and Jean Tirole, 1992: "The Principal-Agent Relationship with an Informed Principal, II: Common Values," *Econometrica* 60:1, 1-42

Murphy, Kevin J., 1999: "Executive Compensation," working paper, Marshall School of Business, University of Southern California

Myers, Stewart, and Raghuram G. Rajan, 1998: "The Paradox of Liquidity," *Quarterly Journal of Economics* 113:3, 733-771

Rajan, Raghuram G., 1992: "Insiders and Outsiders: The Choice between Informed and Arm's Length Debt," *Journal of Finance* 47:4, 1367-1400

Stein, Jeremy C., 1989: "Efficient Capital Markets, Inefficient Firms: A Model of Myopic Corporate Behavior," *Journal of Finance* 104:4, 655-669

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