

Effort and Honesty:
Compensation Contracts in the Presence of
Earnings Manipulation

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Abstract

Compensating managers with incentive pay may motivate earnings manipulation. In this thesis, we develop models that suggest more efficient compensation contracts that incentivize managers to exert effort and report honestly. We analyze the manager's incentive to manipulate the financial statement when the manager is remunerated with short-term and long-term incentive pay and when we apply different performance measures in the manager's compensation plan.

We find that short-term incentives motivates both effort and manipulation, while long-term incentives induces effort, but not manipulation. Shifting incentives towards relatively more long-term pay will reduce earnings manipulation while maintaining incentives for effort. This is because it is not possible to inflate long-term compensation through opportunistically overstating accruals.

We also consider the manager's incentive to manipulate when the manager faces incentive plans with different performance measures. We predict that there will be less manipulation when the stock price is used as a performance measure relative to when accounting earnings is used. The reason is that when the reported earnings goes through the "filter" of the market participants, the value of a high earnings report is discounted if the market believes that the report may be manipulated. This reduces the manager's benefit of manipulation. The consequence is less manipulation when the stock price serves as the performance measure.

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Contents

| | | |
|-------|--|----|
| 1 | Introduction | 8 |
| 1.1 | Thesis outline | 8 |
| 1.2 | Effort and honesty | 9 |
| 2 | Literature review | 11 |
| 2.1 | The objective of incentive pay | 11 |
| 2.2 | Accounting earnings, the main performance measure for bonus pay | 12 |
| 2.3 | Bonus pay, a motivation for earnings manipulation? | 13 |
| 2.3.1 | Healy (1985) | 13 |
| 2.3.2 | Empirical analysis of earnings manipulation and the composition of managerial incentives | 14 |
| 2.3.3 | Earnings management and stock market returns: Teoh, Welch and Wong (1998a, 1998b) | 15 |
| 2.4 | The economic cost of earnings manipulation | 16 |
| 2.5 | Theory on incentive pay and earnings manipulation | 17 |
| 2.6 | Goldman and Slezak (2006) | 17 |
| 2.6.1 | Basic setup | 18 |
| 2.6.2 | Analysis of the Goldman and Slezak (2006) model | 19 |
| 2.6.3 | Implications from Goldman and Slezak (2006) | 22 |
| 2.7 | Sun (2009) | 24 |
| 2.7.1 | Basic setup | 24 |
| 2.7.2 | Analysis of the Sun (2009) model | 25 |
| 2.7.3 | Implications from Sun (2009) | 26 |
| 2.8 | Our reflections on Goldman and Slezak (2006) and Sun (2009) . . . | 27 |
| 2.9 | Features we miss in Goldman and Slezak (2006) and Sun (2009) . . | 28 |
| 2.9.1 | Long-term incentives and accrual reversal | 28 |
| 2.9.2 | Stock price versus earnings as performance measure | 29 |
| 2.10 | Long-term incentives and earnings manipulation | 29 |
| 2.11 | Measuring performance based on accounting earnings and stock price | 30 |
| 2.12 | Conclusion of literature review | 32 |

| | | |
|-------|--|----|
| 3 | Our basic model | 33 |
| 3.1 | Our model's differences from Sun (2009) | 33 |
| 3.2 | The basic assumptions of our model | 35 |
| 3.3 | The long-term incentive scheme | 36 |
| 3.4 | The manipulation opportunity | 38 |
| 3.5 | Accrual reversal | 39 |
| 3.6 | Explanation of outcome and reporting action's effect on compensation | 40 |
| 4 | Analyzing the basic model | 43 |
| 4.1 | The optimization problem | 43 |
| 4.2 | Deriving the optimal contract for the basic model | 46 |
| 4.3 | Summary of analysis | 52 |
| 5 | Pay and reporting equilibrium, the economic intuition for the optimal contract | 53 |
| 5.1 | The optimal contract | 53 |
| 5.2 | Increasing the proportion of long-term incentives | 57 |
| 5.3 | Increasing the probability of having a manipulation opportunity | 60 |
| 6 | The stock market model | 62 |
| 6.1 | Assumptions | 62 |
| 6.2 | Analysis | 63 |
| 6.3 | Deriving the optimal contract in the stock market model | 66 |
| 6.4 | Pay and reporting equilibrium in the stock market model | 70 |
| 6.4.1 | The no manipulation area | 71 |
| 6.4.2 | Incentivizing high effort in the inevitable manipulation area | 73 |
| 6.5 | Increasing the proportion of long-term incentives | 77 |
| 6.6 | Increasing the probability of having a manipulation opportunity | 77 |
| 6.7 | Discussion of investor sophistication level | 79 |
| 7 | Summary of findings | 80 |
| 7.1 | Manipulation | 80 |
| 7.2 | Pay-for-performance sensitivity | 80 |
| 7.2.1 | The probability of having a manipulation opportunity | 80 |

| | | |
|--------|---|-----|
| 7.2.2 | Long-term incentives | 81 |
| 7.3 | The stock market model | 81 |
| 7.3.1 | Less manipulation and more pay-for-performance | 81 |
| 7.3.2 | The probability of having a manipulation opportunity | 81 |
| 8 | Comparison with Goldman and Slezak (2006) and Sun (2009) | 83 |
| 8.1 | Long-term incentives | 83 |
| 8.2 | Market and accounting based performance measures | 84 |
| 8.3 | Discussion of investor sophistication level | 84 |
| 8.4 | Discussion of unrealistic assumptions | 86 |
| 8.5 | Pay-for-performance sensitivity and corporate governance | 87 |
| 9 | Extending the model to replicate the results of Goldman and Slezak (2006) | 89 |
| 9.1 | Model extension: Compensation when manipulation destroys value | 90 |
| 9.1.1 | More effort levels | 94 |
| 9.1.2 | Costly manipulation changes our initial prediction | 96 |
| 9.2 | Model extension: Bonus pay cap | 97 |
| 10 | Empirical implications | 100 |
| 10.1 | Earnings manipulation and long-term incentives | 100 |
| 10.1.1 | Model predictions | 100 |
| 10.1.2 | Empirical findings | 101 |
| 10.2 | Earnings manipulation and performance measures | 101 |
| 10.2.1 | Model predictions | 102 |
| 10.2.2 | Empirical findings | 102 |
| 11 | Conclusion | 105 |
| 12 | References | 108 |

List of Figures

| | | |
|----|--|----|
| 1 | Model timeline | 38 |
| 2 | Explanation of outcome and reporting action's effect on compensation | 41 |
| 3 | Summary of variables and assumptions in the basic model | 42 |
| 4 | The optimal contract in the basic model | 56 |
| 5 | Increasing the proportion of long-term incentives in the basic model | 59 |
| 6 | Summary of probabilities in the stock market model | 64 |
| 7 | The probability tree in the stock market model | 65 |
| 8 | The optimal contract in the stock market model | 76 |
| 9 | The optimal contract with costly manipulation | 93 |
| 10 | The optimal contract with costly manipulation, continuous effort . . | 95 |
| 11 | The optimal contract with a bonus pay cap | 99 |

1 Introduction

How do you get the manager of a firm to work for the shareholders' best interest? In the literature on the separation of ownership and control, incentive pay is presented as a way of aligning the interests of owners and management. The firm's accounting earnings is a natural basis for the management's bonus, as it measures the firm's value creation. Acknowledging the fact that the management may have strong influence over the accounting decisions, we expect incentive pay to also create the incentive to manipulate the financial statement. Not being able to assess the real value creation of a firm increases the uncertainty, and makes investing in the firm more risky and less attractive. Thus, a dishonest manager is undesirable. A more efficient incentive scheme motivates effort, and not manipulation.

Our question is, how can the shareholders incentivize both effort and honesty? This thesis aims to provide an answer to this question through the development of a principal-agent model. Our model's predictions will be compared with closely related theoretical research and discussed against empirical findings.

1.1 Thesis outline

The outline of this thesis is the following. In section 2, we give an overview of empirical findings regarding incentive pay and earnings manipulation, and summarize theoretical research relevant to our question, how do we incentivize effort and honesty in management? In section 3, we present our basic model that allows us to research the relationship between incentive pay and earnings manipulation. The optimal contract based on the assumptions in the basic model is derived in section 4. In section 5, we provide extensive economic reasoning behind the optimal contract, and how we can motivate effort and honesty in managers, which is the core subject of our thesis. Section 6 provides a modification of our basic model. In the modified model, the manager is paid in stock rather than a cash bonus directly related to accounting earnings. Comparing the modified model with the basic model provides an insight into whether we should use market based or accounting based compensation to incentivize effort and honesty. Section 7 gives a short summary of our findings for a quick and easy reference. In section 8, we com-

pare our predictions to the literature on incentive pay and earnings manipulation, and show how this thesis contributes to this discussion. In section 9, we present two extensions of our model to show that our models yield realistic predictions. In section 10, we discuss the empirical implications of our results and how these are supported by empirical research.

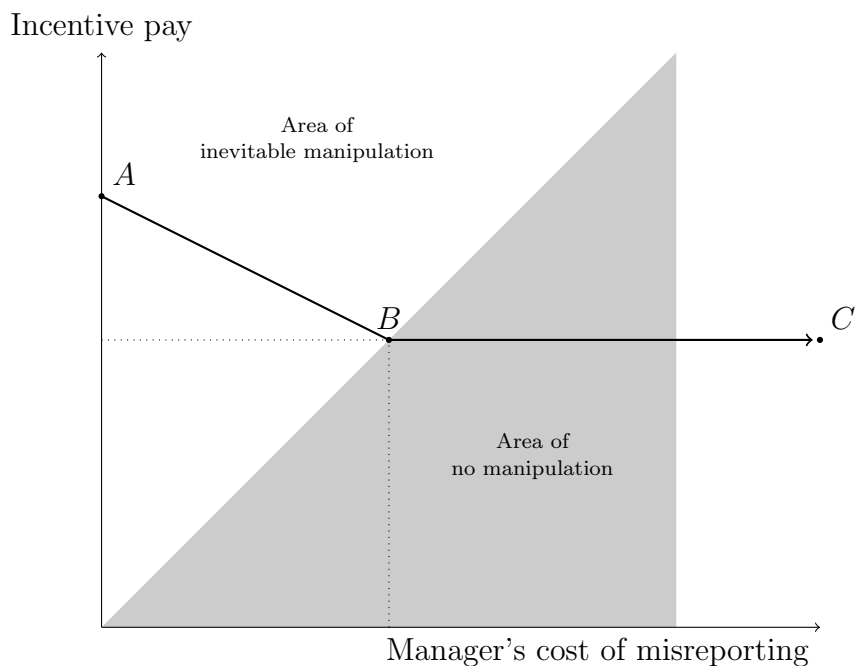
For the sake of clarity, note that the discussion of the basic model is structured as follows. We present our assumptions in section 3, formally derive the optimal contract in section 4 and present the intuition for the optimal contract in section 5. Thus, section 4 is highly technical while section 5 provides an extensive discussion of the optimal contract using economic reasoning.

1.2 Effort and honesty

In this thesis, we provide insights that can be used to incentivize effort and honesty in managers. We develop a principal-agent model, which is summarized in the figure on the next page. In short, we have investors that need a manager to run their firm. The manager's compensation is based on a financial report that the manager may manipulate to increase her compensation.

The manager decides on whether to report truthfully or to manipulate based on a cost-benefit analysis. The choice depends on the corporate governance mechanisms she faces, and our model predicts under which circumstances the manager will be tempted to manipulate. We split the figure into two areas, one where the manager will never be tempted to manipulate, and one where she will manipulate if she has the opportunity to do so.

When the manager is located in the no manipulation area, we are successful in incentivizing effort and honesty. The goal of this thesis is to discuss which factors that go into the manager's cost-benefit analysis, how we can increase the area of no manipulation and the implication manipulation has on the incentive pay necessary to motivate high effort.



The vertical axis depicts incentive pay and the horizontal axis depicts the manager's cost of misreporting, which can be thought of as the strength of corporate governance. The manager decides to manipulate on the basis of a cost-benefit analysis. In the white area, the manager will always be tempted to manipulate, and in the shaded area, the manager will never be tempted to manipulate. The line that connects A - B - C is the optimal contract, and it shows the minimum incentive pay necessary to motivate high effort in the manager. As the corporate governance mechanisms grow stronger, incentive pay necessary to induce high effort decreases. This is because when the cost of misreporting increases, manipulation becomes less attractive and the incentive pay is more effective in inducing high effort. When the manager is in the no manipulation area, we are successful in incentivizing effort and honesty.

2 Literature review

In this section, we provide a literature background on the issue of incentivizing high effort in a manager who may manipulate the accounting earnings that serve as a performance measure for incentive pay. The literature review section consists of two main parts.

The first main part covers empirical findings regarding incentive pay and earnings manipulation. It is structured as follows. First we provide a brief review of the basic theoretical explanation for incentive pay, then we provide a summary of empirical research on performance measures for incentive pay, whether incentive pay based on accounting earnings leads to earnings manipulation, and which specific component of incentive pay, e.g. short-term and long-term incentives, that make managers manipulate. We then cover earnings management related to equity offerings, and then we review the economic cost of manipulation.

The second main part covers theories that aim to explain earnings manipulation in connection to incentive pay. We summarize two papers by providing the basic setup, analysis and implications from the models they present. Then we reflect on these models, before we suggest possibilities to create a richer and thus more realistic model. We argue that introducing long-term incentives and stock-price-based compensation are such enhancements. Then we provide a review of empirical findings in the literature regarding long-term incentives and compensation based on stock price.

2.1 The objective of incentive pay

The compensation paid to executives is a topic of great interest to the general public and researchers (Murphy, 1999). The pay package generally consists of two components: a fixed salary and a bonus salary, where the bonus salary is dependent on the performance of the firm. An explanation of this relationship is due to the well discussed separation of ownership and control first suggested by Berle and Means (1932) and formalised by Jensen and Meckling (1979).

The firm's shareholders (the principal) hire a manager (the agent), and delegate discretion to make decisions on the behalf of the shareholders. When both parties

are utility maximizers, there is reason to believe that the manager may not always act in the shareholders' best interest. To solve this potential problem, the pay contract must be designed such that the incentives of the manager aligns with the interests of the shareholders. This can be achieved through incentive pay.

2.2 Accounting earnings, the main performance measure for bonus pay

Virtually all for-profit companies use a bonus plan in the remuneration of top executives (Murphy, 1999). To use incentive pay, shareholders must decide on a measure to serve as a basis for determining it. Murphy (1999) presents a descriptive statistic for measures that are used in incentive plans for 177 large U.S. corporations, in the industries "Industrials", "Finance", and "Insurance and Utilities", extracted from Towers Perrin 1997. The statistic shows that of the firms that used only one performance measure in the performance evaluation, 67 percent used earnings as the measure.¹ For firms that use two or more performance measures, earnings is by far the most common performance measure. For these firms, the bonus pay structure follows an additive formula over measures, and the different measures can essentially be treated as separate bonus plans (Murphy, 1999). Thus, a manager's bonus pay is directly linked to accounting earnings in most cases. Market based performance measures, such as stock price returns, are not a prominent part of performance measures in the statistic Murphy (1999) refers to.²

Fox (1980) also finds that accounting earnings is a popular measure in executives' bonus plans. The author reports that in 1980, 90 percent of the 1000 largest U.S. manufacturing firms used a bonus plan based on accounting earnings.

¹Towers Perrin define earnings as either net-income, pre-tax net income, return on assets, return on equity and return on capital. The important point here is that all these numbers are found in the financial statement. In other words, they are accounting numbers, and thus subject to the accounting decisions by the manager. Note that we deviate from Towers Perrin's definition of earnings in the rest of the thesis.

²The raw data from the Towers Perrin survey consists of 264 incentive plans for top level managers. Murphy (1999) excludes data from private companies, non-U.S. companies, and subsidiaries, and incomplete data. This results in a sample of bonus plans from 177 publicly traded U.S. corporations.

2.3 Bonus pay, a motivation for earnings manipulation?

As accounting earnings is a key determinant in the executives' bonus pay, an interesting question is whether executives manipulate earnings in order to increase their bonus pay. There is no shortage in examples where executives deceive shareholders for personal gain. Management at the large companies Enron, Worldcom and Tyco achieved to inflate the perceived value of their companies through accounting trickery, before getting caught (Masters, 2011).

2.3.1 Healy (1985)

An influential empirical study on the effect of bonus schemes on accounting decisions is Healy (1985). One of Healy's tests is the relationship between the sign of accruals and the predicted sign of accruals, given the manager's bonus incentive. Accruals are defined as the difference between reported earnings and cash flow. Accruals are used in order to convert cash flows to value flows, so that the financial statement can explain the value creation in a period. As the level of accruals are subject to uncertainty and assumptions by the manager, accrual manipulation may be an opportunity to misreport earnings for personal gain. According to Healy, a typical specification for a pool that is distributed as bonus payment, B , is

$$B = p(\min[U, \max[E - L, 0]])$$

The bonus pool equation states that if earnings E exceed a target L , then a proportion p of $E - L$, capped at U , is transferred to the bonus pool of the company. Let the incentive zone denote E in excess of L , but such that $E - L$ is below U , such that bonus pay is still increasing in E . If earnings are so low that we are out of the incentive zone, the manager uses accruals to decrease earnings further in order to achieve a higher probability of higher earnings in the future, as deferred income today would be transferred into the future. If we are in the incentive zone, the manager uses accruals to increase earnings. This will increase the bonus. If earnings are so high that we are out of the incentive zone, the manager uses accruals to reduce earnings such that it is more probable that the

manager will be in the incentive zone in the future.

Healy tests these theoretical predictions on the 250 largest industrial corporations in the U.S. in 1980. His findings are in line with the hypothesis above. Thus, the claim that bonus pay is a motivation for earnings manipulation is supported by empirical findings. Healy's findings are supported by earlier studies. Watts (1977) and Watts and Zimmerman (1978) postulate that accounting based compensation schemes create incentives for managers to apply accounting procedures and accruals in order to increase the present value of their awards.

2.3.2 Empirical analysis of earnings manipulation and the composition of managerial incentives

Healy (1985) has established that incentive pay is a motivation for earnings management. Incentive plans consist of many different components, such as cash bonus, stock options and long-term incentive payouts. The relationship between earnings management and each incentive plan component is studied by Burns and Kedia (2006) and Oberholzer-Gee and Wulf (2012).

Burns and Kedia (2006) find significant evidence that differences in CEO compensation packages explain earnings management. The authors find that the sensitivity of the managers' option portfolio to stock prices is significant in explaining the propensity to misreport the financial statement. A manager's portfolio of stock options consists of both vested and unvested options. Vested options can be exercised during periods of potential misreporting, thus vested options can be considered as short-term incentive pay. This will serve as a motivation to misreport. In short, Burns and Kedia find evidence that short-term incentive pay is significant in explaining earnings manipulation.

The authors also examine the relationship between earnings management and other incentive pay. Long-term incentive plans make the manager's wealth a function of long-term firm value, and this reduces the incentive to misreport. An upwards manipulation today will revert in the long-term due to accrual reversal. The idea of accrual reversal will be discussed further in section 2.9.1. Thus, the manager cannot increase long-term incentive pay by misreporting the financial report. Consistent with this, Burns and Kedia find no relationship between

long-term incentive payouts and the propensity to misreport.

Oberholzer-Gee and Wulf (2012) have a similar research topic as Burns and Kedia. They study the relationship between abnormal accruals and decision-makers' bonus, stock options, restrictive stocks and other long-term incentive plans. This study focuses on the manipulation incentives of division managers and CFOs, while Burns and Kedia only consider CEOs. Oberholzer-Gee and Wulf find a systematic association between pay below the CEO level, in particular CFO pay, and earnings management. Stock options and cash bonus act as a motivation to manipulate. Burns and Kedia find that long-term incentives do not influence earnings manipulation, but this finding is not statistically significant to alternative econometric model specifications in Oberholzer-Gee and Wulf.

2.3.3 Earnings management and stock market returns: Teoh, Welch and Wong (1998a, 1998b)

It is reasonable to believe that it is especially important for shareholders that earnings are high when firms do an initial public offering or seasoned equity offering. Incentives should be strong for the manager to deliver high earnings in the period preceding such activities. Teoh, Wong and Rao (1998) find evidence that accruals are opportunistically manipulated upwards before an initial public offering. Teoh, Welch and Wong (1998a, 1998b) find a strong relationship between upwards earnings manipulation and consequently long-run negative abnormal returns in initial public offerings and seasoned equity offerings.³ The studies show that the market underestimates the manipulation bias. Thus, investors are tricked by manipulated financial reports.

Since incentives should be strong for the manager in a period before such an event, it is possible that the manager may want to manipulate earnings to increase the compensation awarded. Manipulation by the manager to increase the compensation might be a reason for the phenomena described in this subsection. Note also that in this case, shareholders who sell shares in the offering gain from a manipulated report and may actually encourage manipulation.

³Teoh, Welch and Wong (1998a, 1998b) measure earnings manipulation by the difference of actual accruals and predicted normal accruals. The latter is estimated by two extensions of the Jones (1991) model that estimates normal accruals.

2.4 The economic cost of earnings manipulation

Earnings manipulation may not be considered a problem if the cost related to it is negligible. This subsection establishes that there is a severe cost related to earnings manipulation.

The relationship between the equity cost of capital and earnings quality is relevant to this discussion. Earnings quality is generally used to describe the overall usefulness, relevance and trustworthiness of accounting information. A definition is provided by Melumad and Nissim (2008): "Earnings are said to be of high quality if they are representative of long-term earnings ability".

Why should there be a relationship between the equity cost of capital and earnings quality? The equity cost of capital should be the compensation investors require in order to bear the risks associated with owning a company's stock. Financial theory, such as the Capital Asset Pricing Model (CAPM), aim to explain the equity cost of capital by first assuming that investors are well-diversified. Thus, firm-specific risk is diversified away, and investors do not require compensation to bear company-specific risk. In the CAPM, the equity cost of capital of a specific stock is the general risk premium of owning stocks, scaled by the stock price return's sensitivity to that of the general stock market, plus the risk-free interest rate. Thus, from a CAPM perspective, earnings quality should not influence the equity cost of capital.

However, Easley and O'Hara (2004), O'Hara (2003) and Leuz and Verrecchia (2005) show that firm-specific risk affects the cost of equity and this risk cannot be diversified away. As the firm's financial report is an important source of firm information to investors, the quality of earnings should have an effect on the firm-specific risk and thus the equity cost of capital.

Francis, LaFond, Olsson and Schipper (2004) study if earnings quality and the equity cost of capital are related. In their research, Francis, LaFond, Olsson and Schipper split earnings quality into six different metrics that can be estimated empirically. These are accrual quality, persistency, predictability, smoothness, relevance, timeliness and conservatism. The authors find a significant relationship between the different metrics of earnings quality and the equity cost of capital.

Considering a report where accruals have been manipulated versus a truthful

report, a manipulated report would have lower earnings quality in this framework. This is because the report would exhibit lower accrual quality, lower persistency, be less useful for predicting future earnings, have less timeliness and less conservatism, as the accounting statement of the period would be overstated on purpose.

Thus, a manipulated report would be subject to a higher cost of equity than a truthful report. Imagine a listed company that produces regular financial reports. The company engages in earnings manipulation and consequently has a higher cost of capital. This company will have worse terms than necessary in the capital markets due to its earnings manipulation. This could lead to underinvestment in the economy, since marginally profitable projects may not be undertaken with this extra cost of capital. The implication is that there is an economic cost of manipulation which raises the cost of equity and, broadly, reduces the level of investment in the economy.

2.5 Theory on incentive pay and earnings manipulation

Goldman and Slezak (2006), referred to as GS, and Sun (2009) have developed theoretical models to study the dynamics of incentive pay and earnings manipulation. They both use a principal-agent framework, and introduce the feature that the manager's pay is directly or indirectly based on an earnings report the manager produces. A difference from Healy (1985) is that these models do not consider the situation where management may manipulate earnings downwards, which Healy refers to as "taking a bath".

This part of the literature review provides a short summary of the setup and analysis in GS and Sun, which serves as a background for the model we develop later in this thesis. For a full and complete presentation of the models, please refer to the respective papers.

2.6 Goldman and Slezak (2006)

GS study pay-for-performance sensitivities when the manager may manipulate the financial statement, which affects the short-term stock price of the firm. The manager is paid with fixed pay and bonus pay, where the bonus pay is fully based on the short-term stock price. GS find that when it is attractive for the manager to

manipulate earnings, there will be lower optimal pay-for-performance sensitivity relative to the case where it is unattractive to manipulate earnings. This is because increasing incentive pay increases both effort and manipulation. GS assume that manipulation destroys firm value due to inefficient resource allocation. GS find that incentive pay will increase in the strength of corporate governance.

2.6.1 Basic setup

In GS, the shareholders, who are risk-neutral, hire a manager, who is risk-averse, to run the firm. The model has three time periods. In period 0, the contract is offered and accepted, and effort and manipulation is chosen. In period 1, a report on the value of the firm is produced by an independent monitor, which may be manipulated by the manager, a value expectation is formed and the manager receives his remuneration. In period 2, which represents the long-run, the real economic value of the firm is realized and recognized by the market. GS argue that it is not feasible to have compensation based on long-term value because such contracts will be impractical to the manager. GS claim that having some long-term pay has no effect on the qualitative nature of their results.⁴ The value of the firm is linear in the manager's effort, and effort is costly and unobservable. Shareholders want to induce the manager to exert an effort level that balances the marginal gain of effort versus the marginal cost of effort. When the contract is offered, the manager chooses an unobservable effort level and an amount of the firm's resources to divert towards activities that influence the future reported value of the firm. In period 1, a third-party monitor (i.e. auditor) reports to the market the expected value of the firm's gross terminal cash flow. The manager may influence this report by employing the firm's resources to manipulate. Based upon the report, the market forms an expectation of the value of the firm's stock price. Based on this stock price, the manager receives a bonus. Thus, the manager may be tempted to manipulate earnings. GS assume that the manager is paid to get utility such that his participation constraint is satisfied. Thus, costs due to effort, manipulation and risk aversion in the manager is beared by the shareholders. In GS, the incentive pay is only based on the short-term stock price, and thus the

⁴In the model we develop in this thesis, we allow for pay to be split up between a short-term and a long-term period. See section 3.

short-term report. In addition to the incentive contract, there exists a monitoring technology where manipulation can be detected ex-post with some probability, and in the case he gets caught, the manager incurs a fine.

2.6.2 Analysis of the Goldman and Slezak (2006) model

A feature of GS is that both effort and manipulation is chosen by the manager before the realization of firm value. The model assumes that firm value, V , is affected by effort, e , in the following manner

$$V = \beta e + \eta + \varepsilon$$

Where both η and ε are random variables with zero mean and variance σ_η^2 and σ_ε^2 . ε is realized in period 1, when the financial report is published, while η is realized in period 2, the final stage. When choosing effort and the extent of manipulation, the manager knows neither η nor ε , and the parameters affecting effort and manipulation are public information. The manager's reporting choice is independent of the state of the firm as it is predetermined, thus the extent of manipulation is *perfectly predicted* by a rational principal. Note that β is interpreted as the manager's productivity.

What is the effect of the financial report in period 1? As effort is unobservable and the manager must have his bonus compensation at this stage, the investors base their belief of e on a signal on the value of the firm, based on the financial report. GS assume the true signal to be $\theta^T = \beta e + \eta$, while the expected signal is $\theta = \theta^T + \alpha$, where α denotes manipulation, which is reflected in the report as an upward bias. Thus the expected firm value at the time of the report is

$$\theta - \alpha^e - \zeta \alpha^e = \beta e + \eta + (\alpha - \alpha^e) - \alpha^e \zeta$$

Note that manipulation affects the stock price linearly. α^e is the amount of manipulation expected by investors, and ζ is the opportunity cost of the manager employing resources for manipulation purposes. According to GS, the stock price

is the following

$$S = \frac{1}{1 + \omega_1} \left((\beta e + \eta) + (\alpha - \alpha^e) - \alpha^e \zeta - \omega_0 - \gamma \bar{X} \sigma_\epsilon^2 \right)$$

Inside the main parenthesis, the first parenthesis denotes the effect of effort and the remaining uncertainty of the outcome. The second parenthesis shows the effect of manipulation in excess of expected manipulation. $\alpha^e \zeta$ is the expected value destruction due to manipulation. ω_0 is the fixed wage. The last term summarizes the risk effects on the demand of investors. The main parenthesis is discounted by $\frac{1}{1 + \omega_1}$ to reflect the dilution effect of paying the manager with stock. Note that a rational principal will perfectly predict the amount of manipulation, such that $\alpha = \alpha^e$. Thus, the only effect of manipulation in GS with rational investors is the cost due to inefficient resource allocation, $\alpha^e \zeta$. Note that the manager will still manipulate even though he knows that the principal will predict optimal manipulation, since his compensation will increase in the actual manipulation, α , for the given level of expected manipulation, α^e . The manager will increase α until it reaches α^e .

The contracting problem is solved by finding the manager's optimal responses of his choice variables, effort and manipulation, to the shareholders' choice variable, the pay-for-performance sensitivity, $\hat{\omega}$. The shareholders then maximize the long-term value of the firm with respect to $\hat{\omega}$. The pay-for-performance sensitivity denotes the manager's share in the company after the short-term compensation has been paid in stock, and is written as $\hat{\omega} = \frac{\omega_1}{1 + \omega_1}$. When the share price increases by one unit, the manager receives $\hat{\omega}$.

The manager chooses effort, $e(\omega)$, and manipulation, $\alpha(\omega)$, in order to maximize his expected utility at time period 0.

The benefit of exerting higher effort is that the expected short-term stock price increases. The portion of this increase that is attributable to the manager's bonus pay is determined by the pay-for-performance sensitivity, $\hat{\omega}$. Note that this benefit is amplified by the manager's productivity per unit of effort, β . The drawback of effort is the cost of exerting effort, which is $\frac{\delta}{2} e^2$. Differentiating the manager's utility function with respect to effort leads to the optimal effort by the manager,

dependent on the pay-for-performance sensitivity

$$e(\omega) = \frac{\hat{\omega}}{\delta}\beta$$

The benefit of manipulation is that a one unit increase in manipulation increases the short-term stock price by $\hat{\omega}$. The drawback of manipulation is that the manager incurs a fine proportional to the extent of manipulation if caught, $\varphi\alpha$. The manager is caught with probability ρ . Thus the expected punishment of manipulating α is $\rho\varphi\alpha$. In addition, the manager faces the disutility of risking punishment when he manipulates, as he is risk-averse. Differentiating the manager's utility function with respect to manipulation yields the optimal manipulation

$$\alpha(\omega) = \max\left(0, \frac{\hat{\omega} - \rho\varphi}{K}\right)$$

K is the impact of the riskiness of manipulation on the manager's utility. Note that we will not have manipulation if the difference $\hat{\omega} - \rho\varphi$ is negative, which is the case when the expected punishment of manipulation is sufficiently severe to discourage such behaviour at a given level of pay-for-performance.

The shareholders find the optimal pay-for-performance sensitivity that maximizes the long-term stock price. What is the optimal sensitivity, $\hat{\omega}$? GS find this by differentiating the long-term expected firm value net of wage payments and manipulation cost at time 0, with respect to $\hat{\omega}$. This firm value contains the manager's effort and manipulation, effort increases firm value, while manipulation destroys firm value. Since manipulation is either positive or zero, and the extent of manipulation affects firm value, we get two cases for pay-for-performance sensitivity: one when manipulation is zero, and one when manipulation is positive. GS define Ψ

$$\Psi = \frac{\frac{\beta}{\delta} - \frac{\zeta}{K}}{\frac{\beta^2}{\delta} + \gamma\sigma_\eta^2 + \frac{1}{K}}$$

GS now consider two cases. In case $\Psi > \rho\varphi$, the equilibrium manipulation level is positive and the equilibrium pay-for-performance sensitivity $\hat{\omega} = \Psi$. In this case we note that the costs associated with manipulation ζ and K affect the pay-for-

performance sensitivity, and when they increase, pay-for-performance goes down.

The second case is $\Psi \leq \varphi\rho$. In this case there will be no manipulation and pay-for-performance becomes

$$\hat{\omega} = \frac{\frac{\beta}{\delta}}{\frac{\beta^2}{\delta} + \gamma\sigma_\eta^2}$$

In both cases, ω_0 is set such that the participation constraint always binds. Thus, increases in the cost of effort, attractiveness of manipulation, or an increase in risk-aversion, are costs that are beared by the shareholders.

Comparing the two cases, we see that pay-for-performance goes up when we go from the case of manipulation to no manipulation. This is because in the case of manipulation, the principal is less tempted to use incentives to induce more effort, as he knows this will also lead to more manipulation, which will destroy value. In the case of no manipulation, the principal can use incentives to induce effort without worrying about value destroying manipulation by the manager.

2.6.3 Implications from Goldman and Slezak (2006)

Comparing the two cases, we see that in the case of manipulation, pay-for-performance is lower due to ζ and K . GS state that in the case of manipulation, we will have lower pay-for-performance than without manipulation. The implication is that in the presence of manipulation, the principal can induce less effort than in the case of no manipulation. This means that firm value is reduced, and more broadly, production in the economy is lower in the presence of manipulation.

GS give several more implications from their model, but here we focus on the implications most central to our thesis. First, pay-for-performance increases in the incremental punishment of manipulation, φ , and increases in the probability of apprehension ρ , under $\rho \leq 0.5$. As the expected punishment of manipulation increases, it becomes less attractive to manipulate the financial report. Thus, the principal can use more incentives than before. Under the interpretation of ρ and φ as corporate governance mechanisms, stronger corporate governance leads to more incentive pay. Incentive pay is now more efficient in inducing effort in the manager: we can increase effort without increasing manipulation.

Pay-for-performance sensitivity is increasing in the detection probability. This explains empirical evidence in Murphy (1999) where the pay-for-performance sensitivity decreases in firm size. It can be interpreted that these firms are more complex and thus the detection probability is lower.

Pay-for-performance sensitivity will decrease with the explicit or implicit penalty of being caught manipulating. If managers are fired when caught, they will lose private benefits of control and reputational rents in the industry. An important result from GS is that they predict there will be more pay-for-performance sensitivity the stronger the firm's governance system is. This is consistent with Hartzell and Starks (2003) and Fahlenbrach (2003), who show that pay-for-performance sensitivities increase when minority shareholders get more influence.

On the other hand, pay-for-performance decreases in the opportunity cost of manipulation, ζ , as manipulation gives greater costs than before. GS also show how an increase in φ may actually increase manipulation. Considering a situation where we fix pay-for-performance, increasing the marginal punishment will have a negative direct effect on manipulation. Then the principal will want to increase the pay-for-performance sensitivity to induce more effort. This will then again increase the attractiveness of manipulating. GS show that this second effect may outweigh the first effect, if the elasticity of pay-for-performance with respect to φ is low. This may occur if the opportunity cost of manipulation, ζ , is high, productivity, β , is low or uncertainty, σ_η , is high.

GS also consider the impact of manipulation on incentive pay when some investors cannot perfectly predict the equilibrium amount of bias, i.e. there is differences in sophistication levels among investors. When some investors underestimate the extent of the bias, a principal with a short horizon relative to a principal with a long horizon, will offer contracts that have higher pay-for-performance sensitivity. This results in a higher intermediary stock price, since managers exert more effort and perform more manipulation. With short-horizons and the existence of naive investors, GS predict that an increase in unsophisticated market participants will lead to that the extent of manipulation will be underestimated. This will result to higher short-term stock prices due to higher effort and more manipulation. They predict initially inflated stock prices, followed by a period of price decline as inflated earnings do not realize or as investors recognize the potential for fraud and

some managers are caught. The predicted market movements are supported by empirical findings in Teoh, Welch and Wong (1998a, 1998b). In the GS model, this is modelled through the long-term principal choosing to maximize the stock price at period 2, while the short-term principal maximizes the stock price at period 1. The contracts will be different if the short-term principals underestimate the level of manipulation, as in this case, there will be too much incentive pay.

2.7 Sun (2009)

Sun (2009) studies the dynamics of executive pay in a setting where managers may manipulate corporate performance.⁵ The opportunity to manipulate is stochastic and misreporting earnings is costly for the manager. Based on this, Sun presents conditions for when earnings manipulation occurs, and establishes the optimal compensation contract in this framework. Pay-for-performance sensitivity increases in the presence of earnings manipulation and incentive pay will decrease in higher intensity of corporate governance mechanisms. Sun's basic findings contradict GS, and she provides empirical observations that are consistent with her findings.

2.7.1 Basic setup

Sun (2009) considers the case where a risk-neutral principal (shareholders) hires a risk-averse agent (manager) for one period. Earnings can be either high or low. The outcome of earnings is stochastic, the probability of high earnings improves with effort, and effort may be either high or low. Effort is costly for the manager, and the chosen level of effort is unobservable to the principal. The project is only profitable for high effort, and the shareholders have to motivate high effort through incentive pay. The manager's incentive pay is based on a report she produces, and at the time the report is produced, the earnings of the firm is private information to the manager. With a certain probability, she privately learns that she has an opportunity to manipulate earnings. If she has such an opportunity, she will

⁵The model we develop in section 3 is based on Sun (2009) and shares the same framework. An analytical walkthrough of Sun (2009) is not included here, but our Sun-inspired model is explained thoroughly in section 3.

report high earnings in the case low earnings are realized, but only if manipulation is tempting. Else, the report will correspond to the true outcome of earnings.

To determine if manipulation is attractive, the manager considers her private cost of misreporting versus the cash bonus gain from reporting a high outcome. If the change in compensation due to manipulation exceeds her private cost of misreporting, she will manipulate.

In this framework the shareholders are uncertain whether manipulation has occurred in the financial report because the shareholders do not observe the true outcome at this stage, nor if the manager's opportunity for manipulation has occurred. Thus, the shareholders base the compensation to the manager on a report that may be manipulated.

2.7.2 Analysis of the Sun (2009) model

The optimal contract must not only induce high effort, but also control for the manager's reporting incentive. The optimal contract in Sun's model induces high effort, in every contingency of the manipulation opportunity. If the private cost of misreporting is sufficiently large, manipulation will not be attractive. In the event that manipulation is unattractive, incentive pay must only control for the private cost of high effort, and not the reporting incentive.

If the private cost of misreporting is sufficiently small, manipulation will be attractive, and incentive pay must control for the manager's incentive to misreport. She will manipulate earnings upwards if she has the opportunity to manipulate and low earnings realize. In order to induce high effort in this case, incentive pay must be higher than in the case when earnings manipulation is unattractive. This is because the earnings manipulation opportunity serves as an insurance in the case low earnings are realized, thus increasing the overall attractiveness of exerting low effort. More incentive pay is now necessary to induce high effort.

The smaller the private cost of manipulation, the more attractive it becomes to choose low effort. Thus incentive pay increases as the private cost of misreporting decreases.

The probability of the manipulation opportunity affects the optimal contract. When this probability increases, we know that in the case where manipulation

is attractive, there is now effectively less incentives for high effort since the expected value of low effort and manipulation has increased. When the probability of having a manipulation opportunity increases, the shareholders must provide more incentives in order to incentivize high effort.

A key feature of the model is that the reporting choice is done after earnings realize, and the shareholders cannot perfectly gauge the true performance of the company. Note that this different from the GS model, where the manipulation choice is done before earnings realize.

2.7.3 Implications from Sun (2009)

Sun (2009) interprets the private cost of manipulation as a policy parameter, which is influenced by public policies and internal governance. As the private cost of manipulation increases, we will have less manipulation. Executive pay needs to be more sensitive to performance as earnings management becomes more pronounced. Sun's model implies that stronger governance will result in less manipulation and less incentive pay.

According to Sun, there is a positive correlation between manipulation and incentive pay in both time series and cross section. Sun suggests that this may be consistent with optimal contracting, and not reflect any inefficiency. In order to support her findings, Sun cites a time series from Cohen et al. (2005a) that shows strong growth in earnings management from 1987 to 2003. Sun also cites a time-series from Cohen et al. (2005b) which states that in the period 1992 to 2003, there has been an enormous increase in incentive pay for management.⁶

Sun's main finding can be summarized as follows: conventional wisdom suggests that manipulation is related to incentive pay, while Sun suggests a more subtle causality. The possibility of manipulation actually requires executive pay to be more sensitive to possibly biased financial reports.

Sun predicts that firms with more intangible assets will have more incentive pay, due to the opportunity to manipulate earnings is more probable. In Sun's paper, she supports this statement by stating that firms in the financial sector have more intangible assets and therefore more leeway in financial reporting, thus

⁶A discussion on the possible endogeneity issues of this relationship is discussed in 2.8: Our reflections on Goldman and Slezak (2006) and Sun (2009).

managers in the financial sector have more opportunities for manipulation than those in the traditional manufacturing sector. Pay-for-performance is stronger in the financial industry, which lends support to her predictions.

2.8 Our reflections on Goldman and Slezak (2006) and Sun (2009)

Goldman and Slezak (2006) develop a model with the prediction that pay-for-performance sensitivities are lower when there are opportunities to manipulate. This provides an explanation for why pay-for-performance sensitivities are too low to be reconciled with standard principal-agent models, a problem which is raised in Murphy (1999).

We think that the GS model has one unrealistic feature, namely that the extent of manipulation is decided on before earnings realize. Following the logic from Healy's (1985) experimental design, it only make sense to manipulate earnings up when the manager is in a situation where an increase in earnings will positively affect the cash bonus. This may not always be the case, for example when earnings realize over a bonus cap. We believe the bonus cap is a realistic feature, since the typical annual incentive plan in earnings are first flat, then increasing, then flat (Murphy, 1999). In GS, it is assumed that the bonus payment is always increasing in earnings, then manipulation may happen regardless of realized earnings. Acknowledging the fact that the financial statement is prepared after a time period is over, the decision to manipulate or not is done after the true performance of the firm is known to the manager, and a realistic model of earnings manipulation should incorporate this.

The prediction regarding the relationship between incentive pay and strength of corporate governance in Sun (2009) may not have sufficient evidence in empirical observations. The statement that the two time series of earnings manipulation and incentive pay correlate does not necessarily imply causality as there are possible endogeneity issues, since both variables may just increase over time. Sun (2012) states that the mentioned correlation is only suggestive evidence supporting the model's prediction.

Although it has shortcomings, we think that Sun (2009) provides a simple

framework to study the dynamics of incentive pay and earnings manipulation. In particular we like that the decision to manipulate is done after earnings realize. We see this as more realistic than the case of Goldman and Slezak (2006), where the decision of manipulation is done before the manager knows the true performance of the company. In Sun (2009), high realized earnings will always be truthfully reported, while only low realized earnings will be manipulated, when this is attractive for the manager. This is in line with the incentives provided by the typical incentive plan, as described in Murphy (1999). Thus, on the manager's decision to manipulate or not, the Sun framework is in our view more realistic than the model of Goldman and Slezak (2006).

Neither model discuss the case of manipulation when the manager will manipulate the earnings downwards, which is described in Healy (1985) as "taking a bath". The idea of "taking a bath" is in line with the typical incentive plan described in Murphy (1999).

Both models have risk-averse managers. However, in the comparative statics in the Sun model, risk aversion has little qualitative effects on the results.

2.9 Features we miss in Goldman and Slezak (2006) and Sun (2009)

There are many important phenomena in the real life remuneration of CEOs that are not included in the models of GS and Sun. We believe that two important phenomena are the use of long-term incentives and the use of accounting earnings versus stock price as performance measure. This is because we believe that differences in these variables yield different incentives with respect to effort and honesty.

2.9.1 Long-term incentives and accrual reversal

Many companies report their management's incentive plans in their annual reports. These often include a short-term and a long-term incentive plan. An example of a company with this scheme is Statoil (Statoil ASA, 2012). A model that incorporates earnings manipulation and short-term and long-term incentive plans will be interesting to study because when earnings are manipulated they are often

manipulated by extreme accruals. Allen, Larson and Sloan (2011) state that: "In practice (...) extreme accruals exhibit a high frequency of subsequent reversals that do impact future earnings". Thus, manipulated accruals today will revert in the future, revealing the true value creation of the period. Managers cannot manipulate the long-term performance of companies by inflating accruals, but they may successfully inflate the short-term bonus by manipulating earnings. We would then expect firms with a high ratio of long-term incentive pay to have more honest reporting, and in the framework of Sun (2009), require less incentive pay.

2.9.2 Stock price versus earnings as performance measure

Murphy (1999) states that accounting earnings is the most common basis for a manager's bonus plan, but also states that stock price returns are important. When a firm is both listed on a stock exchange and produces a financial statement, it will be interesting to study if the firm should use accounting earnings or stock price as the performance measure, when the market participants use the financial statement as an important information source. In some cases, the investors on the stock exchange may help to reduce the incentives to manipulate, if they can predict a biased financial statement, and the investors use this information to price the stock.

The two next sub-sections provide a literature background on the topics of long-term incentive plans and accounting earnings versus stock price as the performance measure in compensation contracts.

2.10 Long-term incentives and earnings manipulation

According to Murphy (1999), long-term incentive plans are typically based on a rolling-average of three-year or five-year cumulative performance. In 1996, of the CEOs who received long-term incentive payouts, long-term incentive pay was 20 percent of total compensation. According to Jarrell (1993), there has been a significant increase in the use of long-term incentive plans from the mid 1970s to the late 1980s.

Larcker (1983) describes long-term incentive pay as an additional bonus component to a pay package consisting of fixed pay and bonus pay. It differs from

bonus schemes in several respects: the performance is measured over several years and changes in share price is commonly used as the performance measure. There are six schemes that qualify as long-term incentive pay: 1) Stock Options, 2) Stock Appreciation Rights, 3) Phantom Stock, 4) Dividend Units, 5) Restricted Stock and 6) Performance Plans. What the first five have in common is that they are market based. Number six, Performance Plans, is separated into two units: performance units and performance shares. Performance units assign a unit value to a measure that is unrelated to the share price, for instance the book value of equity at the end of the period or earnings-per-share growth. Performance shares are market based.

Consider a firm that goes from only a short-term performance plan to a plan that consists of both short-term and long-term performance goals. This will encourage the manager to allocate effort into the search for new investment opportunities and other activities which will increase long-term performance, rather than allocating effort into selecting a method of scheduling current production or other activities which only increases the short-term bonus. In particular, long-term incentive plans lengthen executives' time horizons and focus their attention on creating shareholder value, thus reducing the agency cost. Larcker (1983) finds empirical support for such a hypothesis.

2.11 Measuring performance based on accounting earnings and stock price

Murphy (1999) states that companies use a variety of financial and non-financial performance measures in the remuneration of CEOs. Almost all companies use accounting earnings as a performance measure, but stock price returns are also important. Paying out bonuses through equity will provide what we will refer to as a market based performance measure, where stock price appreciation rewards the manager.

Lambert and Larcker (1987) analyze the use of accounting earnings and market based performance measures in executive compensation contracts. Employing econometric techniques, the authors examine the relationship between accounting figures such as return on equity and market returns and cash bonuses paid to

managers of large U.S. companies. The sample is from Forbes' annual compensation survey from the Forbes 500 list. Lambert and Larcker's (1987) result is that both performance measures are significant in explaining the management's cash bonuses, and that accounting earnings play a more important role than the stock price as a performance measure.

Bushman and Indjejikian (1993) employ a formal principal-agent model to study the use of both accounting earnings and stock price in executive compensation contracts. As accounting information can be assumed to be discounted into the share price, the authors question the usefulness of using earnings as the performance measure in alleviating agency costs. They argue that as stock prices are generated by valuation decisions, it is generally not capable of providing efficient multi-task incentives. Thus, there is room for earnings to add value to the compensation contract. Including earnings as a performance measure will better balance incentives across managerial activities, filtering out uncontrollable output risk and non-output related noise. The optimal compensation contract should include both performance measures (Bushman and Indjejikian, 1993).

If the market relies on the financial statement for information on the value of the company, how different are the two measures in measuring the management's performance? We refer to the research of value relevance in the accounting research literature, which focuses exclusively on the usefulness of accounting information in the values of stock prices. The research is usually done by applying econometric techniques to determine the relationship between accounting figures and equity prices. Collins et. al. (1997) is one of the more important contributions to the research, and the authors find a strong relationship between accounting figures and market prices over time.⁷ This implies that using either accounting earnings or stock price as the performance measure may provide the same incentives, since they have such a strong positive relationship.

Bertrand and Mullainathan (2001) discuss a problem in the use of the performance measures accounting earnings and stock price. The authors recognize that these measures do not have a perfect relationship with the effort of the man-

⁷Collins et. al (1997) do not control for reported losses. Hayn (1995) and Beisland (2010) argue that accounting information may be consistently underestimated because the sign of the earnings variable is not controlled for. The idea is that a reported loss can be seen as a non-recurring event, and must therefore be less relevant in explaining the value of the company.

ager. The measure that is used may be influenced by factors the manager cannot control, for instance commodity prices. Recognizing the fact that the individual managers have little to no power over commodity prices, accounting based performance measures and market based performance measures in incentive plans may reward CEOs for luck.

In summary, the literature gives no clear answer to whether accounting earnings or stock price return is the best performance measure. Bushman and Indjejikian (1993) suggest that both should be used, and empirical observations of Lambert and Larcker (1987) suggest that this is done in practice.

2.12 Conclusion of literature review

In this section we have discussed the idea of incentive pay and how this may create unfortunate incentives for the manager to manipulate the financial statement. Goldman and Slezak (2006) and Sun (2009) have developed theoretical models to study this phenomenon. We recognize that thorough discussions on long-term incentives and accounting earnings versus stock price as a performance measure are omitted in these models, and we believe that a model with these features will be more realistic. We want to research the effect that long-term incentives and the choice of performance measure have on effort and honesty. We incorporate these features in our model. In section 3-5, we study long-term incentives, and in section 6, we study the choice of performance measure.

3 Our basic model

In this section, we present the assumptions of the model that we have developed. Our model will serve as a framework for the discussions in this thesis. In section 4, we formally derive the optimal contract, and in section 5 we provide extensive economic intuition for the optimal contract.

Our model is based on the Sun (2009) framework. Sun examines how a stochastic opportunity to misreport financial statements affects executive compensation contracts. The model examines misreporting of financial statements by managers and executive pay. Our basic model incorporates three new features to the Sun framework that allows for further analysis. The objective of our analysis is to shed light on this thesis' main question, how do we get both effort and honesty from the manager of a firm? In this section we will first explain the differences between our model and the Sun framework. Then we present the assumptions of our model, with a particular focus on the relationship between the incentive pay the manager faces and the reversal of overstated accruals, and the implication this has on the manager's incentives to exert effort and report honestly.

3.1 Our model's differences from Sun (2009)

The differences between our model and Sun (2009) are a second time period with accrual reversal of first period manipulation, and a compensation contract consisting of both short-term pay and long-term pay. In addition, we simplify the manager's risk preferences. The discussion on which performance measure that is the most efficient to incentivize effort and honesty is first covered in section 6.

In our model, we introduce a second time period to allow for any manipulation of accounting accruals to revert in the second time period. This incorporates the idea of accrual reversal. If a manager inflates current earnings by an artificial positive accrual, for example inflating the revenue through overstating credit sales for the period, future earnings have to include a write-down of this overstatement. This reverts the future earnings by the same magnitude as the previous overstatement. Accrual reversal is studied in the accounting research literature. Allen, Larson and Sloan (2011) state that: "Extreme accruals exhibit a high frequency

of subsequent reversals that do impact future earnings”. Earnings manipulation is an important systematic extreme accrual. We assume that earnings manipulation in the basic model is done through an opportunistic exaggeration of the accruals.

Our second modification to Sun’s model is that the manager is paid with incentive pay in both period one and period two. The pay in the first period can be considered short-term incentive pay, and the pay in the second period can be considered long-term incentive pay. The company’s value creation is measured by the accounting earnings, and all value creation happens in the first period. The manager is remunerated according to the shareholders’ belief of the company’s true earnings. In the first period, the shareholders compensate the manager based on the reported earnings. In the second period, the accrual reversal provides information to the shareholders about the actual true earnings of the firm. Thus, the manager’s compensation is partly based on earnings that may be possible to manipulate, and partly based on true earnings. The proportion of long-term incentives determines the proportion of pay in each period. Long-term incentive plans are often used in practice (Westphal and Zajac, 1994). Statoil ASA uses long-term incentive plans in their executive remuneration packages, where 20 - 30 percent of a participant’s base salary is invested in Statoil stock, which is locked-in for three years before the participant can sell the stock. The reason for the long-term incentive system is that it contributes to strengthening the common interest between the top management and the shareholders (Statoil ASA, 2012).

The goal of our thesis is to learn more on how we can promote effort and honesty in managers. In short, we want to study how we can keep incentives to motivate high effort, while reducing manipulation. We assume a risk-neutral manager in our model. Goldman and Slezak (2006) and Sun (2009) assume that the manager is risk-averse, and this is common in the executive compensation literature (Oyer and Schaefer, 2010). The effect of risk aversion in a principal-agent model where the agent is paid with incentive pay, is that the agent must be compensated for facing risky compensation. Comparing a risk-averse agent and a risk-neutral agent facing the same incentive pay contract, the risk-averse agent has less expected utility from the contract than a risk-neutral agent, because the risk-averse agent incurs disutility of facing risky compensation. The risk-averse agent thus needs more compensation than the risk-neutral agent to accept the contract.

The discussion of incentive pay and risk is not a topic that we want to study, and we choose to simplify the manager's risk preferences in our model. One effect of having a risk-neutral manager is that this manager does not need to be compensated for bearing risk associated with incentive pay. Thus, a risk-averse agent would need more compensation than the agent in our model. When we assume risk-neutral shareholders and a risk-neutral manager, all payoffs in the model can be interpreted as both utility values and monetary values.

3.2 The basic assumptions of our model

A principal (shareholders) hires an agent (manager) to manage a firm with one project, see figure 1 for the timeline of the model. Both the shareholders and the manager are risk-neutral. The objective is to hire the manager for one period to maximize the value of the company. After the first period is over, the project is finished and the outcome of the project is private information to the manager. The manager creates a financial report of the project's earnings, which may be subject to manipulation. In period two, the outcome (earnings) of the project becomes public information. Note that effort is exerted in the first period, and no value creation takes place in the second period. The only reason for the second period is to let any exaggerated accruals due to manipulation revert.

The firm's earnings, y , may be either high (H) or low (L), and the probability of H is dependent on the manager's effort, (e). High earnings is the preferred outcome as in this case the value of the firm is maximized. The effort, e , is unobservable to the principal and may take two values, high (h) or low (l). p_e is the probability of H given the manager's effort, e , with $e \in \{h, l\}$. Exerting effort is costly for the manager and she incurs disutility $c(e) = c$ for high effort and $c(e) = 0$ for low effort.

We assume that the project requires the manager to exert high effort to be profitable. Since effort is costly and unobservable, the principal must motivate the manager to choose high effort through incentive pay. Their only mutually observed variable on the project's outcome in the first period is the reported earnings. In the second period, the true earnings becomes public information. Pay is thus based on reported earnings in the first period, and true earnings in the second period.

As remuneration, the manager gets a cash compensation, v_y , which is dependent on earnings y , $y \in \{H, L\}$. In the case of high earnings the value of the manager's compensation is v_H , and in the case of low earnings the compensation is v_L . When the manager changes the effort level from low to high, the probability of achieving high earnings has improved, while the probability of realizing low earnings has decreased. Thus, in order to motivate high effort, the compensation corresponding to high earnings must be bigger than the compensation corresponding to low earnings. $(v_H - v_L)$ represents incentive pay, and is naturally $(v_H - v_L) = 0$ for fixed pay. \underline{V} denotes the manager's best outside opportunity at the time the contract is offered. In the case where the manager has manipulated the report, reported earnings differs from true earnings, and the value of the manager's cash compensation changes in the second period when true earnings becomes public information.

In our model, all value creation happens in the first period. The sole purpose of the second period is to let any exaggerated accruals due to manipulation revert, revealing the true earnings. This is a new contribution to the Sun framework.

3.3 The long-term incentive scheme

In period 1, the manager privately learns the project's earnings, and creates a financial report. She is paid $(1 - s)$ of the cash compensation corresponding to the reported earnings. The rest of the compensation, s , is paid when true earnings has become public information, in period 2. This part of her cash compensation is based on the true outcome of the project. If earnings were manipulated, accruals will revert in the financial statement of period 2. We have that $0 \leq s < 1$ and that s is exogenously given in the model. s is the proportion of compensation that has to be held long-term.

A larger s can be thought of as a shift from short-term incentives to long-term incentives for the manager. Because accruals revert, a higher proportion of long-term incentives will decrease the attractiveness of manipulating the financial statement. This is because less of the compensation can be inflated through manipulation. When she faces $s > 0$, the manager cannot increase 100 percent of her compensation by misreporting. In this case, some of her pay is based on true earnings, which is impossible to inflate through manipulation. Without any

proportion of pay as long-term incentives, ($s = 0$), the revelation of true earnings has no consequence on the manager's compensation.

We do not discount future payments nor address any preference for short-term pay or long-term pay by the manager. We realize that this may be an unrealistic simplification. It is unreasonable to expect a manager to accept a contract with a very large s , such that almost all compensation is paid in the long-term. There should be some upper constraint on s below 1, such that the manager gets enough pay to cover her day-to-day expenses. Our model does not formally include such a constraint, but our results should be interpreted with this in mind. We innovate the Sun framework by imposing long-term incentives on the manager.

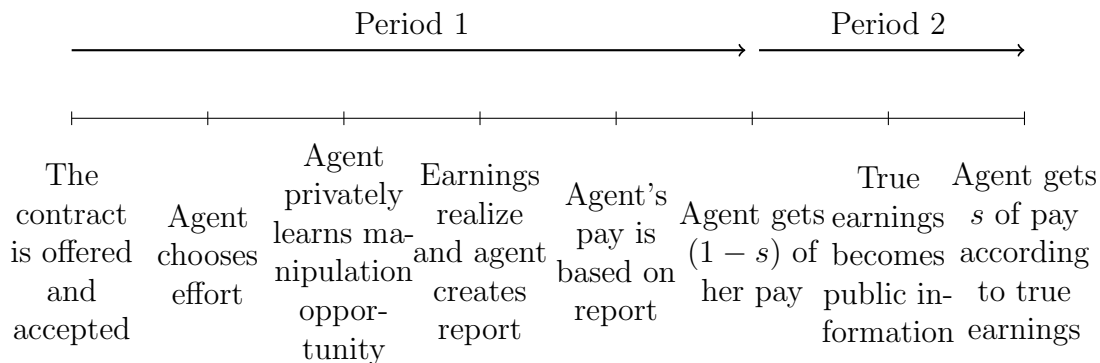


Figure 1: Model timeline

3.4 The manipulation opportunity

After the manager has exerted effort, she privately learns whether or not she has an opportunity to manipulate earnings. With probability x she has such an opportunity, and with probability $(1 - x)$ she does not. Then the manager privately observes the realized earnings, and based upon this and the manipulation opportunity, she makes a report to the shareholders on the outcome of earnings. An increase in x can be interpreted as weaker internal control mechanisms, weaker control of the financial statement by the firm's auditors and more leeway in accounting principles which may vary across industries.

Let $R(\cdot)$ denote the manager's reporting action. For instance, for realized earnings, L , a manipulated report yields $R(L) = H$, while an honest report $R(L) = L$. If the manager chooses to manipulate earnings, she incurs a private cost given by the function $\phi(\cdot)$. If she reports honestly, $\phi(L - L)$ or $\phi(H - H)$, this cost equals 0. If she manipulates earnings, there is a positive cost $\phi(H - L) = \psi$. In the model's objective function, the private cost of manipulation appears as $\phi(R(y) - y)$.

ψ is the utility loss of manipulating the financial statement. It covers all types of disutility associated with manipulation, such as expected punishment, costs of preventing auditors to detect discrepancies, expected reputational loss and private moral costs.

In the model's setup, the manager will never choose to manipulate when high

earnings has occurred, because the manager will in this case incur an avoidable loss in compensation, when $v_H > v_L$. For the rest of this thesis, manipulation means reporting high earnings when low earnings has occurred.

3.5 Accrual reversal

If the manager has achieved low earnings, but chooses to manipulate the report in order to inflate earnings, we know that earnings must revert in the next period since the manipulation is done through an artificial inflation of accruals. In the case where the financial statement is truthfully reported, the earnings are not inflated and will not revert in the next period. In the case of manipulated earnings, the accrual reversal provides information to the shareholders about the project's true earnings, in the second period. The project's true earnings are public information in the second period independent of the reported earnings in the first period. How does this affect the manager's compensation?

The manager is paid in two periods, where $(1 - s)$ of the compensation is paid in the first period and s is paid in the second period. Since the project's true earnings are public information in the second period, the compensation that is paid in the second period will not be subject to manipulation and only dependent on true earnings, v_y . Thus, only $(1 - s)$ of the compensation may be inflated by manipulation, and this part of the compensation is dependent on the reported earnings, $v_{R(y)}$. In the case where the manager does not have the opportunity to manipulate the earnings, the compensation in both periods is only dependent on the true earnings, v_y .

For the sake of clarity, let us underline that the project is finished in the first period and the purpose of the second period is to let any accrual manipulation revert. The manager's compensation is dependent on the shareholders' perception of earnings. In the first period, the shareholders can be fooled into thinking earnings were higher than they actually were, but in the second period the shareholders have perfect information on the true performance of the firm. Thus, short-term pay can be manipulated through the report, while long-term pay is always based on true earnings.

Recall that we do not discount future payments nor address any preference for

short-term pay or long-term pay by the manager. The features of accrual reversal and two time periods are not part of the model of Sun (2009). We include these features in order to shed light on the phenomenon of long-term incentives and its effect on effort and honesty.

3.6 Explanation of outcome and reporting action's effect on compensation

Let $\{y, R\}$ denote the reporting action where true earnings is denoted as y and reported earnings is denoted as R . We have three possibilities, X , Y and Z . Figure 2 on the next page shows the relationship between the reporting action and paid compensation.

There are two honest reporting actions $X = \{H, H\}$ and $Z = \{L, L\}$, and one dishonest action $Y = \{L, H\}$. If true earnings becomes H, the manager can only choose X. The manager's compensation claim is v_H in period 1, and this value will remain v_H in period 2. When the true earnings realize at L, the manager has two options, to manipulate, Y , or to report honestly, Z . If the manager reports honestly, action Z , the value of the manager's compensation is v_L in period 1 and remains at this level in period 2. If she decides to misreport, Y , the value of the compensation is v_H in period 1, and it reverts to its true value v_L in period 2. This is the change in compensation due to accrual reversal. As some pay is paid in period 1 and some pay is paid in period 2, determined by s , the manager can inflate some of her compensation by manipulating.

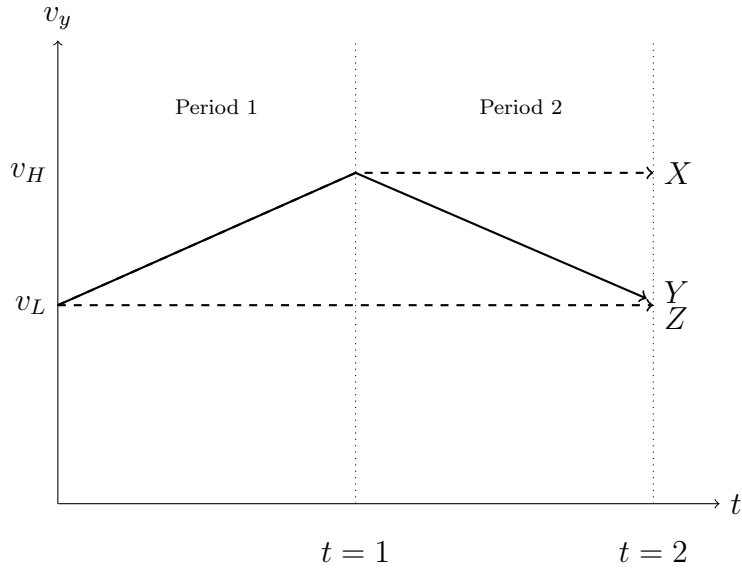


Figure 2: The manager has three possible reporting actions, X , Y and Z . The v_y -axis shows the value of the manager's compensation in period 1 and 2. The value of the compensation with the dishonest reporting action, Y , reverts down after period 1 because of the accrual reversal. X and Z are honest reporting actions where the reported earnings equals the realized earnings. If H earnings occur, only reporting action X is optimal for the manager. It is not utility maximizing to report L when H has occurred because the manager will in this case incur a loss, and no gain in compensation. Thus, she will never report L when H has occurred. If the manager chooses action X , the compensation claim increases to v_H in period 1 and remains at the same level in period 2. If L is realized, the manager has two options. If she truthfully reports L , reporting action Z , the compensation claim is v_L for both periods. If she chooses to manipulate the financial statement, reporting action Y , the compensation claim is upwardly biased in period 1, and reverts down to its true value in period 2. The proportion of the compensation she gets in each period is determined by the extent of long-term incentives.

Summary of variables and assumptions

| | |
|---------------------|---|
| $y, y \in \{H, L\}$ | True outcome of the project's earnings |
| $e, e \in \{h, l\}$ | Manager's effort |
| $R(y)$ | Reporting action given y |
| v_y | Value of the manager's compensation given y |
| $v_H - v_L$ | Value of the manager's incentive pay |
| $v_{R(y)}$ | Value of the manager's compensation given reporting action $R(y)$ |
| $x, 0 < x < 1$ | Probability that the manager has a manipulation opportunity |
| p_e | Probability of H given e |
| $c(e)$ | Cost function of effort |
| \underline{V} | The manager's best outside opportunity |
| $s, 0 \leq s < 1$ | The share of the manager's compensation she must hold until period 2 |
| $\phi(R(y) - y)$ | The manager's private cost of reporting, equal to ψ if dishonest |

Figure 3: Summary of assumptions for quick reference

4 Analyzing the basic model

In this section we will analyze the basic model that was introduced in the previous section. We will formalize this as an optimization problem, and derive the optimal contract. Section 4 is a technical section where our focus is on the mathematics of the model. The intuition for the optimal contract, which is based on the derivation presented in this section, will be discussed thoroughly in section 5.

In short, we have owners of a firm that need a manager to run a project. The project is only profitable when the manager exerts high effort, and the manager's compensation is based on a report that may be subject to manipulation. We contribute to the Sun (2009) framework by introducing new features. What is the optimal contract?

4.1 The optimization problem

Contrary to Sun we assume a risk-neutral manager, incorporate the idea of accrual reversal using two periods and introduce an exogenously given long-term incentive scheme to the manager. We have a manager that observes both the true earnings of the project in period 1 and the opportunity to misreport. The manager is only allowed to communicate through the financial statement with limited information space. Thus, the true earnings cannot be unambiguously identified from the financial statement. In this environment, the principal must incentivize high effort, but also control for the manager's reporting incentive (Sun, 2009).

The manager's objective is to maximize her expected utility by choosing a level of effort $e \in \{l, h\}$ and to report earnings, denoted as $R(y)$, subject to the contract she is offered. Equation (1) states the manager's expected utility given effort e and reporting action $R(y)$.

$$V(e, R(y)) = xE[(1-s)v_{R(y)} + sv_y - \phi(R(y) - y)] + (1-x)E[v_y] - c(e) \quad (1)$$

The first term shows the manager's utility when there is a manipulation oppor-

tunity, and the second term shows the manager's utility when there is not. Both terms are weighed by the probability that they occur, x and $1 - x$, where x denotes the probability of the earnings management opportunity. When there is an opportunity to manipulate, $(1 - s)$ of the compensation of the manager will depend on the *reported* earnings, which will revert to the true value in the next period in the case of manipulation. Thus, the proportion s of the compensation will depend on *true* earnings. $\phi(\cdot)$ denotes the private cost of misreporting, which takes the value ψ if the manager chooses to manipulate, and zero if not. If there is no manipulation opportunity, the compensation will only depend on the true earnings. Note that in this case the s is not important since no accrual reversal can take place. We do not discount future payments and we do not address any preference the manager may have of the composition of short- and long-term pay. Recall that in the model, s is exogenously given. $c(e)$ is the cost of effort, which takes the value c in the case of high effort and 0 in the case of low effort.

The principal chooses the compensation values $v_y, y \in \{L, H\}$ that minimizes the expected cost of inducing high effort, but the principal must also control for a reporting choice $R(y)$ for each y . Equation (2) shows the principal's objective function that must be optimized subject to equation (3), (4) and (5). This is a minimization problem, and the solution is the optimal contract which is named the pay and reporting equilibrium. The optimal contract yields a promise of compensation $\{v_H, v_L\}$ and optimal action $\{e, R(y)\}$.

$$\begin{aligned} \min_{v_y, R(y)} E[V | h] = & x [p_h((1 - s)v_{R(H)} + sv_H) + (1 - p_h)((1 - s)v_{R(L)} + sv_L)] \\ & + (1 - x) [p_h v_H + (1 - p_h)v_L] \end{aligned} \quad (2)$$

Subject to:

$$\begin{aligned} h = \operatorname{argmax}_{e \in \{l, h\}} V = \operatorname{argmax}_{e \in \{l, h\}} & x E[(1 - s)v_{R(y)} + sv_y - \phi(R(y) - y)] \\ & + (1 - x) E[v_y] - c(e) \end{aligned} \quad (3)$$

$$V(e, R(y)) = xE[(1-s)v_{R(y)} + sv_y - \phi(R(y) - y)] + (1-x)E[v_y] - c(e) \geq \underline{V} \quad (4)$$

$$R(y) = \operatorname{argmax}_{R \in \{L, H\}} (1-s)v_R + sv_y - \phi(R - y) - c(e) \quad \forall y \in \{L, H\} \quad (5)$$

The principal's objective function, (2)

The principal's objective function, (2), is the expected cost to induce high effort in the manager. The first term is the cost of inducing high effort when the manager has an opportunity to manipulate the earnings. In this case, the proportion $(1-s)$ of the pay is based on the reported earnings, $R(y)$, and the proportion s is based on the true earnings y . Thus, the shareholders must consider that the manager might manipulate the financial statement, and the effect this has on the manager's incentives to exert high effort.

Given high effort, the probability of the high earnings outcome is p_h and the probability of a low earnings is $(1-p_h)$. When low earnings occur, the manager may manipulate since the gain from manipulation may be larger than the cost of manipulation, if $v_H > v_L$. It is not optimal for the manager to manipulate when high earnings occur and $v_H > v_L$. The attractiveness of manipulation is dependent on the cost of misreporting, ψ , and the degree of the long term incentive scheme, s . In the case where we have no manipulation opportunity, the manager's compensation is based on true earnings, y .

The incentive compatibility constraint of the manager, (3)

(3) is the incentive compatibility constraint for the managers choice of effort. The contract offered must be such that it is optimal for the agent to choose high effort. When there is an opportunity to manipulate the financial statement, she must be incentivized to exert high effort when she considers the compensation of a reporting action $(1-s)v_{R(y)} + sv_y$, the private cost of misreporting $\phi(R(y) - y)$ and the

cost of effort $c(e)$. When there is no opportunity to misreport, she only has to be compensated for the cost of effort in order to exert high effort.

The participation constraint of the manager, (4)

(4) is the participation constraint for our manager, where the wealth obtained in this position (LHS) is equal or larger than that of the best outside job opportunity, \underline{V} . We do not pay much attention to this constraint in the basic model, and we assume it to always hold with equality.

The optimal reporting action constraint, (5)

(5) is the optimization problem's last constraint and it states that reporting action $R(y)$ is optimally chosen by the manager given the contract she is offered.

4.2 Deriving the optimal contract for the basic model

We will now derive the optimal contract and present our propositions. These propositions will determine under which circumstances we have effort and honesty, and when the manager will misreport. The intuition for the optimal contract is thoroughly discussed in section 5. The focus now is to solve the model mathematically. This is thus a technical section.

We start with some reflections on the optimization problem. It is assumed that the manager must exert high effort in order for the project to be profitable. Thus, the optimal contract must be such that exerting high effort always is the optimal choice for the manager. However, the manager also has a second choice variable, her reporting choice given the earnings that occur. The manager will manipulate if the benefit of doing so exceeds the benefit of reporting truthfully. The benefit of misreporting is determined by the level of incentive pay, while the cost of misreporting is constant for different levels of incentive pay. Thus, when we increase incentive pay, manipulation becomes more attractive. The manager will only manipulate if low earnings occur. Note that the probability that low earnings occur is the greatest when low effort is exerted. This means that when manipulation becomes more attractive, the benefit of exerting high effort decreases on a relative level. When we determine the optimal contract, we need to consider this

interdependence between the effort-choice and the reporting-choice. The incentive pay needed to induce high effort will vary with the attractiveness of manipulation, because an increase in the benefit of manipulation decreases the benefit of high effort on a relative level. These reflections result in the following strategy to solve for the optimal contract. We first need to consider under which conditions the manager will manipulate and not manipulate, and then determine the incentive pay necessary to induce high effort under each reporting-choice-case.

We start the derivation of the optimal contract with determining when the manager will manipulate. To do this, we need to study the manager's cost-benefit analysis of misreporting. Proposition 1 states the condition for when the manager will be tempted to manipulate. In this case, we do not have effort and honesty.

Proposition 1: If $\frac{\psi}{1-s} < \frac{c}{p_h - p_l}$, incentive pay needed to induce high effort is so high that the manager *will* misreport if she gets the chance to.

Derivation: To determine when the manager will *not* manipulate, we consider the manager's cost-benefit analysis of manipulation. In the case low earnings occur, the payoff of truthfully reporting low earnings (LHS) must be preferred over the payoff of misreporting high earnings (RHS):

$$\begin{aligned} (1-s)v_L + sv_L &\geq (1-s)v_H + sv_L - \psi \\ v_L &\geq v_H - s(v_H - v_L) - \psi \\ v_H - v_L &\leq \frac{\psi}{1-s} \end{aligned}$$

As long as the benefit of reporting truthfully, v_L , exceeds the net benefit of manipulating, $1-s$ of pay corresponding to the pay of high earnings, and s of pay corresponding to the pay of low earnings, minus the utility loss of manipulation, ψ , the manager will not manipulate when low earnings occur. Note that an increase in the utility loss of manipulating, for instance an increase in the legal punishment of getting caught manipulating, will make manipulation less attractive. An increase in the proportion of pay that must be held for the long-term will also reduce the attractiveness of manipulation, since a smaller proportion of pay can

be inflated through manipulation.

Will the manager manipulate if high earnings occur? If the compensation corresponding to high earnings is higher than the compensation corresponding to low earnings, the manager will never manipulate high earnings downwards, because she has nothing to gain from it. If high earnings occur, it will never be optimal to manipulate, as long as $v_H > v_L$.

We can summarize the condition for no manipulation if low earnings occur and the condition for no manipulation if high earnings occur into equation (6):

$$0 \leq v_H - v_L \leq \frac{\psi}{1 - s} \quad (6)$$

When equation (6) holds, the cost of manipulating exceeds the benefit of manipulating, and the manager will not be tempted to misreport the financial statement. Equation (6) is equal to the no manipulation condition in Sun (2009), in the special case of $s = 0$. Note that in the hypothetical case of fixed pay, $v_H - v_L = 0$, the manager will not manipulate.

We have now determined the condition for when the manager will not manipulate. The next step is to determine incentive pay necessary to motivate high effort in the case where manipulation is unattractive. When the manager will not manipulate, we do not have to consider the effect the opportunity to manipulate has on the relative attractiveness of high effort, because the manager will always report truthfully. The compensation must be such that high effort is optimal, when the cost of effort is the only consideration. We examine the incentive compatibility constraint (3), and determine the condition for high effort when there is no manipulation. For high effort to be optimal, the manager's payoff from exerting high effort (LHS) must be preferred over the payoff from low effort (RHS).

$$p_h(v_H - c) + (1 - p_h)(v_L - c) \geq p_l v_H + (1 - p_l)v_L$$

$$v_H - v_L \geq \frac{c}{p_h - p_l} \quad (7)$$

Equation (7) states the incentive pay necessary to motivate high effort when manipulation is unattractive. When equation (7) holds, we say that the incentive pay is larger than or equal to the effective cost of effort. In some cases, incentive pay

necessary to motivate high effort is so high that equation (6) does not hold.

Recall that the manager will manipulate if incentive pay exceeds $\frac{\psi}{1-s}$, see equation (6). Thus, if incentive pay needed to incentivize high effort exceeds this, the optimal contract will incentivize manipulation. Combining what we know from (6) and (7), if $\frac{\psi}{1-s} < \frac{c}{p_h - p_l}$, both high effort and truthful reporting are not optimal choices for the manager. In this case, the incentive pay necessary to motivate high effort exceeds $\frac{\psi}{1-s}$, which make manipulation attractive. Thus, misreporting will be the optimal action for the manager. Incentives that were meant to induce high effort also induce dishonest reporting.

Thus, if $\frac{\psi}{1-s} < \frac{c}{p_h - p_l}$, incentive pay needed to induce high effort is so high that the manager *will* be tempted to misreport. This ends proposition 1.

We now want to determine the incentive pay necessary to motivate high effort, in the case when the manager is tempted to misreport. We then study this incentive pay for a cost of misreporting, ψ , that makes the manager indifferent between honest reporting and manipulating. By doing this, we can determine how the incentive pay must change in response to changes in the cost of misreporting, ψ . This is discussed in proposition 2.

Proposition 2: If $\frac{\psi}{1-s} \geq \frac{c}{p_h-p_l}$, incentive pay can incentivize high effort without making manipulation attractive. In this case, we have both effort and honesty.

Derivation: What do the shareholders have to pay the manager when manipulation is attractive? We compare the manager's payoff of exerting high effort (LHS) to the manager's payoff of exerting low effort (RHS), when the manager will manipulate if she gets the chance to:

$$x[p_h v_H + (1 - p_h)((1 - s)v_H + sv_L - \psi)] + (1 - x)[p_h v_H + (1 - p_h)v_L] - c \geq x[p_l v_H + (1 - p_l)((1 - s)v_H + sv_L - \psi)] + (1 - x)[p_l v_H + (1 - p_l)v_L]$$

This simplifies to:

$$v_H - v_L \geq \frac{c - x(p_h - p_l)\psi}{(p_h - p_l)(1 - x + xs)} \quad (8)$$

Equation (8) states the incentive pay necessary to induce high effort when the manager will manipulate the earnings. Note that it decreases in ψ . The incentive pay necessary to induce high effort is larger when earnings manipulation is attractive compared to when earnings manipulation is not attractive. The manager needs additional incentives to exert high effort under the circumstances where manipulation is the optimal action for the manager. Below we show that incentive pay, when the manager will manipulate, (8), equals the incentive pay when the manager will not manipulate, (7), when the ψ is such that the manager is indifferent between misreporting or not. We see that, in (8), incentive pay decreases linearly in ψ , thus (8) must be bigger than (7) for a ψ up to the point where manipulation is unattractive. At this point, (8) and (7) are equal. The intuition behind this will be further discussed in the next section. How much do the shareholders need to pay the manager when the manager is indifferent between manipulating or not? We set the ψ to make the manager indifferent, and insert this ψ into incentive pay necessary to induce high effort when the manager is tempted to manipulate, (8).

If $\frac{\psi}{1-s} = \frac{c}{p_h-p_l}$, the manager is indifferent between misreporting and honest re-

porting. Substituting this ψ in equation (8) yields:

$$v_H - v_L \geq \frac{c - cx(1 - s)}{(p_h - p_l)(1 - x + xs)} \Rightarrow v_H - v_L \geq \frac{c}{p_h - p_l}$$

Incentive pay needed for high effort when manipulation is attractive equals the incentive pay needed for high effort when manipulation is unattractive, when $\psi = \frac{c(1-s)}{p_h - p_l}$.

$$v_H - v_L \geq \frac{c}{p_h - p_l}$$

For a low private cost of misreporting, ψ , we must compensate the manager according to (8). This is the incentive pay the shareholders must provide the manager to exert high effort in the case of no manipulation. We know a ψ that makes the manager indifferent between misreporting and not. Inserting this ψ into the incentive pay needed to induce high effort when the manager manipulates yields an incentive pay that equals the effective cost of effort (7). For a higher ψ than this, (7) states the optimal compensation contract. Thus, the incentive contract "kinks" at the ψ that makes the manager indifferent between manipulating or not manipulating, shifting optimal incentive pay from (8) to (7).

The probability that the manager has a manipulation opportunity, x , affects the optimal contract when the manager is tempted to manipulate. It can be shown that the derivative of (8) with respect to x is positive. This means that incentive pay needed to motivate high effort when manipulation is attractive increases in x .

We now discuss the relationship between the manager's cost-benefit analysis of manipulation and the proportion of long-term incentives, s .

Proposition 3: When $s \rightarrow 1$, the manager will never be tempted to manipulate

Derivation: When $s \rightarrow 1$, the no manipulation condition, (6), is always satisfied.

$$\lim_{s \rightarrow 1} \left(\frac{\psi}{1-s} \right) = \infty$$

It is easy to see that the incentive pay needed to make manipulation tempting goes towards infinity when $s \rightarrow 1$. It is infeasible to pay this much for high effort, and thus the manager will never face incentive pay needed to make manipulation tempting when $s \rightarrow 1$. When $s \rightarrow 1$, all of the compensation is paid in the second period when the true earnings are public information. In this case, there will be no benefit of manipulating the financial statement, only the disutility from the misreporting cost, ψ . In this case, it will never be optimal for the manager to misreport the financial statement. The no manipulation condition, (6), holds for a lower ψ when we increase s .

4.3 Summary of analysis

The shareholders of a firm hire a manager that is compensated through a financial report that may or may not be subject to manipulation. Our model explains the optimal compensation contract to the manager and it predicts under what circumstances the manager is tempted to manipulate the financial report.

Two variables play a central role in the manager's choice between reporting honestly or manipulation. These are ψ and s , where ψ denotes the private cost of misreporting, and s denotes the proportion of compensation that is paid in period 2, when the true earnings have become public information. When the benefit of misreporting is sufficiently high, the shareholders must provide larger incentives to the manager in order to induce high effort compared to the case where the benefit of misreporting is low. The model predicts decreasing incentive pay in ψ and s . Both variables can be interpreted as corporate governance mechanisms. s decreases the temptation of manipulating the financial statement.

Incentive pay when the manager is tempted to manipulate increases in x . This is because the expected payoff from exerting low effort increases because if low earnings realize, there is a higher probability that the report can be manipulated.

5 Pay and reporting equilibrium, the economic intuition for the optimal contract

In this section, we will discuss the optimal compensation contract and provide intuition for the mechanics of the model. We name the optimal contract the pay and reporting equilibrium, which is presented graphically in figure 4 and 5.

5.1 The optimal contract

The optimal contract is the solution that minimizes the shareholder's objective function, (2), subject to the incentive compatibility constraint, (3), the participation constraint, (4), and the reporting action constraint (5).

From the propositions of the model, we know that the manager will sometimes manipulate and sometimes not. The manager will decide to manipulate based on a cost-benefit analysis. Recall that the manager can only manipulate when low earnings realize. Thus, the benefit of manipulation is dependent on the difference in pay between a high earnings report and a low earnings report, $v_H - v_L$. Recall that only a proportion of the pay is based on the report, the proportion of short-term incentive pay, $(1 - s)$. The proportion of incentive pay that is paid in the long-term, s , is not possible to manipulate, since the true value of earnings is public information at that time. The proportion of long-term incentive pay thus serves as a mechanism to reduce the benefit of manipulation. Thus, the benefit of manipulation is the difference between the pay corresponding to a high report and a low report, in the short-term. This is $(1 - s)(v_H - v_L)$. The private cost of misreporting, ψ , is the direct cost of manipulating, and is the disutility the manager incurs the second she manipulates the report. The cost-benefit analysis of manipulation thus considers the incentive pay, the proportion of long-term pay and the private cost of misreporting.

When will the manager choose to manipulate? For some combinations of misreporting cost, proportion of long-term incentives and incentive pay, the manager will never be tempted to manipulate, and some combinations will always induce manipulation when the manager has the opportunity. From this, we can split the manager's decision to manipulate or not in two areas. In figure 4, the area of

inevitable manipulation shows the combination of ψ and $v_H - v_L$ that makes it attractive to manipulate, for a constant s . The no manipulation area shows the exact opposite. The line that determines the boundary of the two areas is $\frac{\psi}{1-s}$. What is the intuition for this boundary? The benefit of manipulation is $(1-s)(v_H - v_L)$ and the cost of manipulation is ψ . The incentive pay, $v_H - v_L$, that makes the manager indifferent between manipulating or not is then $\frac{\psi}{1-s}$.

In short, an increase in incentive pay makes it more attractive to manipulate, while increases in the private cost of misreporting and proportion of long-term incentives reduces the net benefit of manipulating. The private cost of misreporting and proportion of long-term incentives can be interpreted as corporate governance mechanisms that act to reduce manipulation. The choice of manipulation or no manipulation is independent of the probability of having a manipulation opportunity, x . This is because the decision of manipulating is done after the opportunity has realized.

How do we remunerate a manager when we operate in the no manipulation area? In the no manipulation area, the manager will never be tempted to manipulate the financial statement. When this is the case, the shareholders can motivate high effort by making the expected pay of high effort marginally better than the expected pay of low effort without having to consider the effects of manipulation. The effect of manipulation on the manager's incentives is that when low earnings realize, the manager can simply cheat to gain a higher compensation which increases the attractiveness of exerting low effort. This means that when we are in the inevitable manipulation area, the incentive pay must also control for the relatively reduced attractiveness of high effort. The shareholders must then provide more incentives in the inevitable manipulation area, because the effect of incentive pay is weaker in motivating high effort. This is due to the increased benefit of manipulating which makes low effort more attractive on a relative level.

What determines the optimal incentive pay? This is determined by the variables that affect the attractiveness of high effort versus low effort. In the inevitable manipulation area, we must also consider the effect manipulation has on the incentive pay's ability to motivate high effort. Every variable that makes high effort less attractive will increase the necessary incentive pay to motivate high effort. In the case manipulation is unattractive, the manager only has to be compensated

for the effective cost of effort. In the no manipulation area, this is the only concern that affects the attractiveness of high effort versus low effort for the manager.⁸

The new variables that affect the effort-decision in the inevitable manipulation area deal with the attractiveness of manipulation. Increases in the attractiveness of manipulation will make choosing low effort and manipulating if low earnings realize more attractive. This will make high effort relatively less attractive and the shareholders must provide more incentives to motivate high effort in the manager. The private cost of misreporting, ψ , is the disutility from manipulating the financial statement and affects the attractiveness of misreporting directly. The proportion of long-term incentives, s , serves as a restriction on how much of the compensation the manager can successfully inflate through manipulation. For a large s , there is very little to gain from manipulating, while the cost of manipulation remains the same. An increase in the probability of having a manipulation opportunity, x , increases the attractiveness of low effort on a relative level, because the expected value of low effort and misreporting has increased.

As the cost of misreporting increases, incentive pay will decrease up to the point where we enter the no manipulation area. After this point, incentive pay stays constant with respect to the misreporting cost. The reason for this is that as the cost of misreporting increases, the attractiveness of manipulation decreases and the option to choose low effort and manipulate if low earnings realize becomes less attractive. The manager will require less incentives to exert high effort. When the cost of misreporting is so high that we are in the no manipulation zone, the incentives pay will no longer be dependent on variables that affect the attractiveness of manipulation. This is why we get a "kink" in our optimal compensation scheme at the sufficiently high cost of misreporting, $\frac{c(1-s)}{p_h-p_l}$. We interpret this variable as a corporate governance mechanism. Thus, our model predicts decreasing incentive pay in the strength of corporate governance.

⁸Note that the necessary incentive pay is $\frac{c}{p_h-p_l}$. For the sake of simplicity, we refer to this fraction as the effective cost of effort.

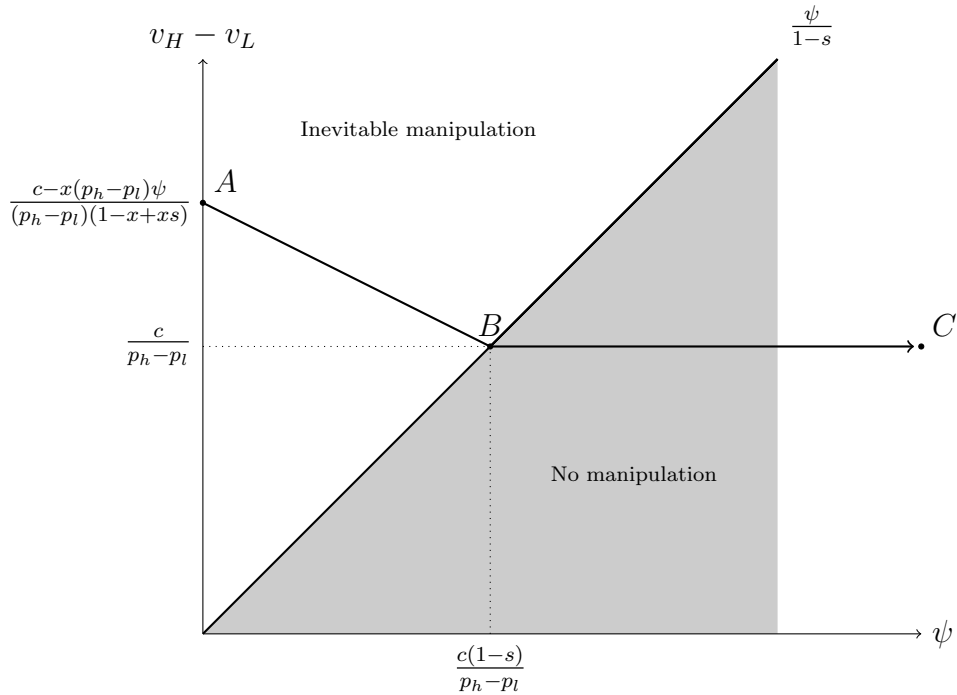


Figure 4: The vertical axis depicts incentive pay and the horizontal axis depicts the private cost of misreporting. On the basis of the benefit of manipulating, $(1-s)(v_H - v_L)$, versus the cost of manipulating, ψ , we create a line, $\frac{\psi}{1-s}$ that shows when the manager is indifferent between manipulating or not. Above this boundary, the manager will always choose to manipulate and below this boundary the manager will not be tempted to manipulate. The optimal contract is the line that connects A - B - C. As the private cost of misreporting, ψ , increases, manipulation becomes less attractive, which reduces the benefit from choosing low effort. Less incentive pay is now necessary to induce high effort. For a sufficiently high ψ , the manager will no longer manipulate, and the optimal contract "kinks" to reflect that manipulation no longer affects the manager's incentives.

5.2 Increasing the proportion of long-term incentives

Recall that s is the proportion of long-term incentive pay, and $(1 - s)$ is the proportion of short term incentive pay, which is possible to inflate by manipulation. When we increase the proportion of long-term incentives, s , we decrease the amount that can be inflated by misreporting. This means that for a higher s , the benefit of manipulation has decreased. How do long-term incentives affect the pay and reporting equilibrium? We visualize a change in the proportion of long-term incentives in figure 5 to see how this affects the optimal contract.

The choice of manipulation or no manipulation is done through comparing the incentive pay that is possible to manipulate, $(1 - s)(v_H - v_L)$, versus the cost of manipulation, ψ . When s increases, less incentive pay can be successfully inflated by manipulation. This reduces the attractiveness of manipulation. For a given level of incentive pay and private cost of misreporting, an increase in the proportion of long-term incentives will reduce temptation to misreport. For a higher proportion long-term incentives, the manager needs more incentive pay in order to find manipulation attractive given the same private cost of misreporting. This results in a steeper slope in the boundary of manipulation areas. More long-term incentives, and thereby less short-term incentives, yields less manipulation. Our model predicts that a larger proportion of long-term incentives can be used to promote effort and honesty.

How can we motivate that there is less manipulation when we increase the proportion of long-term incentives? If we imagine a distribution of managers over ψ , a proportion of the managers have a ψ that will make it attractive to manipulate when we have a low s , while unattractive when we have higher s . In figure 5, any manager that has a ψ between the points B' and B will stop manipulating when when we increase the proportion of long-term incentives from s to s' .

The pay-for-performance sensitivity is also affected by the proportion of long-term incentives. Recall that incentive pay in the inevitable manipulation zone has to control for the manager's temptation to manipulate. The attractiveness of manipulation affects the attractiveness of low effort. If manipulation gets less attractive, the shareholders need to provide less incentives in order to motivate high effort. More long-term incentives and less short-term incentives means that

the manager has less compensation to gain from manipulation. This means that a larger proportion of long-term incentives reduces the benefit of manipulation, and low effort gets relatively less attractive. Now, less incentive pay is necessary to motivate high effort. The pay-for-performance sensitivity thus decreases in the proportion of long-term incentives.

For a larger proportion of long-term incentives, the "kink" in the contract appears at a lower value of private cost of misreporting, ψ , than before. For a larger s , the model predicts that for a given private cost of misreporting, ψ , we are more likely to have an honest manager.

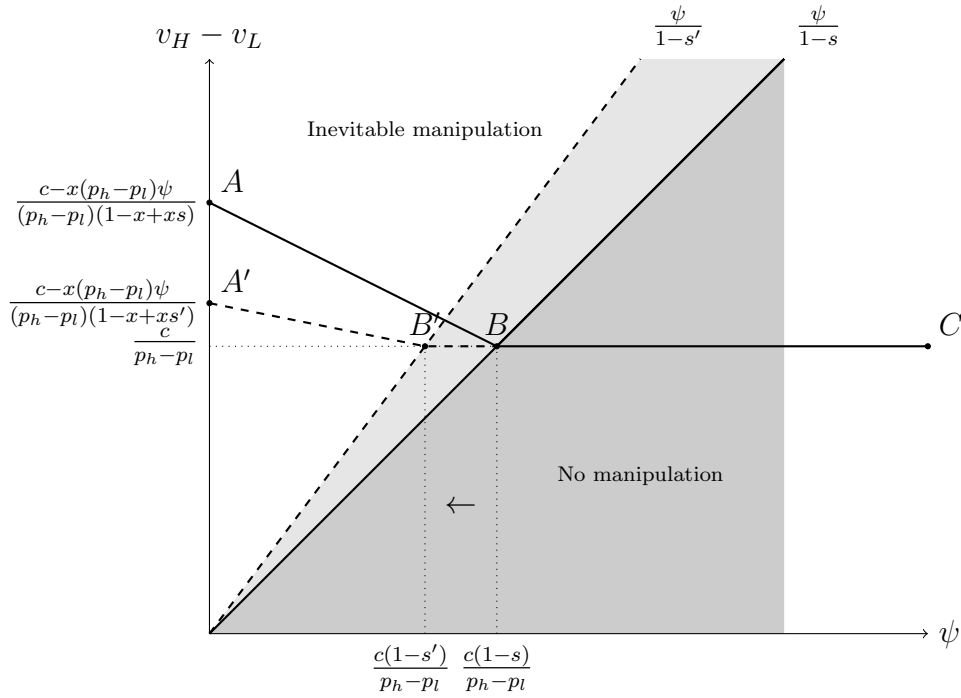


Figure 5: When increasing the proportion of long-term incentives from s to s' , the area of no manipulation increases as the benefit of manipulating has decreased. This makes the manager indifferent between manipulating and not manipulating for a lower private cost of misreporting, ψ , than before. The manager is now more likely to report honestly. The reduced benefit of manipulation also has an effect on incentive pay in the inevitable manipulation area. The option to choose low effort and manipulate if low earnings realize is less attractive than before, as less incentive pay can successfully be inflated. The shareholders can now pay less to induce high effort. Thus, when the proportion of long-term incentives increases from s to s' , the optimal contract shifts from $A - B - C$ to $A' - B' - C$. The take-away is: a higher proportion of long-term incentives promotes effort and honesty.

5.3 Increasing the probability of having a manipulation opportunity

The probability that the manager has a manipulation opportunity is denoted as x . An increase in x can be interpreted as weaker internal control mechanisms, weaker control of the financial statement by the firm's auditors and more leeway in accounting principles which may vary across industries. Changing this variable will affect the model's optimal contract, because the decision of effort is done before the manager knows that she has a manipulation opportunity.

When earnings manipulation is unattractive, the manager will disregard any payoff from manipulation when she decides on her effort level. This is because she has already decided to not manipulate regardless if she gets the opportunity or not. The probability of getting such an opportunity is thus irrelevant in the no manipulation area.

In the case where earnings manipulation is attractive, a higher x will lead to a higher expected payoff when low earnings are realized. When low earnings are realized, a higher x means that there is a higher probability that the manager can report high earnings and engage in manipulation. This mechanism increases the attractiveness of choosing low effort and manipulate the earnings in the case low earnings are realized. This is because the probability of low earnings to realize is larger for low effort than high effort. The overall effect is that low effort gives more payoff than before, and will be chosen by the manager given a contract that is set on a lower x . In order to make high effort the preferred action by the manager, more incentive pay is necessary. Pay-for-performance is thus increasing in x .

The probability of having a manipulation opportunity, x , does not affect the cost-benefit analysis of manipulation versus no manipulation. This is because the decision to manipulate is done after the manipulation opportunity realizes. If the manipulation opportunity does not occur, the manager has no choice, and must report honestly. It is only when the manipulation opportunity occurs that she faces the choice of manipulation or not. Thus, the probability of having the opportunity to manipulate is irrelevant in her decision to manipulate. If the x affects the compensation of reporting high earnings, then the x will affect the manipulation choice. The information value of a high earnings report is obviously

dependent on x , because when $x = 1$, the manager will always report high earnings in the inevitable manipulation area, and the financial report becomes meaningless. We incorporate this perspective in section 6, where outside shareholders use the x to determine the information value of the earnings report.

6 The stock market model

In this section, we introduce a modification of our basic model where market participants consider the information value of the financial statement with the suspicion that it might be manipulated, and use this information to compensate the manager. The objective of this section is to see whether a market based compensation contract can provide a more efficient solution in terms of effort and honesty than the accounting based compensation contract of the basic model.

In the basic model, we assumed that the manager's compensation was based on the reported accounting earnings. This means that when the manager reports earnings in period 1, her compensation will be based on this report, without any assessment of *expected* true earnings. In this section, we will analyze the compensation scheme in the case where the manager is compensated through an equity stake in the company. The idea is that market participants will value the company's equity based on the *expected* true earnings. The market participants will be guided by the information from the financial statement in period 1, but knows better than to blindly trust the content of this report. In some cases, the market participants will know that the manager reports honestly, and in some cases the market participants will be unsure whether the report is honest or dishonest and must arrive at an expected value estimate.

6.1 Assumptions

The shareholders of a company hire a manager who is compensated through an equity stake in the company. The true value of the company is F_y , $y \in \{H, L\}$, and the manager receives a proportion, z , of the company such that: $zF_y = v_y$. The company's stock is actively traded on the stock exchange, and we assume that the equity is fairly priced. We still assume an exogenously given long-term incentive compensation plan for the manager, where the proportion s of the equity stake must be held by the manager until period 2 and $(1-s)$ will be sold in period 1. The market participants can observe the manager's private cost of misreporting, ψ , the probability of the opportunity to manipulate the earnings, x , and the proportion of equity that must be held long-term, s . Based on the information available,

the participants calculate the expected true value of the company. The project requires a high effort-exerting manager in order to be profitable. The cost of effort, c , and the probability of achieving high earnings given effort, p_e , are the same as in the basic model.

6.2 Analysis

As discussed in proposition 1 and 2 of the basic model, if $\frac{\psi}{1-s} \geq \frac{c}{p_h-p_l}$, there will be no earnings manipulation. If $\frac{\psi}{1-s} < \frac{c}{p_h-p_l}$ the manager will always manipulate when she has the opportunity to do so. This is because the incentive pay necessary to induce high effort is so high that the benefit of manipulating exceeds the cost. In the stock market model, the compensation is based on the market participant's belief of the true state of earnings, thus we need new conditions for the manipulation areas.

First, we assume that we are in a situation where the manager will never choose to manipulate the earnings, i.e. the unknown condition of no manipulation holds. When this is the case, the market participants know that earnings have been reported truthfully. The compensation paid to the manager will be equal to that of the accounting based basic model, $\frac{c}{p_h-p_l}$.

Now, assume that the mentioned unknown condition does not hold. Then the market knows that the manager will always misreport when she gets the chance to. How will the market calculate the value of the firm? If the manager reports L , the market participants know that the manager did not have any opportunity to manipulate, and the earnings are in fact truthfully reported. If H is reported, the market participants will be unsure of the true state of earnings. They face the probability tree on figure 7, which shows the manager's reporting choice, given realized earnings and manipulation opportunity.

A high earnings report may be manipulated, or the manager may be telling the truth, because with probability p_h , high earnings occurs given high effort. We know that the probability that the manager reports H given that high earnings occurred is 1, since reporting down to L incurs an avoidable loss for the manager. The probability that the manager reports H given that low earnings occurs is x , since x is the probability that the manager has an opportunity to misreport,

and we already assumed that we are in a situation where the manager will always misreport when she gets the chance. These probabilities are summarised in the table below. In addition we present probabilities that can be derived from the assumptions presented above by the use of Bayes' rule.

Probabilities

| | |
|--|---|
| Observing a H -report given that true earnings are high | $P(H_{Reported} H) = 1$ |
| Observing a H -report given that true earnings are low | $P(H_{Reported} L) = x$ |
| High earnings occur | $P(H) = p_h$ |
| Low earnings occur | $P(L) = 1 - p_h$ |
| Observing a H -report | $P(H_{Reported}) = p_h + x(1 - p_h)$ |
| High earnings occurred, given that we observe a H report | $P(H H_{Reported}) = \frac{p_h}{p_h + x(1 - p_h)}$ |
| Low earnings occurred, given that we observe a H report | $P(L H_{Reported}) = \frac{x(1 - p_h)}{p_h + x(1 - p_h)}$ |

Figure 6: Summary of probabilities

If H is reported in the inevitable manipulation area, the expected value of the firm is:

$$E[F | H_{reported}] = \frac{p_h F_H + x(1 - p_h) F_L}{p_h + x(1 - p_h)}$$

For completeness, the expected value of the firm when H is reported is:

$$F = \begin{cases} F_H & \text{if the no manipulation condition hold} \\ \frac{p_h F_H + x(1 - p_h) F_L}{p_h + x(1 - p_h)} & \text{if the no manipulation condition does not hold.} \end{cases}$$

Note that if L is reported, the report cannot be subject to manipulation, and the value of the company will be correctly calculated to F_L .

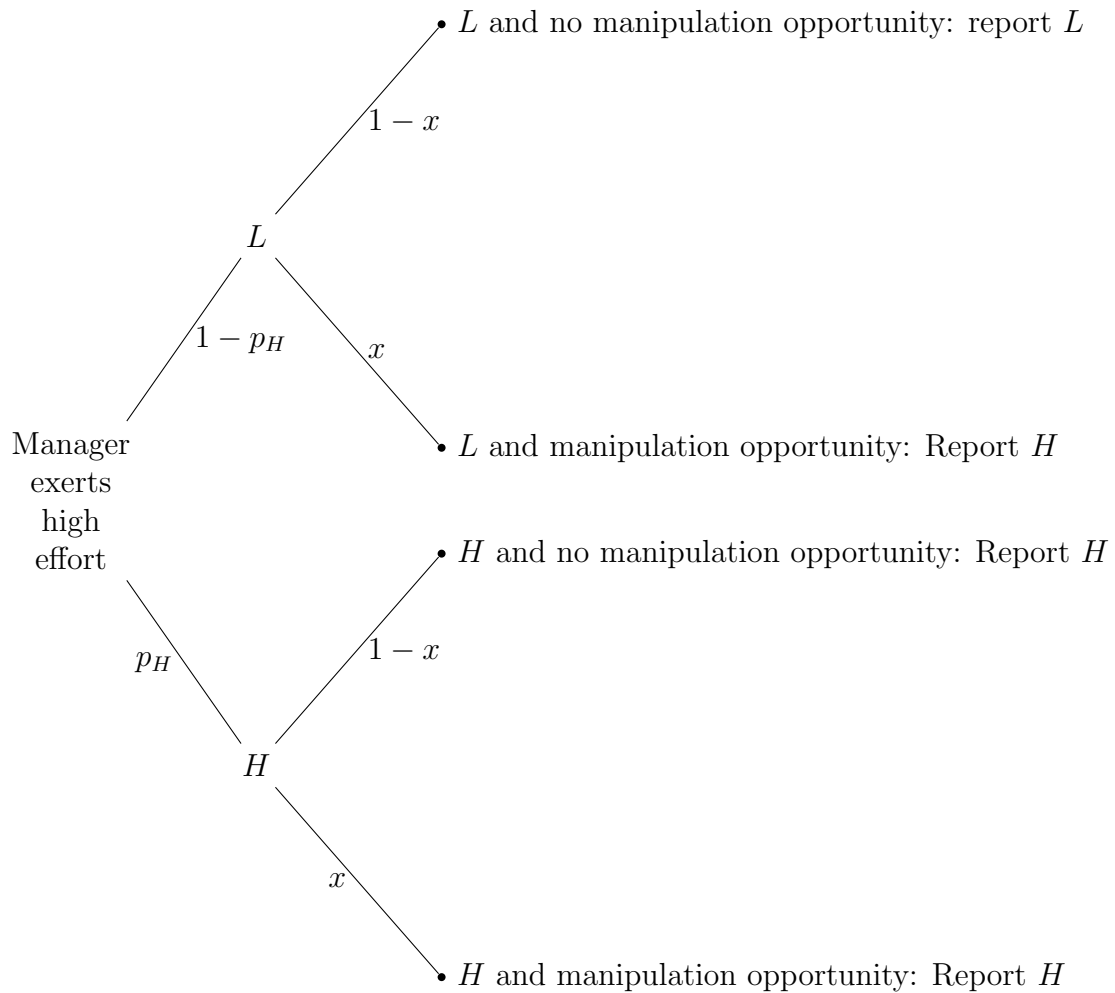


Figure 7: The probability tree depicts the reporting choice of the manager in the inevitable manipulation area. The probability tree is public information, and the market uses this to compute the probability of high earnings and low earnings, given a high report in the inevitable manipulation area. If low earnings are reported, the market knows that low earnings occurred. In the no manipulation area, all financial reports are truthfully reported, and the market knows this.

6.3 Deriving the optimal contract in the stock market model

We have presented the assumptions of our stock market model, and now we will present the optimal contract that can be drawn from them. We present two propositions that will define when manipulation occurs, and the necessary incentive pay to motivate high effort, in the case where manipulation is tempting. The question we are trying to answer is: under which circumstances will we have effort and honesty?

First we need to define the manipulation areas. We do this by examining the cost-benefit analysis of manipulating.

Proposition 4: If $\frac{\psi(p_h + x(1-p_h))}{(1-s)p_h} < \frac{c}{p_h - p_l}$, the manager will misreport because incentive pay necessary to induce high effort is so high that it creates incentives to manipulate.

Derivation: To arrive at the expression above, we examine the incentive compatibility constraint in the stock market model. Under which conditions will the manager never manipulate earnings? In the case low earnings are realized, we must have that the payoff of truthfully reporting low earnings (LHS) is greater or equal to the payoff of misreporting high earnings (RHS). For an intuitive explanation of the derivation, please see below.

$$\begin{aligned}
 v_L &\geq (1-s) \left[\frac{p_h z F_H + x(1-p_h) z F_L}{p_h + x(1-p_h)} \right] + s v_L - \psi \\
 (1-s)v_L &\geq (1-s) \left[\frac{p_h v_H + x(1-p_h)v_L}{p_h + x(1-p_h)} \right] - \psi \\
 v_L &\geq \frac{p_h v_H + x(1-p_h)v_L}{p_h + x(1-p_h)} - \frac{\psi}{1-s} \\
 v_H - v_L &\leq \frac{\psi(p_h + x(1-p_h))}{(1-s)p_h}
 \end{aligned}$$

High earnings will never be manipulated as long as the manager's pay is larger for high earnings than low earnings, $v_H > v_L$. Thus, the financial statement will not

be manipulated if:

$$0 \leq v_H - v_L \leq \frac{\psi(p_h + x(1 - p_h))}{(1 - s)p_h} \quad (9)$$

If low earnings are realized, the manager will never manipulate as long as v_L , the benefit of honest reporting, is bigger than $(1 - s) \left[\frac{p_h v_H + x(1 - p_h)v_L}{p_h + x(1 - p_h)} \right] + s v_L - \psi$, the net benefit of manipulating the report. By choosing to manipulate, she reports H , and the value of her equity stake becomes $\frac{p_h v_H + x(1 - p_h)v_L}{p_h + x(1 - p_h)}$. She sells $(1 - s)$ of her equity stake in this period, and sells the rest, s , at the value v_L , because the true earnings, L has become public information in the second period. If high earnings occur it will never be optimal to manipulate, as long as $v_H > v_L$. Equation (9) states the no manipulation conditions.

We have assumed that the manager must exert high effort. The compensation must be such that high effort is optimal when high effort is costly. Thus the following from the incentive compatibility constraint (3) must hold:

$$\begin{aligned} p_h(v_H - c) + (1 - p_h)(v_L - c) &\geq p_l v_H + (1 - p_l)v_L \\ v_H - v_L &\geq \frac{c}{p_h - p_l} \end{aligned} \quad (10)$$

Combining what we know from (9) and (10), if $\frac{\psi(p_h + x(1 - p_h))}{(1 - s)p_h} < \frac{c}{p_h - p_l}$, both constraints cannot hold simultaneously, and earnings manipulation is inevitable.

Proposition 5: If $\frac{\psi(p_h + x(1 - p_h))}{(1 - s)p_h} \geq \frac{c}{p_h - p_l}$, the manager will never misreport because high effort can be induced without creating an incentive to manipulate.

Derivation: First, we will present the value of the manager's equity stake given a high earnings report when we are in the inevitable manipulation area. Recall that when we are in the inevitable manipulation area, the shareholders do not blindly trust a high earnings report. The shareholders observe the probability that the manager has a manipulation opportunity, and the value of the company after the report has been published becomes dependent on this. α is the expected value of the manager's equity stake given that H is reported and that we are in the

inevitable manipulation area:

$$\alpha = \frac{p_h v_H + x(1 - p_h)v_L}{p_h + x(1 - p_h)}$$

Note that when x goes towards 1, α goes towards the value of the manager's equity stake before the report is published. This is because the manager will then always report high earnings, which reduces the information value of the financial report.

Now we present the incentive compatibility constraint on the manager for her to exert high effort given that we are in the inevitable manipulation area. The constraint is:

$$p_h[(1 - s)\alpha + sv_H] + (1 - p_h)[x(1 - s)\alpha + (1 - s)(1 - x)v_L + sv_L] - x(1 - p_h)\psi - c \geq p_l[(1 - s)\alpha + sv_H] + (1 - p_l)[x(1 - s)\alpha + (1 - s)(1 - x)v_L + sv_L] - x(1 - p_l)\psi$$

With probability p_h , high earnings occur and the manager reports H . The manager's equity stake is then priced at α , and the manager sells off $(1 - s)$ of the shares, and the rest, s is sold in period 2 when the true earnings H is public information, pricing the manager's equity stake correctly at v_H . With probability $(1 - p_h)$, L earnings occur. In the inevitable manipulation area, the manager will manipulate if she gets the chance to, which she does with probability x . If she does not have a manipulation opportunity, she will report low earnings. In period 2, she gets sv_L , corresponding to the true performance of the firm. The cost of effort is c and the private cost of misreporting is ψ . The expression above can be simplified to:

$$v_H - v_L \geq \frac{c - x(p_h - p_l)\psi}{(p_h - p_l) \left[\frac{p_h - xp_h + sx}{p_h + x(1 - p_h)} \right]} \quad (11)$$

Equation (11) states incentive pay necessary to motivate high effort in the case of inevitable manipulation in the stock market model.

The next step of the analysis is to determine the critical ψ that determines when the manager goes from the no manipulation area to the inevitable manipu-

lation area. We know that when $v_H - v_L \leq \frac{\psi}{1-s} \frac{p_h + x(1-p_h)}{(1-s)p_h}$, the manager will never manipulate. When this is the case, the optimal contract pays according to the manager's effective cost of effort, shown in (10), $v_H - v_L = \frac{c}{p_h - p_l}$. How large must the private cost of misreporting be for us to change from the inevitable manipulation area to the no manipulation area? The ψ that prevents the manager to manipulate satisfies:

$$\begin{aligned} \frac{\psi}{1-s} \frac{p_h + x(1-p_h)}{(1-s)p_h} &\geq \frac{c}{p_h - p_l} \\ \psi &\geq \frac{c(1-s)p_h}{(p_h - p_l)(p_h + x(1-p_h))} \end{aligned} \quad (12)$$

Now we want to determine the necessary incentive pay to motivate high effort, when we are on the boundary of the manipulation areas. Inserting the ψ that puts us on the boundary, i.e. the ψ that makes (12) holds with equality, into incentive pay necessary to motivate high effort in the inevitable manipulation area, i.e. (11), gives us the incentive pay on the boundary.

$$\begin{aligned} v_H - v_L &\geq \frac{c - x(p_h - p_l) \left[\frac{c(1-s)p_h}{(p_h - p_l)(p_h + x(1-p_h))} \right]}{(p_h - p_l) \left[\frac{p_h - xp_h + sx}{p_h + x(1-p_h)} \right]} \\ v_H - v_L &\geq \frac{c}{p_h - p_l} \frac{p_h + x - xp_h - x(1-s)p_h}{p_h + sx - xp_h} \end{aligned} \quad (13)$$

(13) states the minimum incentive pay to the manager in order to induce high effort for a private cost of misreporting, ψ , that puts us on the boundary of the manipulation areas. When ψ is above this level, manipulation is prevented and and when ψ is below this level, we have inevitable manipulation. Note that incentive pay on the boundary of the inevitable manipulation area, (13), equals the effective cost of effort, (10), multiplied by a number that is always bigger than one. The multiplier is:

$$\begin{aligned} \frac{p_h + x - xp_h - x(1-s)p_h}{p_h + sx - xp_h} &\geq 1 \\ p_h + x - xp_h - x(1-s)p_h &\geq p_h + sx - xp_h \end{aligned}$$

$$x - x(1 - s)p_h \geq sx$$

$$1 - s \geq (1 - s)p_h$$

$$1 \geq p_h$$

This is always satisfied, thus the multiplier is bigger than one. The implication is that incentive pay in the inevitable manipulation area is always bigger. When we cross the boundary, incentive pay jumps down with a factor equal to the multiplier above. This is because the compensation value of a high report changes between the two areas, going from α to v_H when going from the inevitable manipulation area to the no manipulation area. The reason for this is that in the inevitable manipulation area, the shareholders price the manager's compensation by a expected value estimate, and in the no manipulation area, the shareholders know that the report is truthfully reported, pricing the compensation correctly at v_H . Thus, incentive pay in the optimal contract changes non-linearly when we cross the boundary.

6.4 Pay and reporting equilibrium in the stock market model

What is the difference between the basic model and the stock market model? In this section we compare the extent of manipulation and pay-for-performance sensitivity between the models. The goal is to answer the question, which performance measure is better in motivating effort and honesty? See figure 8 on page 76 for a summary of the differences between the two models.

Active market participants realize that the manager will seize the opportunity to manipulate the financial statement when the benefit from doing so surpasses the cost. Assume that we are in the inevitable manipulation area. Then the market discounts the possibility of manipulation into the share price. With one probability, high earnings are truthfully reported, and with one probability, the high earnings report is manipulated. This means that when the manager reports high earnings, the value of the company, and consequently the value of her equity stake, is somewhere in between the value corresponding to a high earnings report and the value corresponding to a low earnings report. Thus, the change in the

manager's compensation when reporting high earnings is *less* in the stock market model than in the basic model. This will affect the extent of manipulation and the cost of incentivizing high effort.

6.4.1 The no manipulation area

First, we want to compare the extent of manipulation in the two models. The manager decides to manipulate or not based on a cost-benefit analysis. Let us assume that the manager has the opportunity to manipulate and that low earnings have realized. Should she manipulate or not?

In the basic model, the manager's benefit from manipulating is determined by the proportion of long-term incentives. Only the proportion of the incentive pay that is short-term can be inflated by manipulation, which determines the benefit of misreporting. She compares this benefit to the private cost of misreporting. If the benefit exceeds the cost, she will manipulate. We have previously shown that the condition that she will *not* manipulate is:

$$0 \leq v_H - v_L \leq \frac{\psi}{1-s}$$

This defines the no manipulation area in the basic model.

What is the manager's cost-benefit analysis in the stock market model? We still assume that the manager has the opportunity to manipulate and that low earnings have realized. If the manager reports truthfully, she receives the same compensation as she would in the basic model. If she reports high earnings, the market will not fully believe that the report is true, valuing her compensation at a lower level than in the basic model. The consequence is that she has less to gain from manipulating, but the cost of misreporting is the same. Everything else constant, the manager is less tempted to manipulate in the stock market model. Going from the basic model to the stock market model, the area of no manipulation increases. The no manipulation area in the stock market model is:

$$0 \leq v_H - v_L \leq \frac{\psi}{1-s} \frac{p_h + x(1-p_h)}{p_h}$$

We now show that the no manipulation area is larger in the stock market model compared to the basic model. We can see that the no manipulation area of the stock market model equals that of the basic model, multiplied with a factor. Below we show that this factor is always bigger than one.

$$\frac{p_h + x(1 - p_h)}{p_h} \geq 1$$

$$x(1 - p_h) \geq 0$$

As both x and p_h are probabilities, the condition above always holds and we can say that the no manipulation area in the stock market model is bigger than that of the basic model. What is the interpretation of this condition? $x(1 - p_h)$ states the probability that a high earnings report is manipulated. As long as the market believes that the financial statement can be manipulated, there will be less manipulation in the stock market model. For a given private cost of misreporting, ψ , and long-term incentive plan, s , the market-based compensation is more likely to eliminate the problem of earnings manipulation. The take-away is that using a market based performance measure is better than using an accounting based performance measure, with respect to honest reporting.

For an illustration of the reduced manipulation, we can imagine a distribution of managers over the private cost of misreporting, ψ . A proportion of the managers have a ψ that will make it attractive to manipulate using accounting as a performance measure, while unattractive using the stock price as a performance measure. In figure 8, any manager that has a ψ between the points B' and B will stop manipulating when the stock price is used over accounting earnings as the performance measure. Going from an accounting based performance measure to a market based performance measure reduces manipulation.

Note that the no manipulation area in the stock market model is dependent on the probability of having a manipulation opportunity, x . The higher the probability, the bigger the no manipulation area. This may sound counter-intuitive, as more manipulation opportunities, for instance more leeway in accounting standards, makes it less attractive to manipulate. The reason for this is that the shareholders use this probability to assess the likelihood of a high earnings report

being false. The higher the x , the less the market believes that the report is true, and the less the value of the company changes when the report gets published. The information value of the report decreases in x . This means that the manager has less to gain from publishing a high earnings reports, and thus less to gain from manipulation. This increases the no manipulation area.

6.4.2 Incentivizing high effort in the inevitable manipulation area

When the manager does not find manipulation attractive, the shareholders must only provide incentives that covers the effective cost of effort. In the inevitable manipulation area, the shareholders must also consider the effect manipulation has on the manager's incentives. The effect of manipulation on the manager's incentives is that it becomes more attractive to choose low effort, because now the manager can manipulate when low earnings occur. Low effort is now relatively more attractive. The shareholders must then provide more incentives to motivate high effort. Incentivizing high effort in the inevitable manipulation area is thus more expensive than in the no manipulation area. The question we want to answer is, in which model is it more costly to incentivize high effort, the basic model or the stock market model? In other words, which performance measure, accounting or stock price, has the highest pay-for-performance sensitivity?

The difference in pay-for-performance sensitivity between the two models will be determined by the differences in how the value of the manager's compensation is affected by a high earnings report. The shareholders react differently to this report in the two models, which affects the compensation to the manager, but only in the first period. In the second period, the manager is paid according to the earnings that actually occurred. This is the case in both models. Thus, to understand the difference in pay-for-performance sensitivity between the two models, we focus on the short-term pay, which is the pay in the first period.

In the basic model, the manager is paid in cash. If she reports high earnings, she is paid $(1 - s)v_H$ in the first period, and if she report low earnings she is paid $(1 - s)v_L$ in the first period. In the stock market model, the manager is paid in stock which is priced on the basis of the accounting earnings under the suspicion of manipulation. If she report high earnings, she is paid $(1 - s)\alpha$ in the first period,

and if she report low earnings she is paid $(1 - s)v_L$ in the first period. Recall that α is the expected value of the manager's equity given a high earnings report in the inevitable manipulation area:

$$\alpha = \frac{p_h v_H + x(1 - p_h)v_L}{p_h + x(1 - p_h)}$$

We can see that the expected value of the manager's equity stake is somewhere in between the value of the cash compensation of high and low earnings in the basic model:

$$v_H \geq \alpha \geq v_L$$

We now compare the two models, holding the incentive pay constant, $v_H - v_L$. In the stock market model, compared to the basic model, the manager has less to benefit from both exerting high effort and manipulating. This is because when high effort is exerted, she improves her probability to get the high outcome, which is $(1 - s)\alpha$, which is less than the $(1 - s)v_H$ in the basic model. High effort is now less attractive than low effort. This means that we need a higher incentive pay, $v_H - v_L$, in the stock market model to motivate high effort, such that we can increase α .

The stock market also reduces the attractiveness to manipulate. This has the opposite effect on the manager's incentives to exert high effort. When she manipulates she gets $(1 - s)\alpha$, which is less than $(1 - s)v_H$ in the basic model. We know from before that when manipulation becomes less attractive, less incentives are needed to motivate high effort. The isolated effect from this is less incentive pay in the stock market model compared to that of the basic model to motivate high effort.

When going from the basic model to the stock market model, we have two effects that drag in opposite direction on the manager's incentives to exert high effort in the inevitable manipulation area. What is the net effect? In which model do we have to pay more for high effort when manipulation is attractive?

We will now determine the net effect. By increasing the incentive pay, we can see that high effort becomes more attractive in the stock market model. We can

also observe that this happens at a slower pace than in the basic model. This is because the value of the short-term compensation is $(1 - s)\alpha$ if a high earnings report is published, and not $(1 - s)v_H$. If we increase incentive pay $v_H - v_L$, $v_H - v_L$ increases faster than α . If we compare the two models, starting at fixed pay and increase the incentive pay one unit at a time to see which of the two models that first get a high effort exerting manager, the basic model will arrive at the sufficient incentive pay faster than the stock market model. Thus, we need more incentive pay in the stock market model. It is more costly to incentivize high effort in the stock market model.

We now show that the pay-for-performance sensitivity is higher in the stock market model. Recall that the incentive pay needed to motivate high effort in the basic model is:

$$v_H - v_L \geq \frac{c - x(p_h - p_l)\psi}{(p_h - p_l)[1 - x + xs]}$$

Similarly, in the stock market model we have that the incentive pay must be atleast:

$$v_H - v_L \geq \frac{c - x(p_h - p_l)\psi}{(p_h - p_l)\left[\frac{p_h - xp_h + sx}{p_h + x(1 - p_h)}\right]}$$

Now, which is larger? By comparing the right hand side of the two expressions we can determine this. We can see that we get the following condition for when the stock market model has a higher pay-for-performance sensitivity:

$$x(1 - p_h) > 0$$

Both x and p_h are probabilities, making the above condition always hold. $x(1 - p_h)$ is the probability that a high earnings report is manipulated. As long as the market believes that the financial statement may be manipulated, there will be a higher pay-for-performance sensitivity in the stock market model. Shareholders must pay more incentive pay in the stock market model than in the basic model.

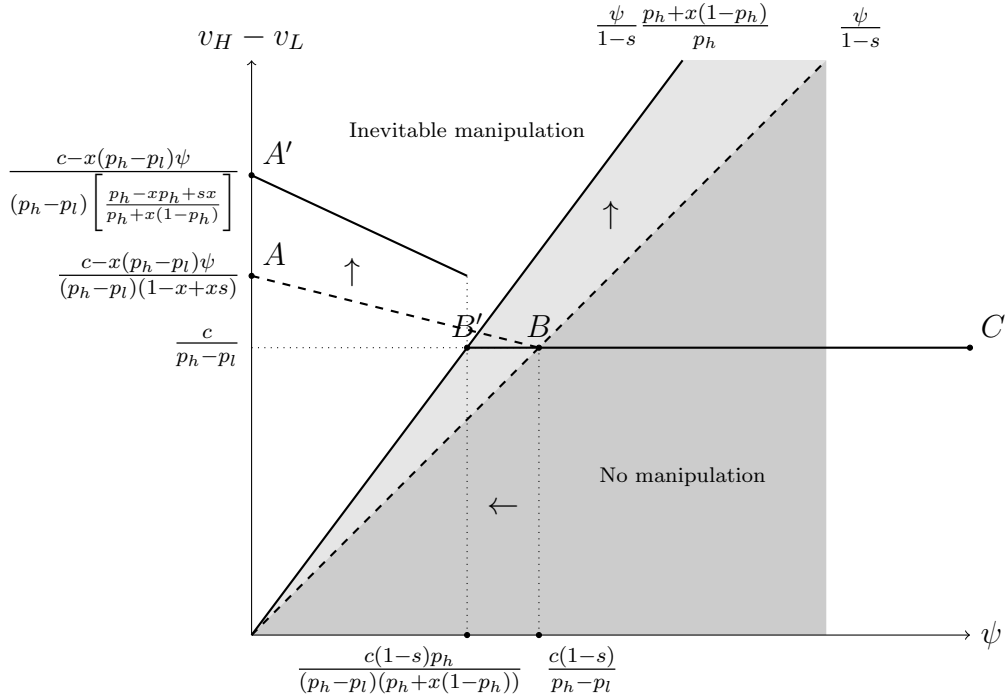


Figure 8: The line through A' - B' - C illustrates the optimal contract in the stock market model, and the line through A - B - C illustrates the optimal contract in the basic model. Dashed lines show the basic model while the solid line shows the stock market model. When we go from the basic model to the stock market model, the area of no manipulation increases. The reason for this is that the market participants expect a high earnings report to sometimes be manipulated, and this discounts the value of a high earnings report. This reduces the benefit of manipulating. A lower ψ than before is now needed to prevent the manager to misreport. The drawback from implementing a market based compensation is that it becomes more expensive to induce high effort in the inevitable manipulation area. This is due to the market acknowledging the manipulation possibility, decreasing the compensation value of reporting high earnings. The optimal contract in the stock market model jumps down when we enter the no manipulation area. The reason for this is that the market goes from questioning the truth of a high earnings report into believing it 100 percent. This affects the pay-for-performance sensitivity in a non-linear way.

6.5 Increasing the proportion of long-term incentives

When we increase the proportion of long-term incentives, s , a larger proportion of the manager's compensation cannot be inflated through manipulation. An increase in s will thus reduce the expected payoff from manipulating. This has two effects. The no manipulation area will increase because for a given private cost of misreporting, ψ , the attractiveness of manipulation decreases because a smaller proportion of the compensation can be inflated through manipulation. When we increase s , the cost of manipulation stays the same, while the benefit of manipulation decreases.

The second effect of increasing s is that in the inevitable manipulation area, incentive pay necessary to make the manager exert high effort decreases. The choice of low effort and manipulating if low earnings realize has become less attractive since a smaller proportion of pay is subject to manipulation. High effort has become more attractive on a relative level, and less incentive pay is necessary.

In short, the effect of changing the proportion of long-term pay in the stock market model has the same qualitative effect as in the basic model.

6.6 Increasing the probability of having a manipulation opportunity

The probability of having a manipulation opportunity, x , plays a more important and complex role in the stock market model compared to the basic model. The no manipulation area will in fact increase in x , which may sound counter-intuitive. Recall that if we are in the inevitable manipulation area, the firm value given a high report is:

$$E[F \mid H_{reported}] = \frac{p_h F_H + x(1 - p_h)F_L}{p_h + x(1 - p_h)}$$

Consider the special case of $x = 1$. Then the financial statement has no value in the determination of the performance of the firm. This is because the manager will always report high earnings, thus the value of the firm does not change when the report is published. Increasing the x will increase the investor's suspicion of

a misreported financial statement, and their new assessment of the firm's value given a H report is now lower. The consequence is that the manager has less to gain from manipulating. When x is increased, the no manipulation area increases, as the slope of the boundary of the manipulation areas increases in x . When we increase x , we require a lower private cost of misreporting, ψ , to make manipulation unattractive to the manager. Higher x means less manipulation.

The x will also affect the pay-for-performance sensitivity. There will be two effects from the increase in x . The increase in x will increase the expected payoff from low effort relatively more than the expected payoff from high effort, since low earnings can be manipulated with a higher probability. The increase in x will also reduce the value of a high earnings report due to a higher suspicion of misreporting by the market participants. This reduces the attractiveness of manipulation. The two effects have opposite impact on the pay-for-performance sensitivity. The manager can more often manipulate, but the benefit of reporting high earnings has decreased. This will also affect the benefit of exerting high effort since a truthfully reported high earnings will have less impact on the stock price and compensation. The net effect is a higher pay-for-performance sensitivity. As x increases, the manager will require more incentive pay in order to exert high effort.

We want to shed light on the different effects the probability of having a manipulation opportunity, x , has on the pay and reporting equilibrium in our two models. In the basic model, the probability has no impact on the manipulation area as the decision to manipulate is done after the opportunity realizes. In the stock market model, the decision is also done after the opportunity occurs, but now the cost-benefit analysis includes the probability, because the shareholders use the probability to assess the true value of the firm with a suspicion that the report may be manipulated. The value of the manager's compensation is dependent on the shareholders valuation of the firm. Thus, the gain from manipulating, and thus the decision to manipulate, is dependent of x in the stock market model.

6.7 Discussion of investor sophistication level

In the stock market model, we assume that the investor update their beliefs of a truthful report based on the information available, while in the basic model, the investor naively trust the reported earnings. The shareholders in the basic model are far less sophisticated in their assessment of the true performance of the company compared to the investors in the stock market model. We can view the basic model as a special case of the stock market model where the investors are unsophisticated. More sophisticated investors will give less manipulation, but also a higher pay-for-performance sensitivity.

7 Summary of findings

In this section we summarize the findings from our analysis from the basic model, section 4 and 5, and the stock market model, section 6, for a quick and easy reference.

7.1 Manipulation

The manager will manipulate the financial report if the benefit of manipulation is greater than the cost. This makes it possible to split the manager's motivation to manipulate into two cases, one case where she will always be tempted to manipulate and one case where she never manipulates. We find that the private cost of misreporting and the proportion of long-term incentives act as corporate governance mechanisms that can be used to reduce the attractiveness of manipulation.

7.2 Pay-for-performance sensitivity

If it is attractive to manipulate, the pay-for-performance sensitivity decreases in the private cost of misreporting. When manipulation is unattractive, the pay-for-performance sensitivity is only dependent on the effective cost of effort. When manipulation is attractive, the manager needs more incentive pay relative to when manipulation is unattractive. This is because the opportunity to manipulate makes low effort relatively more attractive than high effort, because the manipulation opportunity is more valuable when she exerts low effort.

7.2.1 The probability of having a manipulation opportunity

The pay-for-performance sensitivity increases when the probability of having a manipulation opportunity increases. This is because the manager's expected payout of exerting low effort and manipulating increases. In order to incentivize high effort, more incentive pay is now necessary.

7.2.2 Long-term incentives

When we increase the proportion of long-term incentive pay, the manager's benefit of manipulating decreases as a smaller proportion of pay can be inflated through manipulation. This is because it is impossible to inflate long-term incentive pay by opportunistically overstating accruals. If all incentive pay is long-term, manipulation bears no benefit. If we increase the extent of the long-term incentives, the attractiveness of exerting low effort and manipulating decreases. Thus, it is less costly to incentivize high effort than before.

7.3 The stock market model

We increase the sophistication level of the Sun framework by paying the manager on the basis of the stock price. Shareholders value the firm based on the basis of the financial statement, but with a suspicion that it might be manipulated. We find two important results.

7.3.1 Less manipulation and more pay-for-performance

Introducing a market based performance measure reduces the attractiveness of manipulation because the shareholders do not fully believe the financial statement. This makes the compensation gain of reporting high earnings smaller than in the basic model. The negative effect of this mechanism is that the manager's benefit from high effort has also decreased, since an actual high earnings report is not distinguished from a manipulated high earnings report in the case where manipulation is attractive. The effect of changing the long-term incentives have the same effect as in the basic model, but the probability of having a manipulation opportunity plays an extra role in the stock market model.

7.3.2 The probability of having a manipulation opportunity

The higher the probability of having a manipulation opportunity, x , the more suspicious the shareholders are when reading a high earnings report. For a higher x , the information value of the financial statement falls and the net benefit of manipulating is reduced. This reduces manipulation. The x will also increase the

pay-for-performance sensitivity. A higher x creates higher expected payoff from exerting low effort and manipulating if low earnings are realized, but also reduces the benefit of publishing a high earnings report. The effect of the latter is less incentives to exert high effort and less benefit from manipulating the financial statement, which calls for more and less incentive pay respectively. The net effect of higher x , is more pay-for-performance in order to incentivize high effort.

8 Comparison with Goldman and Slezak (2006) and Sun (2009)

In this section, we will compare our findings with the findings of two related papers. Sun (2009) serves as the framework of our model, and Goldman and Slezak (2006), referred to as GS, cover a similar topic as ours.

In this thesis, we develop a model based on the Sun framework. We incorporate the empirical observation that executives' incentive plans consist of both short-term and long-term incentives (Murphy, 1999). In introducing long-term incentives, we need to add a period to the model framework where the manager receives the long-term pay. If the manager chooses to manipulate the financial report in the first period we assume that earnings will revert to its true value in the second period. This reflects the empirical phenomenon of accrual reversal related to earnings manipulation (Allen, Larson and Sloan, 2011).

We provide an innovation to the Sun framework by a modification where the manager is paid in stock, and the shareholders price the stock based on the earnings report the manager publishes, under the suspicion that it might be manipulated. This is the stock market model. In the model of GS, the manager is also paid in stock, and the shareholders predict manipulation. Thus, our stock market model can be viewed as a mix of the models of Sun and GS.

8.1 Long-term incentives

As in Sun, we can divide the manager's reporting choice into two areas, one where she manipulates and one where she does not. We find that the pay-for-performance decreases in the private cost of misreporting. When introducing the long-term incentive scheme, we get two effects. The area of the inevitable manipulation area decreases, and the pay-for-performance sensitivity is lower for a given private cost of misreporting. The long-term incentive scheme will reduce the benefit of manipulating the financial report. Since a manipulated accrual today will revert in the future, the long-term part of the manager's pay contract will not be possible to inflate by manipulation. In the hypothetical case where the entire compensation is paid as long-term pay, manipulating the financial report will have no benefit for the

manager. Our analysis gives an empirical implication regarding the relationship between the use of long-term incentives and earnings manipulation. Firms that use more long-term incentives will have less manipulated financial statements, for the same corporate governance mechanisms.

8.2 Market and accounting based performance measures

In Sun's model, the manager is paid according to the reported accounting figures, while in the GS model, the manager is paid in stock, and the value of the manager's stock compensation is dependent upon the predicted level of manipulation. In the GS model, the level of manipulation is perfectly predicted in equilibrium. In Sun's model, the manipulated report is taken as the truth, while it is reasonable to believe that a third party examining the report will expect it to be manipulated with some probability. We incorporate this perspective into a new model based on the Sun framework, where the manager will be paid in stock and the market participants discount the possibility of manipulation into the stock price. The objective of developing such a model is to shed light on the discussion of using stock price or accounting earnings as a performance measure of incentive pay. We find that using stock price as a performance measure reduces manipulation, but is a more costly way to incentivize high effort in the manipulation zone.

In our analysis from the stock market model we find interesting insight between the relationship of the probability of having a manipulation opportunity and the pay and reporting equilibrium. In our stock market model, this probability plays a more important and complex role than in the basic framework of Sun. A higher probability of having a manipulation opportunity will both reduce manipulation and increase pay-for-performance sensitivity.

8.3 Discussion of investor sophistication level

The idea of differences in sophistication levels among market participants can be discussed in our framework. In our basic model, the shareholders interpret the earnings in the financial report as the true earnings. This is why the manager receives the highest level compensation in the case where high earnings is reported. This may be naive, as the manager will manipulate the report in some cases. A

sophisticated investor will expect the report to be dishonest with some probability in the case where manipulation is attractive.

GS predicts that when we have more naive investors, that are short-term, we will have higher pay-for-performance sensitivity, which increases the manager's temptations to manipulate.⁹ Thus, in GS, there will be more manipulation when we decrease the sophistication level of the investors. In our stock market model, which can be viewed as a mix of the models of Sun and GS, investors are more sophisticated than in our basic model. We predict that we will have less manipulation in the stock market model than in the basic model. Thus, when we increase the sophistication level of the market participants, we get less manipulation. This finding is in line with GS.

In Sun, the probability of having a manipulation opportunity does not affect the manager's cost-benefit analysis of manipulation. This is because the choice of misreporting or honest reporting is done after the opportunity has occurred, and the value of the manager's compensation by misreporting is independent of this probability. The probability of having a manipulation opportunity will affect the optimal compensation contract in the inevitable manipulation area. This is because an increase in this probability will increase the relative attractiveness of low effort and manipulating. Thus, more incentive pay is needed to motivate high effort. In our stock market model, with more sophisticated shareholders, we find that the probability of having a manipulation opportunity has a more complex role. This probability affects the cost-benefit analysis of manipulation, because when we increase this probability, investors get more suspicious that the financial report is manipulated, which will discount the manager's payoff of reporting high earnings. Thus, the manager has less to gain from manipulating from low earnings to high earnings. A higher probability of having a manipulation opportunity will decrease manipulation, and thus decrease the relative attractiveness of choosing low effort and manipulating. The isolated effect from this is *less* incentive pay needed to motivate high effort. Increasing the probability also increases the expected payoff of low effort, because we are now more likely to have the opportunity to manipulate. This is the same effect as in the basic Sun framework. Thus, in our model with more sophisticated shareholders, increasing the probability means

⁹The increase in pay-for-performance sensitivity also increases the manager's effort level.

that the manager is more likely to manipulate, but has less to gain from manipulating. Thus, there are two things that happen when we increase this probability, one that will decrease incentive pay, and one that will increase incentive pay. The relationship between pay-for-performance sensitivity and the probability of having a manipulation opportunity is more complex when we have more sophisticated investors.

Related to the discussion of changes in the probability of having a manipulation opportunity, GS arrive at a opposite relationship between the probability and the pay-for-performance sensitivity. GS study the probability of not getting caught manipulating as the probability of having a manipulation opportunity, where a lower probability of not getting caught means a higher probability to have a opportunity to manipulate. When this probability of getting caught decreases, the pay-for-performance sensitivity in the optimal contract decreases. This is the opposite results from Sun and our thesis' two models.

In our thesis, the basic model can be viewed as a model with naive shareholders, while the stock market model can be viewed as a model with sophisticated shareholders. When we increase the sophistication level, and go from the basic model to the stock market model, we get less manipulation. If naive investors value the company at the time of the report, the firm will be overvalued. The consequence will be that the manager's earnings manipulation will lead to negative abnormal returns in the next period due to the reversal of the abnormal accruals. This result lends support to Teoh, Welch and Wong (1998a, 1998b) and is consistent with the discussion in GS on naive, short-term investors who underestimate the extent of manipulation and thus overvalue the firm's shares that consequently leads to a strong price decline in the next period.

8.4 Discussion of unrealistic assumptions

In this subsection, we will discuss the assumptions we find unrealistic in the papers of GS and Sun. In GS, the manager's decision to manipulate is done before the outcome of the project realizes. This can be done because the manager's incentive pay is always increasing in the reported earnings. We find this assumption to be unrealistic. For the manager, we believe that there is always a cost of manipulating,

but it may not always be beneficial. In the real world, if the true earnings of the project become very high, the manager may already have reached her maximum bonus pay for the period, and manipulation has no benefit. The manipulation prediction may be unrealistic in GS, because the manager's cost-benefit analysis of manipulating is hard to reconcile with how the manipulation decision is presented in the empirical literature on the subject, for instance Healy (1985).

In Sun, the firm's project is only profitable when the manager exerts high effort. This may only be a simplifying assumption that enables us to ignore the discussion of which effort level that maximizes firm value. We can then focus on the relationship between incentive pay and manipulation. With this assumption, we can derive the optimal contract where we can analyze effort and honesty versus effort and dishonesty, which is the focus of our thesis. Sun discusses that when the effort-assumption is changed to allow for changes in effort levels, the model gets more complex, and in our view, the model becomes less suitable for the analysis of the dynamics of incentive pay and earnings manipulation. When these changes are done to the effort-assumption, the model's prediction of the relationship between the pay-for-performance sensitivity and the strength of corporate governance changes and becomes in line with the prediction of GS, which is supported by empirical research.

8.5 Pay-for-performance sensitivity and corporate governance

In GS pay-for-performance sensitivity increases with the strengthening of corporate governance mechanisms. Sun states that this is the opposite result from her model's predictions. Since our model is based on Sun, we get the same results in this respect. In our view, the key difference between the different relationships between pay-for-performance and corporate governance strength is that effort level changes in GS, while it remains constant in Sun, which is a key assumption in the Sun framework. When the strength of corporate governance increases in GS, manipulation becomes less attractive which allows for the shareholders to induce higher effort by increasing incentive pay. In Sun, we assume effort has to be constant at the high level. When the strength of corporate governance increases, it is optimal to reduce incentive pay because high effort can now be achieved for a con-

tract with lower cost than before. The manager will still exert high effort because manipulating has become less attractive with stronger governance. GS provide empirical evidence to support their prediction of a positive relationship between pay-for-performance sensitivity and corporate governance strength. When the Sun framework gives the opposite prediction, one can become critical to the realism of the Sun framework. Can we still use the Sun framework?

Sun discusses how we can make small changes to the assumptions in the framework that yield a positive relationship between pay-for-performance sensitivity and the strength of corporate governance. These changes regard the assumption that high effort must always be exerted by the manager. When allowing for more optimal effort levels, both GS and Sun predict the same positive relationship between the pay-for-performance sensitivity and the strength of corporate governance. Thus, the two models, and their predictions, are very similar. As an illustration, we provide two new extensions to our basic model to reconcile the GS pay-for-performance relationship with corporate governance strength to the Sun framework, see section 9.

Note that the main findings in this thesis will not change even though we allow for more optimal effort levels. A higher proportion of long-term incentives will still reduce the proportion of pay which can be manipulated. This reduces the benefit of manipulation, independent of the level of incentive pay needed to motivate the optimal effort level. A stock price based performance measure will still help in reducing the problem of dishonest reporting. This is because the stock market will still discount the value of the manager's compensation if the market believes that the report may be manipulated. This is independent of the level incentive pay. The choice of manipulating or not manipulating is done after the effort level has been chosen. Thus, allowing for more optimal effort levels does not change our main findings.

9 Extending the model to replicate the results of Goldman and Slezak (2006)

In our models and in the model of Sun (2009), there is a negative relationship between the pay-for-performance sensitivity and the strength of corporate governance. Goldman and Slezak (2006), referred to as GS, find a positive relationship, and this relationship is supported by empirical evidence of Hartzell and Starks (2003) and Fahlenbrach (2003). Sun finds a negative relationship between the pay-for-performance sensitivity and the strength of corporate governance, and is thus contradicted in the literature. Is the Sun framework unrealistic? If so, this may invalidate our analysis. To justify that the framework is still realistic, Sun discusses how simple changes in the assumptions can be done to replicate this positive relationship.

In this section, we extend our basic model. We want to show that simple changes to the assumptions make the framework realistic in terms of the relationship between the pay-for-performance sensitivity and the strength of corporate governance. This is possible by changing the assumption of the optimal effort level in the Sun model. When we allow for more than one optimal effort level, which is the case in the model of GS, we get the same relationship. Thus, the Sun framework gives realistic predictions.

Now we will discuss why the models yield different results to the mentioned relationship. In the GS model, manipulation is costly and increasing incentive pay will induce more effort, but also more manipulation. Thus, incentive pay is a double-edged sword for the firm's shareholders. When we increase the manager's cost of misreporting, the manager is less tempted to manipulate, and more incentive pay can be used to motivate high effort, which increases the value of the firm. In Sun more incentive pay also induces effort and manipulation, but here manipulation does not directly reduce the shareholders' payoff. Therefore, the shareholders will still provide incentives for high effort, even though the manager will manipulate. The effect of increasing the private cost of misreporting is that low effort becomes relatively less attractive for the manager, and less incentive pay is needed to provide the motivation for the only optimal level of effort, high ef-

fort. Assume that manipulation becomes costly for the firms' shareholders in Sun. Then, for a low corporate governance strength, the shareholders may in some cases prefer low effort and no manipulation than high effort and manipulation. Thus, it may only be desirable to incentivize high effort when the strength of corporate governance is high. If we allow for more optimal effort levels in the Sun framework, low effort will in some cases be the optimal effort level for the shareholders when the strength of corporate governance is low, and high effort will in some cases be the optimal effort level when the strength of corporate governance is high. Thus, incentive pay to incentivize effort, which is more costly in the case of high effort, will be higher when the strength of corporate governance is higher. Allowing for more optimal effort levels will make the Sun framework more similar to the GS model.

In this section, we provide two extensions to our basic model where we have more than one optimal effort level. We show that this yields a positive relationship between pay-for-performance sensitivity and the strength of corporate governance. We introduce a case where manipulation is costly and a case where we have a restrictive cap on the maximum incentive pay. Both modifications yield a positive relationship between the pay-for-performance and corporate governance strength, as in GS. Thus, our model gives realistic predictions when we allow for small changes in the assumptions.

9.1 Model extension: Compensation when manipulation destroys value

In our basic model, we assume that the project is only profitable when the manager exerts high effort. We now assume that the shareholders want to undertake the project even in the case the manager exerts low effort, but that high effort maximizes firm value.

An important assumption in our basic model is that earnings manipulation does not affect the value of the firm, except for the extra incentive pay needed to motivate high effort when manipulation is attractive. In this section, we assume that earnings manipulation has a direct cost. Examples of where this is reasonable is when the manager increases the earnings of the firm in period 1 by cutting

investments in R&D. If we reduce these investments, today's earnings increase due to lower operational costs, but future sales may be affected downwards as the company may not have attractive products to sell in the future. Earnings manipulation through the exaggeration of accruals can also affect the reputation of the firm. In the case of large overstatements, future financial statements have to include large write-downs. Customers and suppliers might not want to do business with a firm that is known for accounting scandals. Thus, earnings manipulation may destroy value. Note that in the model of GS it is assumed that manipulation destroys value.

To fit this new perspective into the framework we first introduce the total value of the firm in the case of high earnings to be F_H and in the case low earnings to be F_L . J is the loss in firm value in the case earnings management occurs. The value of the firm in the case the agent exerts high effort and has no possibility of earnings manipulation is

$$p_h F_H + (1 - p_h) F_L$$

The value in the case the agent exerts high effort and has the opportunity to manipulate is

$$p_h F_H + (1 - p_h)(F_L - xJ)$$

The last term in the last equation contains the expected loss in firm value due to the possibility of earnings manipulation, which occurs with probability $x(1 - p_h)$.

The value in the case the agent exerts low effort and has no possibility for earnings management is

$$p_l F_H + (1 - p_l) F_L$$

We now make the important assumption that we would rather have low effort and no manipulation than high effort with the possibility of earnings manipulation. In other words we assume that value destruction due to earnings manipulation, J ,

is so significant that

$$p_h F_H + (1 - p_h)(F_L - xJ) \leq p_l F_H + (1 - p_l)F_L$$

When it is tempting for the manager to manipulate, incentive pay will induce earnings manipulation and the firm will decrease by the value J with probability x . High effort is impossible without incentive pay, and with sufficiently low ψ , incentive pay will lead to manipulation.

If ψ is sufficiently large, the shareholders know with certainty that the manager will never manipulate, and then they can utilize incentive pay to induce high effort. This is the case when $\frac{\psi}{1-s} \geq \frac{c}{p_h - p_l}$. In this case firm value will be

$$p_h F_H + (1 - p_h)F_L > p_l F_H + (1 - p_l)F_L$$

In the case when earnings manipulation is tempting, the shareholders do not use incentive pay, but rather pay the manager a fixed wage equal to her participation constraint. Then the manager will not have any incentive to exert high effort. In this case, we are certain earnings manipulation will not occur.

Now assume that the cost of misreporting, ψ is sufficiently high to prevent manipulation. The shareholders want to induce the manager to exert high effort, and the optimal contract is incentive pay equal to the effective cost of effort, $\frac{c}{p_h - p_l}$. As the private cost of misreporting increases, we go from only fixed wage to a contract that includes incentive pay. Thus, the pay-for-performance sensitivity increases in the strength of corporate governance.

In short, when manipulation is tempting, the shareholders offer a fixed wage, and the manager chooses low effort and no manipulation. In the case where manipulation is unattractive, the shareholders offer incentive pay equal to the effective cost of effort, and the manager chooses high effort and no manipulation. The optimal contract avoids manipulation at all cost, and only induces high effort when corporate governance strength is sufficiently high to prevent manipulation.

The optimal contract with the modification presented in this section is presented on the next figure.

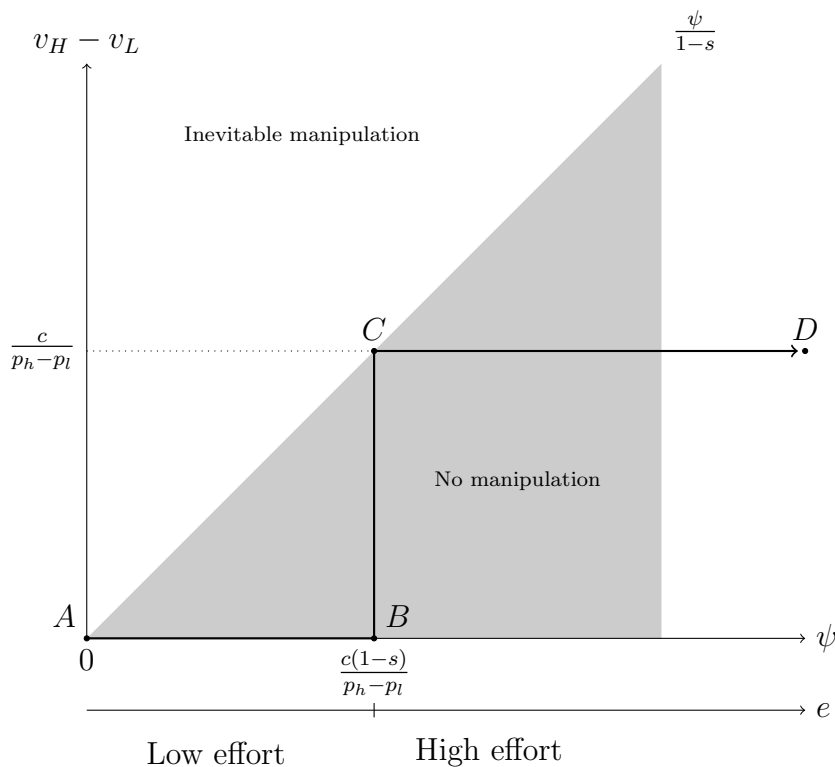


Figure 9: The line that connects A-B-C-D denotes the optimal contract in the case when value destruction due to earnings management, J , is so costly that we would rather have low effort and no manipulation than high effort with the possibility of earnings manipulation. Note that from A to B the shareholders offer a fixed wage equal to manager's participation constraint, and the manager chooses low effort and no manipulation. At point B, the private cost of misreporting, ψ , is sufficiently high to incentivize high effort without risking manipulation. For a ψ equal or larger than this, the shareholders offer incentive pay equal to the manager's effective cost of effort, and the manager chooses high effort and no manipulation. We get a positive relationship between the pay-for-performance sensitivity and the private cost of misreporting.

9.1.1 More effort levels

We now want to introduce a third effort level, medium, corresponding to an effort level somewhere in between low and high. The probability of achieving high outcome with medium effort is p_m , with $p_l < p_m < p_h$. The manager's private cost of exerting medium effort is c_m , with $0 < c_m < c$. The value of the firm in the case of medium effort is somewhere in between the value in the case of low and high effort. Incentive pay is again based on reported earnings, and the manager can manipulate the report in order to increase her compensation in period 1. The shareholders want the highest effort level possible, as long as there is no possibility that there will be manipulation. The extent of manipulation will be dependent on the manager's private cost of misreporting, ψ , and the share of her compensation she must hold until period 2, s . With the cost of medium effort at c_m , the incentive pay must be $\frac{c_m}{p_m - p_l}$ when we want to incentivize medium effort rather than low effort.

In order to induce high effort in the case of three effort levels, the incentive pay must be such that high effort is the best choice. This means that the incentive pay must be constructed such that high effort is better than choosing low effort and medium effort. We must then assume that the effective cost of medium effort is lower than the effective cost of high effort. With three effort levels we see that the degree of incentive pay is increasing in ψ , because a higher effort level can be incentivized without inducing manipulation. Thus, incentive pay and effort level increase in ψ . This gives a positive relationship between the pay-for-performance sensitivity and the strength of corporate governance, ψ .

We can expand the logic of having costly manipulation and a third effort level, to many effort levels between low effort and high effort. We now introduce a continuous effort level between low and high, and must also assume that the effective cost of effort is continuous. The optimal contract is designed such that the shareholders induce the highest possible effort without making manipulation attractive. In this case, the optimal contract will include incentive pay for $\psi > 0$. Incentive pay grows in ψ before reaching maximum at the ψ that allows for the highest possible effort level, corresponding to high effort in the basic model.

The next figure shows the optimal contract in the case of continuous effort level.

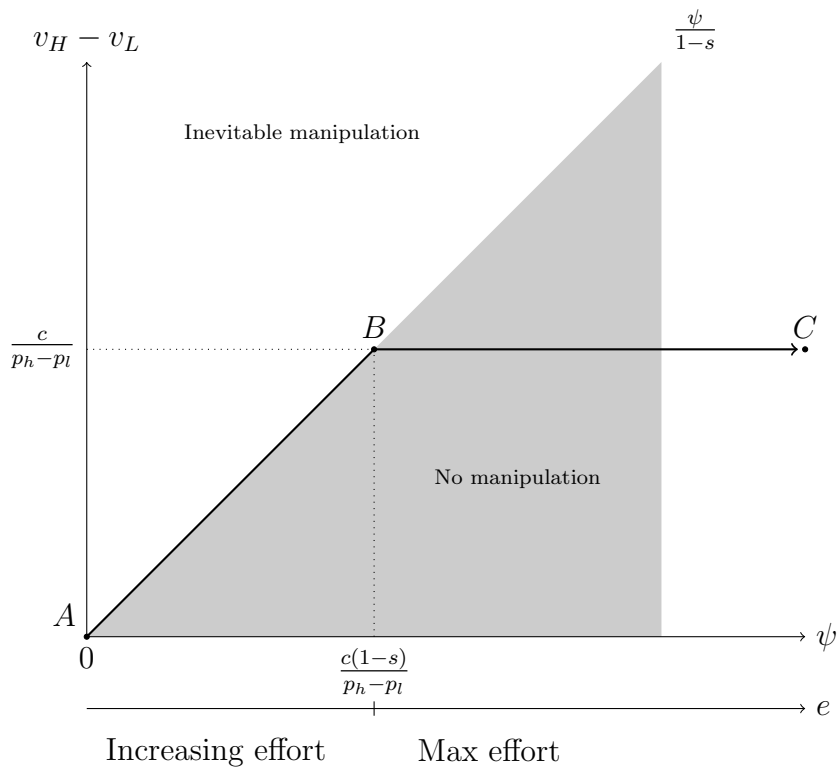


Figure 10: The line that connects A-B-C depicts the optimal contract in the case of a continuous effort level. As ψ increases, more incentive pay can be used to motivate effort, without inducing manipulation. At point B, the maximum effort level is reached, and the manager is paid according to her effective cost of effort. This maximum effort is the same as high effort in our basic model.

9.1.2 Costly manipulation changes our initial prediction

When earnings manipulation destroys value, the shareholders will not offer incentive pay to induce high effort in the case the manager is tempted to manipulate. In this case, the shareholders offer a fixed wage in order to prevent manipulation. The drawback of the fixed wage is that the manager will only exert low effort. When the private cost of misreporting is sufficiently high to prevent manipulation, the shareholders can offer incentive pay to induce high effort without risking manipulation. Thus, a higher cost of misreporting leads to more incentive pay. We interpret the private cost of misreporting as the strength of corporate governance. The model predicts a positive relationship between the pay-for-performance sensitivity and the strength of corporate governance with this simple modification. By introducing the cost of manipulation, we reconcile the prediction of the Sun framework with that of the GS model.

9.2 Model extension: Bonus pay cap

Assume that the project under consideration is still profitable when the manager exerts low effort. We now introduce an upper limit on incentive pay, a bonus cap, \bar{V} . We can imagine that this bonus cap has been imposed by outside regulators. An example is that the European Parliament in 2013 approved a basic ratio of fixed pay to variable pay 1:1 for bankers (Freshfields Bruckhaus Derringer, 2013). The bonus pay cap restricts the incentive pay in the following way:

$$v_H - v_L \leq \bar{V}$$

This bonus pay cap could easily be part of our basic model, if the upper limit was so large that it did not restrict the optimal contract. In this extension of our model, we will assume that this pay cap is restrictive. The cap falls between the effective cost of effort and incentive pay necessary to motivate high effort in the inevitable manipulation area:

$$\frac{c}{p_h - p_l} \leq \bar{V} \leq \frac{c - x(p_h - p_l)\psi}{(p_h - p_l)(1 - x + xs)}, \quad \forall \psi \in [0, \psi_0] \quad (14)$$

In the inevitable manipulation area, there is some private cost of misreporting, ψ , that is so low, below ψ_0 , that the incentive pay necessary to motivate high effort is larger than bonus pay cap, \bar{V} . The shareholders will not be able to incentivize the manager to exert high effort for a ψ below ψ_0 , because of the incentive pay cap \bar{V} . In this case, the shareholders offer a fixed wage that satisfies the manager's participation constraint, and the manager chooses low effort and no manipulation. For a ψ larger than ψ_0 , we get the same compensation contract as in the basic model. Below we present the optimal contract when incentive pay is restricted by the bonus cap. With the restrictive cap, the optimal contract predicts increasing incentive pay in ψ , see figure 11.

In the no manipulation area we can see from (14) that incentive pay is not restricted. The manager's incentive pay is then the effective cost of effort, $\frac{c}{p_h - p_l}$. The manager chooses high effort and no manipulation.

We now consider the incentive pay in the inevitable manipulation area, where the temptation to manipulate affects the manager's incentives to exert high effort.

Consider first the case where the bonus cap is not restrictive. Then the manager is paid according to the incentive pay needed to motivate high effort in the inevitable manipulation area, as in the basic model. This is the case when ψ is larger than ψ_0 and smaller than the ψ that puts us in the no manipulation area.

Then consider the case where the bonus cap is restrictive, i.e. ψ is smaller than ψ_0 . Then the shareholders will not be able to incentivize the manager into high effort. A fixed pay is offered, and the manager chooses low effort and no manipulation. We see that when ψ is sufficiently low, we get no incentive pay, and when ψ is sufficiently large the optimal contract has incentive pay. Thus, the pay-for-performance sensitivity increases in corporate governance strength.

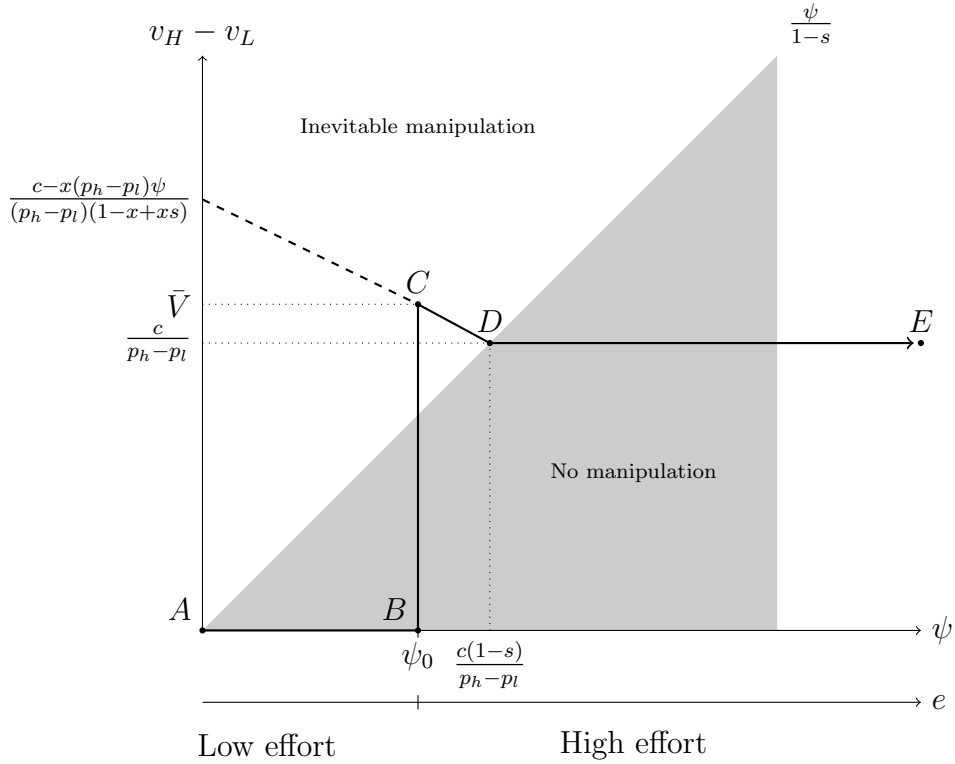


Figure 11: The optimal contract is the line that connects A-B-C-D-E. When introducing bonus pay cap, \bar{V} , the shareholders will not be able to incentivize the manager to exert high effort when the private cost of misreporting, ψ is less than ψ_0 . This is because the manager requires an incentive pay that is larger than the bonus pay cap in order to exert high effort. In this case, the shareholders offer a fixed wage equal to the manager's participation constraint. The manager chooses low effort and no manipulation. When ψ is larger than ψ_0 we get the same contract as in the basic model.

10 Empirical implications

In this section we provide a summary of our models' most important predictions regarding effort and honesty, and discuss them against empirical findings.

The models we have introduced in this thesis have two clear predictions regarding the dynamics of earnings manipulation and incentive pay. Firstly, the composition of short- and long-term incentives will affect the manager's incentives to manipulate the financial statement. Secondly, using a market based performance measure over an accounting based performance measure has implications on the manager's misreporting incentives.

10.1 Earnings manipulation and long-term incentives

The relationship between the composition of short- and long-term incentives and earnings manipulation is one of the most important topics in this thesis.

10.1.1 Model predictions

In the models we introduce in this thesis, we have two time periods. The manager's compensation is split between these two periods, where the first period pay can be considered short-term pay and the second period pay can be considered long-term pay. In our model, only short-term pay can be influenced by manipulating the financial statement, because the true performance of the firm is public information in the long-term. If the financial statement is manipulated in the first period, the earnings will revert in the second period to reflect the true earnings.

The manager gets a proportion of her pay in the short-term and the rest in the long-term. Increasing the proportion paid in the short-term will increase the incentives of manipulating the financial statement. This is because more of her compensation is possible to artificially inflate by manipulating the financial statement. In the extreme case of no short-term incentives, none of the compensation is dependent upon the financial statement in period 1, and there will be no benefit of manipulation. In short, increasing the absolute size of short-term incentives increases manipulation, while increasing the absolute size of long-term incentives has no effect on manipulation. Increasing the relative proportion of pay that is

long-term reduces the incentive to manipulate, since we now have less short-term incentives and more long-term incentives.

10.1.2 Empirical findings

Jarrel (1993), Larcker (1983) and Murphy (1999) find that the use of short- and long-term incentives is common in the remuneration plan of management. An example of a company that uses a short- and long-term incentive plan in the compensation of management is Statoil (Statoil ASA, 2012). Some articles have been written on the subject of the composition of short- and long-term incentives and the implications this has on earnings manipulation. Examples of articles are Burns and Kedia (2006) and Oberholzer-Gee and Wulf (2012).

Burns and Kedia (2006) find a strong positive relationship between the use of short-term incentives and earnings manipulation. Furthermore, the authors find no significant relationship between long-term incentives and earnings manipulation. The findings of Burns and Kedia (2006) is consistent with the predictions of our model.

Oberholzer-Gee and Wulf (2012) find a strong positive relationship between the use short-term incentives and earnings manipulation. Furthermore, the relationship between the use of long-term incentives and earnings manipulation is either insignificant or positive, dependent on the econometric model specification. Our model's prediction is thus mostly supported by the findings of the authors, but not statistically significant for all model specifications.¹⁰

10.2 Earnings manipulation and performance measures

One goal of this thesis is to provide insight into whether shareholders should use the stock price as a performance measure or accounting earnings as performance measure, in the compensation contract to the hired manager.

¹⁰Burns and Kedia (2006) study compensation plans to CEOs and company manipulation, while Oberholzer-Gee and Wulf (2012) study decisionmakers below the CEO, for instance division managers and CFOs. Recall that both authors use stock options as a proxy for short-term incentives. The justification for this is that a proportion of the decisionmaker's options portfolio vests in the short-term, and can be considered short-term pay.

10.2.1 Model predictions

We develop one model where we use accounting earnings as the performance measure, the basic model, and one model where we use the stock price as the performance measure, the stock market model. The market uses the accounting earnings as the source of information for pricing the firm's stock. We then compare the condition for manipulation in the two models. Going from the basic model to the stock market model, the same level of corporate governance strength yields less incentives to manipulate. Thus, our models predict less manipulation when we use the stock price as the performance measure rather than accounting earnings as the performance measure.

The reason for this is that when the reported earnings goes through the "filter" of the market participants, the value of a high earnings report is discounted if the market believes that the report may be manipulated. When we use accounting earnings as the basis, the shareholders compensate the manager independent of any doubt they may have about the truthfulness of the report. The consequence is decreased incentives to manipulate in the stock market model compared to the basic model. The drawback of the discounting of a high earnings report is that when the manager truthfully reports high earnings, she gets less pay than in the basic model. This means that it will be more costly to incentivize high effort with stock price as the performance measure. Thus, there is both a benefit and a cost of using the stock price rather than accounting earnings.

10.2.2 Empirical findings

Murphy (1999) shows statistics that in large U.S. companies, accounting earnings is the most common performance measure when only one measure is used, and when more are used, accounting earnings is the measure that occurs the most frequently across firms. Lambert and Larcker (1987) find that both accounting earnings and market returns is commonly used as performance measures, but that accounting earnings is the most important measure. Fox (1980) reports that accounting earnings is a very common performance measure.

The use of accounting earnings as performance measure opens the door for manipulation by the manager to increase her compensation. Healy (1985) finds

evidence that managers manipulate earnings to increase their compensation, and there are plenty of real life examples of accounting scandals, for example Enron (Masters, 2011).

There is empirical evidence of earnings manipulation in periods where it is particularly attractive to inflate equity values, for example before an initial public offering and secondary equity offering (Teoh, Welch and Wong 1998a; Teoh, Welch and Wong 1998b).

To the best of our knowledge, there is no empirical study on whether the extent of manipulation changes when going from an accounting based performance measure to a market based performance measure. We realize the challenges of an empirical study that compares the extent of earnings manipulation between firms that use the stock price as a performance measure and firms that use accounting earnings as a performance measure.

First, the challenge will be to find companies that can be matched together, but have different performance measures. It may not be sensible for all firms to be listed on a stock exchange. This may be due to the ownership structure, the business characteristics or costs due to legal requirements of being listed are too high to make it worthwhile, for instance if a company has to disclose trade secrets when it lists. These characteristics may be associated with variables that affect manipulation in our model. For instance, the private cost of misreporting may be higher in family owned businesses if a member of the family is the manager, since family ties may be broken if the manager manipulates the financial statement. Another example is a company that produces a steady and highly predictable cash flow and does not need financing to invest. Thus, it does not need to raise money in the capital markets and listing may only have unnecessary costs. This company may have very few manipulation opportunities due to its uncomplicated business model and financial statement. Since we cannot control for the private cost of misreporting in the family business example, or the complexity of the business model in the second example, we will have endogeneity issues. In an econometric analysis, with earnings manipulation as the dependent variable and the performance measure as the independent variable, the coefficient of the performance measure variable will be biased. This is because the unobserved variables mentioned above correlate with both performance measure and earnings manipulation.

To observe real changes in manipulation due to changes in the performance measure, many variables in our model that may be unobservable must be held constant. This constitutes a big econometric challenge. Thus the reason why there is no such study may not be because our finding is invalid, but rather a consequence of the econometric difficulty of such a study.

11 Conclusion

In this thesis we provide answers to the question of how to incentivize effort and honesty in a firm's management. We introduce two models that illuminate this topic, present predictions and compare our findings with empirical research. We study the manager's incentive to manipulate the financial statement when we change the proportion of long-term incentives and apply different performance measures in the manager's compensation plan.

We discuss the idea that incentive pay creates an incentive to misreport earnings. This is unfortunate, as earnings manipulation reduces the quality financial statements, which increases the cost of capital and may reduce the investments in the economy. Goldman and Slezak (2006), referred to as GS, and Sun (2009) have developed theoretical models to study the relationship between incentive pay and earnings manipulation. In our view, a discussion of long-term incentives and the use of accounting earnings or stock price as a performance measure is missing in these papers. We develop models that incorporate these features.

First we introduce a model based on the framework of Sun where we introduce long-term incentives and accrual reversal. This is our basic model. The shareholders of a firm hire a manager who is compensated based on a financial report that may be subject to manipulation. Our model explains the optimal compensation contract to the manager and it predicts under which circumstances the manager is tempted to manipulate the financial statement.

Two variables play a central role in the manager's decision between reporting honestly and manipulating the report. These are the private cost of misreporting and the proportion of long-term pay. Both variables can be interpreted as corporate governance mechanisms that reduce the net benefit of manipulation. When the benefit of misreporting is sufficiently high, the shareholders must provide larger incentives to the manager in order to induce high effort compared to the case where the benefit of misreporting is low. The model predicts decreasing incentive pay in the strength of corporate governance. As exaggerated accounting accruals revert in the long-term, only short-term incentive pay can be inflated by manipulation. Thus, short-term incentive pay motivates manipulation, while long-term incentive pay does not. We predict that a higher proportion of long-term incentive pay

reduces manipulation, and this prediction is supported by empirical evidence.

Pay-for-performance sensitivity increases when the probability of having a manipulation opportunity increases. This is because the manager's expected payoff from exerting low effort and manipulating increases. In order to incentivize high effort, more incentive pay is now necessary. We can think of an increase in this probability as an increase in the leeway of accounting standards, which opens up more opportunities to manipulate.

In Sun's model, the manager is paid according to the reported accounting earnings, while in GS, the manager is paid in stock. In GS, the value of the manager's stock compensation is dependent upon the predicted level of manipulation. The level of manipulation is perfectly predicted in equilibrium. In Sun's model, the manipulated report is taken as the truth, while it is reasonable to believe that a third party examining the report will expect it to be manipulated with some probability. We incorporate this perspective into a new model based on the Sun framework, where the manager is paid in stock and the market participants that determine the stock value will sometimes suspect a dishonest report. This is the stock market model. We can think of this model as a mix of Sun and GS. The objective of developing such a model is to shed light on the discussion of using the stock price or accounting earnings as a performance measure for incentive pay. We find that using the stock price as a performance measure reduces manipulation. This is because the value of the manager's compensation is lower when she reports high earnings in the stock market model compared to the basic model, because the market participants discount the value of such a report due to the suspicion of manipulation. This reduces the benefit of manipulating, but also increases the incentive pay necessary to motivate high effort. We predict less manipulation and a higher pay-for-performance sensitivity when stock price is used as a performance measure over accounting earnings.

In our analysis of the stock market model we find an interesting insight between the relationship of the probability of having a manipulation opportunity and the pay and reporting equilibrium. In our stock market model, this probability plays a more important and complex role than in the basic framework of Sun. A higher probability of having a manipulation opportunity will both reduce manipulation and increase the pay-for-performance sensitivity.

In summary, our thesis provides two important findings. Manipulation is reduced when we increase the proportion of long-term incentive pay and when we adopt a performance measure based on stock price over a performance measure based on accounting earnings. Burns and Kedia (2006) and Oberholzer-Gee and Wulf (2012) lend empirical support to our prediction that a higher proportion of long-term incentives will reduce manipulation. We cannot provide any empirical research that supports our finding that market based compensation yields less earnings manipulation than accounting based compensation. This may be due to significant challenges to investigate our finding empirically.

In this thesis, we provide insights and tools to incentivize managers to effort and honesty. Using the results discussed will maintain the manager's incentives for high effort, but reduce the manager's temptation to manipulate. This will increase the information value of financial statements and lower the cost of capital in the economy.

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