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The Costs of Permitting Managers to Sell Shares

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Abstract

This paper analyzes the costs of permitting corporate managers to sell shares they hold prior to the end of their service at the company. Permitting such selling has an adverse ex ante effect on managers' prior level of effort. This effect exists even when managers do not have private information about the firm's long-term prospects. The existence of such private information further reduces managerial effort to an extent that depends on managers' disclosure obligations and the volume of trading in the company's shares. In addition to the reduction in managerial effort, permitting managers to sell shares also provides them with incentives to hide bad news, whose magnitude again depends on disclosure obligations and trading volume. In setting optimal limits on managers' freedom to unload shares, the identified costs must be traded off against whatever liquidity or risk-bearing benefits might flow from permitting managers to sell shares. Our analysis provides testable predictions as well as corporate governance implications.

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1. Introduction

The recent "corporate governance crisis" has increased interest in the incentives that executive compensation contracts provide to managers. One common feature of compensation practices is the broad freedom given to managers to unload options and shares (Bebchuk, Fried, and Walker (2002)). In some notorious cases, such as Enron, managers used this freedom to unload shares before the market discovered rather bad news about the company. Subsequently, observers, including The Conference Board's Blue-Ribbon Commission on Public Trust and Private Enterprise, have called for companies to adopt greater restrictions on managerial selling. Indeed, Senator John McCain even called for tax incentives to encourage companies to go in this direction.

The benefits of permitting managers to unload options and shares are relatively straightforward. These sales might provide managers with diversification benefits. Such sales might also enable managers to meet liquidity needs. To be sure, liquidity needs can often be addressed also through loans secured by managers' options and shares, but such borrowing would produce a leveraged position that would impose risk-bearing costs on managers.

These risk-bearing and liquidity benefits, however, should be traded off against the costs of the potential adverse incentives produced by freedom to sell shares. This paper develops a model to identify the potential distortions and the factors that determine their magnitude. An understanding of these distortions is necessary to identify the optimal limits if any on managers' freedom to unload options and shares.

To study the subject, we examine a model with several stages. In the first stage, a firm's manager decides how much effort to invest in increasing the firm's long-term value. In the next stage, the manager might get a signal concerning the firm's expected long-term value. Trading subsequently takes place at the third stage. Finally, there is a (long-term) stage in which payoffs are realized.

Our interest lies in studying how the ex ante choice of effort level is affected by whether managers are permitted to sell some of their shares in the short-run trading stage. We begin with a benchmark case in which managers do not have at the intermediate trading stage any private information about the long-term value. In such a case, managerial selling of shares in the trading

period will occur only if the managers experience a liquidity shock. Even in this case, incentives to exert effort ex ante are diluted. Because managers can expect ex ante that they might sell some of their shares before the long-term value materializes, their incentives to maximize this long-term value are weakened. The more shares managers are permitted to sell, and the higher the probability that the managers will experience a liquidity shock, the greater the reduction in ex ante effort. In equilibrium, the short-term market price at the trading period fully reflects the reduction of long-term value caused by the dilution of ex ante incentives, but managers' ex ante incentives to exert effort are still weakened.

We next introduce the possibility of managers obtaining private information about long-term values prior to the intermediate trading stage. In this case, the manager might sell shares in the short-run not only due to liquidity needs but possibly also due to their getting negative information about the firm's prospects. As we show, the existence of such information-based selling operates to further reduce ex ante effort. The intuition is that the ability to sell shares in the event of bad news about long-term prospects softens the negative effect that a reduction in effort would otherwise have on the manager's payoff.

The extent to which managers' private information about long-term value dilutes incentives to exert effort depends on the managers' disclosure requirements and on the volume of trading relative to the amount managers are permitted to sell. In particular, we study three cases in which (1) the market has no ability to detect whether managers are engaged in selling because the selling is made to the company (as is the case in phantom stock plans) and is not registered in the market, (2) managers must sell shares on the market, thus enabling the market to draw inferences from the trading volume, but are not required to disclose their sales in advance, and (3) managers are required to disclose in advance their intention to sell and the market is thus fully aware of any selling. We find that the reduction in ex ante effort is most severe in case (1), least severe in case (3), and at an intermediate level in case (2).

We also study an additional cost of managers' short-term selling – the increased incentive to suppress bad news. We assume that information is observable in principle, but that the manager can make the information unobservable by the market at a cost to the manager (in effort or expected penalty) or to the company. We show that, when short-term selling is permitted, managers will have an incentive to suppress bad news. The

ranking of the above three cases in terms of this dimension is the same as their ranking in terms of the disincentive to exert effort, with the incentive to suppress bad news being strongest in case (1), least severe in case (3), and at an intermediate level in case (2).

There is a large body of work on how executive compensation arrangements can be best designed to induce optimal effort (see Gibbons (1996), Prendergast (1999), and Murphy (1999) for surveys of this large body of work). In examining the impact of compensation on effort, the literature has largely focused on what the manager's payoff should be as a function of the shareholders' payoff.[1] In contrast, our focus is on how effort is influenced by the ability of managers to sell their claim on the shareholders' payoff before this payoff is realized.

A second relevant literature is the myopia literature which studies how managerial concerns about short-term prices affect their ex ante choices between short-term and long-term projects (see Stein (1988, 1989) and Bebchuk and Stole (1993)). This managerial ex ante decision is different from the effort decision that we analyze; although reducing effort would hurt the final long-run payoff, its benefit to the manager would not come through improving short-term results. Furthermore, in the myopia literature, managers are assumed to give some exogenously stipulated weight to short-run and long-run stock prices; as Stein (1989) observes, this assumption is equivalent to managers' being required to sell a given fraction of their holdings (or to issue to the public a given number of new shares) in the intermediate trading stage (Stein, 1989). In contrast, we allow for the possibility that, as is usually the case, managers have the option, but are not required to sell some of their holdings in the short-run. In our model, managers use this option in some circumstances but not others, and managers' use of their private information to decide when to do so significantly affects our results.[2]

Our analysis of the effect of compensation contracts on incentives to suppress information reinforces and generalizes the message suggested by the models of Benabou and Laroque (1992) and Bebchuk and Bar-Gill (2002)

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[1] See, e.g., Holmstrom (1979), Homstrom and Costa (1986), Holmstrom and Milgrom (1987), Baker (1992, 2000), Baker, Gibbons and Murphy (1994), Diamond (1998), and Jenter (2001).

[2] In concurrent work, Bolton, Scheinkman (2003) also extend the analysis to contracts in which managers have an option (which they might or might not use) to sell a fraction of their holdings in the short-run. Their model and ours are quite different; for one thing, we assume rational market pricing, whereas they study speculative markets in which prices deviate from fundamentals.

that the insiders' ability to sell shares might provide incentives to hide information from the market. We extend the analysis in these papers by studying the issue using a model in which managers sell for both liquidity and private information reasons and in which market makers might try to infer from the volume of sales the likelihood that insiders are also selling. This model enables us to identify the effects of contract structures, disclosure requirements, and trading volumes.

The remainder of the paper is organized as follows. Section 2 presents the framework of the analysis. Section 3 studies the effects of freedom to sell in the intermediate trading stage on the equilibrium level of ex ante effort. Section 4 introduces the possibility of managers' having private information about long-term value and shows how it exacerbates the reduction in ex ante effort. Section 5 studies the effects of short-term selling on managers' incentives to suppress bad news. Section 6 extends the analysis to consider renegotiation, the use of shares as collateral and non-standard contracts. Section 7 concludes.

2. Framework of Analysis

2.1 Sequence of Events

The sequence of events in the model is as follows:

T=0: Initial situation with (initially) identical publicly traded firms each run by a manager.

T=1: Ex ante decisions – manager chooses effort level.

T=2: Learning of information – managers learns private information about the firm's expected cash flows at the final period.

T=3: Market trading.

T=4: Realization of payoffs.

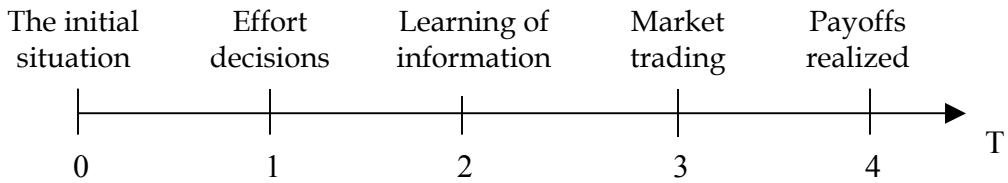

Fig. 1: Sequence of Events

We now describe in detail our assumptions concerning each one of the five stages.

2.2 T=0: Initial Situation

At T=0, all companies are publicly traded, and each is run by a manager. Without loss of generality, we assume that, at T=0, each company has one issued share that is held by initial shareholders including the manager. The manager holds a fraction m of the company's stock. (The analysis can be readily adjusted, with results that are qualitatively similar, to the case where the manager has an option to purchase a fraction m of the company's stock.) The manager is assumed to be cash constrained and consequently unable to purchase additional equity.

We focus on the consequences of allowing managers to sell shares prior to the end of their tenure at the company. We therefore compare the case in which the manager is not permitted to sell any of her shares in the intermediate trading stage with the case in which the manager can sell up to s of her shares. We initially assume that if the manager's compensation contract, which is signed at T=0, prohibits short term selling, then this contract will not be renegotiated in a later period (the assumption is that the board can credibly commit not to renegotiate). In addition, we focus on standard contracts, where shares are sold for the current market price (when such selling is permitted). These assumptions will be relaxed in Section 6 below.

We shall assume that the manager will be making decisions for the firm in all of the model's periods. Thus, there is no possibility of a takeover and the model abstracts from the incentives provided by a takeover threat.

2.3 T=1: Ex Ante Decisions

At T=1, the manager of each company chooses an effort level $e \in \Re^{+}$. This effort level will increase the expected value of the final T=4 payoff from the firm's project. For concreteness, we assume that the final period payoff will be either low, 0, or high, H, with the probability of a high payoff depending on the manager's ex ante effort. In particular, we assume that the probability of a high value, $\theta(e)$, satisfies $\theta'(e) > 0$ and $\theta''(e) \leq 0$. We further assume that e is unobservable and thus cannot be contracted on.

If the manager cannot sell shares at T=3, her choice of effort, e_{NS}, will be characterized by the FOC: $m \cdot \theta'(e_{NS}) \cdot H = 1$.

2.4 T=2: Learning of Information

At T=2, the manager may or may not obtain private information about the final T=4 value of the firm's project. Specifically, if the value of the company's project will be zero, the manager will get a "bad news" signal, *B*, with probability $\beta_1 \geq \frac{1}{2}$. And, if the value of the company's project will be *H*, the manager will get a "bad news" signal, *B*, with probability $\beta_2 \leq \frac{1}{2}$. The case where $\beta_1 = \beta_2 = \frac{1}{2}$ is the case in which the manager has no private information (the private signal is not informative). The private information signal might concern current revenues, costs, earnings, volume of activity, the establishment of strategic or other relations, and so forth.

In the case in which the manger observes an informative private signal (i.e. $\beta_1 > \beta_2$), if the manager receives the negative signal, *B*, she will update downwards the probability of getting *H*. And, if the manager does not get the negative signal, she will update upwards the probability of getting *H*. Let $\beta \equiv (1-\theta) \cdot \beta_1 + \theta \cdot \beta_2$ denote the overall probability of receiving a *B* signal. The difference, $\beta_1 - \beta_2$, represents the quality of the manager's private information.

2.5 T=3: Market Trading

At T=3, market trading takes place. Liquidity sellers place orders to sell an amount $l \sim U[0, \bar{l}]$. If the manager is permitted to sell shares, the manager might place an order to sell an amount $x \in [0, s]$. We denote by v the total supply of shares in the market. As is conventional, we assume that market makers observe the total supply, make whatever inferences might be possible from it, and then set a market price, *P*, that enables them to break even, i.e., to make zero expected profits.[3]

[3] The simple model of market trading that we use builds on the insights of the rich models that were developed to analyze trading when some traders have private information (see, e.g., Kyle (1985), Glosten and Milgrom (1985)) and where market makers try to make inferences as to whether such informed trading is taking place from the volume of orders. We use a simple version of such models because our interest is not

A manager may decide to sell shares for two distinct reasons. First, the manager may wish to sell shares for liquidity reasons. Specifically, we assume that, with probability λ, the manager experiences a consumption need that raises her immediate utility from cash by a multiple of $1+d$.[4] Second, the manager may wish to sell shares in order to take advantage of her private information, i.e. the manager may wish to sell shares when she learns bad news about the company's prospects.[5] Since managers' sales may be motivated by unfavorable private information signals, market makers will make inferences about what this private information is from disclosures of sales made by managers or, in the absence of such disclosures, from the observed volume of orders.

We assume that, if the manager is indifferent between selling and holding the shares, she will choose not to sell (because, say, selling involves some very small transaction costs). In the case in which indifference leads to selling, the cost of permitting short-term selling will be even larger than our analysis suggests.

We assume that the volume of shares sold by liquidity traders is sufficiently large so that $\bar{l} > 2 \cdot s$. In our model, this assumption implies that, if a manager sells any shares, she will sell all the shares that she is permitted to sell. A lower level of liquidity trading may lead managers to sell at T=3 only part of the shares that they are permitted to sell at this period, which will complicate the analysis but will not qualitatively change the results.

As described above, the manager may or may not sell shares at T=3. We assume initially that the manager cannot borrow against her shares. The borrowing extension is discussed in Section 6 below.

2.6 T=4: Realization of Payoffs

At T=4, all cash flows are realized. The company's project produces cash flows of either 0 or *H*. The probability of high cash flows (*H*) is: $\theta(e)$. The final

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in the trading stage itself but rather in how the prices set in it affect earlier managerial decisions.

[4] Alternatively, the manager's need for liquidity may arise from the appearance of a unique investment opportunity.

[5] Fishman and Hagerty (1995) similarly consider such dual motivation for managerial trading.

T=4 value of a company, i.e. the company's T=4 cash flows, are denoted P^f. The manager's payoff equals: $s \cdot P + (m - s) \cdot P^f - e$.

3. Effort Choice in the Absence of Private Information

We first consider the case where $\beta_1 = \beta_2 = \frac{1}{2}$, i.e. where managers have no private information at T=2. The outcome in this benchmark case is described in the following proposition.

Proposition 1: *When managers have no private information at T=2, i.e. when* $\beta_1 = \beta_2 = \frac{1}{2}$ –

(i) The manager will sell all the shares she is permitted to sell at T=3 if and only if she experiences a liquidity shock.

(ii) The manager will choose an effort level, $e_S < e_{NS}$, *that satisfies:* $[(m - s \cdot \lambda) \cdot H] \cdot \theta'(e_S) = 1$.

(iii) The T=3 market price will be: $P_S = \theta(e_S) \cdot H$.

Remark: The intuition for this result, which is proved in the appendix, is as follows.

(i) In equilibrium, the market price will reflect the expected value of the final price. Therefore, if a manager does not experience a liquidity shock, there will be no reason for her to sell shares.[6] At the same time, if the manager experiences a liquidity shock, there will not be any reason not to sell shares for their true value, and thus the manager will sell whatever shares she is permitted to sell. .

(ii) The manager knows ex ante that with a certain probability she will sell part of her holdings at T=3 for the market price which is not expected to be affected by her (unobservable) choice of effort. As a result, her incentives to exert effort are diluted and the ex ante effort level is lower.

(iii) In equilibrium, even though the market does not observe effort, it correctly anticipates the manager's choice of a low effort level. As a result, the

[6] If we had assumed that in case of indifference the manager sells her shares, then a different equilibrium would obtain. In particular, the manager would choose an even lower effort level satisfying $[(m - s) \cdot H] \cdot \theta'(e) = 1$.

market price equals the true expected value of the company's project given the manager's choice of effort.[7]

Based on proposition 1, we can state the following corollary.

Corollary 1: *In the no private information case, i.e. when* $\beta_1 = \beta_2 = \frac{1}{2}$, *the effort level,* e_S, *is decreasing in*

(i) the fraction of shares that the manager can sell at T=3, s; and
(ii) in the likelihood of a liquidity shock, λ.

Remark: The results stated in corollary 1 suggest some testable predictions. Other things equal, the value of a company, as measured for example by its Tobin's Q, can be expected to decrease in the magnitude of the short-term component in its manager's executive compensation contract.

Similarly, the value of a company will be smaller when the characteristics of its manager render her more likely to experience a liquidity shock. Managers with little outside wealth, for example, are more likely to have liquidity reasons for selling their shares.

The results stated in proposition 1 have implications for the optimal design of compensation contracts that are given in the following Corollary.

Corollary 2:

(i) *A contract* (m,s) *that allows the manager to sell s shares is less efficient than a contract* $(m,0)$ *that prohibits short-term selling if and only if* $[\theta(e_{NS}) - \theta(e_S)] \cdot H - (e_{NS} - e_S) > s \cdot \lambda \cdot d \cdot \theta(e_S) \cdot H$.

(ii) *A contract* (m,s) *that allows the manager to sell s shares is Pareto inferior to a* $(m + s \cdot \lambda \cdot d, 0)$ *contract that prohibits short-term selling and compensates managers with additional shares* $s \cdot \lambda \cdot d$ *whenever* $(1 - (m + s \cdot \lambda \cdot d)) \cdot [\theta(e_{NS}^{m+s\cdot\lambda\cdot d}) - \theta(e_S)] > s \cdot \lambda \cdot d \cdot \theta(e_S)$.

(iii) *A contract* (m,s) *that allows the manager to sell s shares is Pareto inferior to a contract* $(m,0)$ *that prohibits short-term selling and compensates managers with an initial cash payment* $k = s \cdot \lambda \cdot d \cdot \theta(e_S) \cdot H / (1 + \lambda \cdot d)$

[7] A similar result can be found in the literature on managerial shot-termism and myopia. See, e.g., Stein (1988, 1989) and Bebchuk and Stole (1993).

(financed by borrowing) whenever $(1-m)\cdot[\theta(e_{NS})-\theta(e_S)] > s\cdot\lambda\cdot d\cdot\theta(e_S)/(1+\lambda\cdot d)$.

Remarks:

(1) *Intuition*: The intuition for these results, which are proved in the appendix, is as follows:

(i) On the one hand, allowing short-term selling produces liquidity gains. On the other hand, it reduces the manager's incentives to exert effort. When the latter effect is dominant, which is when the condition stated in part (i) of the corollary holds, allowing short-term selling is inefficient.

For the optimal contract to prohibit selling, however, it is not sufficient that such prohibition is efficient, as such prohibition might violate the manager's participation constraint. Therefore, we explore the question whether contracts prohibiting sales are optimal by identifying conditions under which such a contract is Pareto superior – making both shareholders and the manager better off – than the contract that permits selling.

(ii) One way to seek a Pareto superior contract is to prohibit short-term selling while compensating the manager through a higher stake in the company. In such a case, the shareholders surrender a larger stake of the company to the manager, but they gain from the increased effort induced by the manager's greater stake. The condition stated in part (ii) of the corollary ensures that the gain from increased effort is dominant and that the shareholders will be thus made better off.

(iii) Another way to compensate the manager for prohibiting short-term is by providing the manager with an additional up-front cash payment. The condition stated in part (iii) of the corollary ensures that the gain to shareholders from increased effort exceeds the cost to them of the upfront initial cash payment.

(iv) The contracts specified in parts (ii) and (iii) of the corollary not only make shareholders better-off, but also make managers better-off. As specified, these contracts prevent any loss to the manager had the expected value of the company remained the same (i.e. as under the part (i) contract). However, the expected value of the company increases due to the higher level of effort induced by these contracts, thus making the manager positively better-off. This implies that the conditions stated in parts (ii) and (iii) of the corollary are sufficient but not necessary for the Pareto inferiority of a contract that permits short-term selling by managers.

(2) *Implications*: Our analysis implies that contracts with short-term components are less likely to be optimal when – (a) the likelihood and magnitude of a liquidity shock are smaller (which is the case when the manager has substantial outside wealth); and (b) corporate value is more sensitive to managerial effort.

If one assumes that current practices are optimal, then these implications lead to testable predictions. If one does not make this assumption, then these implications suggest how prevailing contracting practices may be improved.

4. Effort Choice When Managers Have Private Information

We next consider the case where $\beta_1 > \beta_2$, i.e. at T=2 managers learn private information about the company's future prospects. Consequently, at T=2 the manager updates her prior beliefs regarding the probability that the project will succeed as follows. If she observed the *B* signal, she knows that the probability of success is: $\theta_B(e) = \Pr(H|B) = \dfrac{\theta(e)\cdot\beta_2}{\theta(e)\cdot\beta_2 + (1-\theta(e))\cdot\beta_1} < \theta(e)$. If she does not learn any bad news, she updates the probability of success to: $\theta_{NB}(e) = \Pr(H|\neg B) = \dfrac{\theta(e)\cdot(1-\beta_2)}{\theta(e)\cdot(1-\beta_2) + (1-\theta(e))\cdot(1-\beta_1)} > \theta(e)$.

We consider three cases: (1) the case where the manager can sell shares outside the market, e.g. the case in which the manager has a phantom stock plan; (2) the case where the manager can sell shares only through the market but does not have to disclose sales in advance; and (3) the case where the manager can sell shares only on the market and must disclose in advance her plan to place an order.

4.1 Selling Outside the Market

In this case, the manger's decision to sell will have no effect on the volume of sell orders and thus on the market price. The outcome will be as described in the following proposition.

Proposition 2: *When the manager can sell shares outside the market, if the liquidity gain in the event that the manager experiences a liquidity shock, d, is sufficiently large, then –*

(i) The manager will sell all the shares she is permitted to sell at T=3 if and only if (a) she experiences a liquidity shock, and/or (b) she receives negative private information (i.e. observes a B signal).

(ii) *The manager will choose an effort level,* e_S^{NM} *, that satisfies* $e_S^{NM} < e_S < e_{NS}$ *, and that is defined by:*

$$\left[\left((m-s)+s\cdot(1-\lambda)\cdot(1-\beta_2)\right)\cdot H-(1-\lambda)\cdot(\beta_1-\beta_2)\cdot s\cdot P_S^{NM}\right]\cdot\theta'\left(e_S^{NM}\right)=1\,.$$

(iii) *The T=3 market price will be:* $P_S^{NM}=\theta\left(e_S^{NM}\right)\cdot H$ *.*

Remarks:

(1) *Intuition*: The intuition for this result, which is proved in the appendix, is as follows:

(i) If the manager receives a bad signal *B*, she updates downwards her beliefs regarding the probability that the company's project will succeed. However, since at T=3 the market does not know this information and also cannot infer anything from the manager's sale of shares, the T=3 market price will reflect a higher probability of success. Hence, the manager will sell all the shares that she is permitted to sell. And, for the reasons discussed in the remarks following proposition 1, at T=3 the manager will sell all the shares that she is permitted to sell also when she experiences a liquidity shock.

(ii) As in the no private information case, the manager knows ex ante that with a certain probability she will sell part of her holdings at T=3 for the market price which is not expected to depend on her (unobservable) choice of effort. As a result, her incentives to exert effort are diluted. Moreover, the manager knows ex ante that she may be able to use her private information to profit from selling shares when the company's prospects appear grim. As a result, even in the event that the manager does not experience a liquidity shock, she will not bear the full costs of project failure on the value of the shares she is allowed to sell. This effect further dilutes her incentives to exert effort.

(iii) The market price equals the true expected value of the company's project. In equilibrium, even though the market does not observe effort, it correctly anticipates the manager's chosen level of effort.

(2) *Comparative Statics*: The extra disincentive to exert effort caused by private information – beyond the disincentive caused by permitting managers to sell at T=3 even when they have no private information – will be larger when managers have better private information, i.e. when the difference $\beta_1-\beta_2$ is larger.

4.2 Selling On the Market Without Advance Disclosure

When the manager can only sell her shares on the market, such sales would affect the total supply of sale orders. As long as managers do not have to disclose sales in advance, market makers will be trying to infer from the observed volume the likelihood that the managers are selling because of bad news. The outcome will be as described in the following proposition.

Proposition 3: *When the manager can only sell shares on the market and is not required to disclose trades in advance, if the liquidity gain in the event that the manager experiences a liquidity shock, d, is sufficiently large, then –*

(i) The manager will sell all the shares she is permitted to sell at T=3 if and only if (a) she experiences a liquidity shock, and/or (b) she receives negative private information (i.e. observes a B signal).

(ii) The manager will choose an effort level, e_S^M*, that satisfies* $e_S^{NM} < e_S^M < e_S < e_{NS}$*, and that is defined by:*

$$\left[\left((m-s)+s\cdot(1-\lambda)\cdot(1-\beta_2)\right)\cdot H-(1-\lambda)\cdot(\beta_1-\beta_2)\cdot s\cdot P_S^M\right]\cdot\theta'\left(e_S^M\right)=1,$$

where $P_S^M < P_S^{NM}$ *is the expected price that selling managers can expect to receive at T=3.*

Remark: The intuition for this result, which is proved in the Appendix, is as follows.

(i) A manager who learns bad news will take advantage of her private information and sell at T=3 all the shares she is permitted to sell. If the manager receives a bad signal, she knows her shares are worth less than the market price. As long as the market cannot infer with certainty from the trading that the manger is selling (and that the sale is motivated by private information, rather than by liquidity needs), the manager will be able to profit from selling her shares.

The remaining question is whether the manager will sell her shares when she does not learn any bad information but suffers a liquidity shock. In this case, the manager will receive a price, which is lower than the true expected value of her shares. Still, if the liquidity motive is sufficiently strong (i.e. if *d* is sufficiently large), the manager will sell whenever she experiences a liquidity shock.

(ii) The manager's incentive to exert effort depends on the difference between her expected payoff in case of success and her expected payoff in

case of failure.[8] In case of success the manager's payoff equals the expected number of shares that she retains until the final period, $(m-s)+s\cdot(1-\lambda)\cdot(1-\beta_2)$, multiplied by the success value of the project, *H*. In case of failure, the manager's payoff will be limited to the expected value received from short-term selling based on private information (the *B* signal), which is equal to $(1-\lambda)\cdot(\beta_1-\beta_2)\cdot s\cdot P_S^M$.

The case of selling in the market (proposition 3) differs from the case of selling outside the market (proposition 2) in the T=3 price that the manager expects to receive. When the manager sells in the market, such a sale may reveal information to the market, resulting in a lower expected value for the T=3 price: $P_S^M < P_S^{NM}$. Consequently, $e_S^{NM} < e_S^M < e_S < e_{NS}$.

4.3 Selling On the Market With Advance Disclosure

When the manager can only sell her shares on the market and moreover must disclose in advance her intentions to sell, the outcome will be as described in the following proposition.

Proposition 4: *When the manager can only sell shares on the market and with advance disclosure, if the liquidity gains in the event that the manager experiences a liquidity shock, d, are sufficiently large, then –*

(i) The manager will sell all the shares she is permitted to sell at T=3 if and only if (a) she experiences a liquidity shock, and/or (b) she receives negative private information (i.e. observes a B signal).

(ii) The manager will choose an effort level, e_S^{M+D}, *that satisfies* $e_S^{NM} < e_S^M < e_S^{M+D} < e_S < e_{NS}$, *and that is defined by:*

$$\left[\left((m-s)+s\cdot(1-\lambda)\cdot(1-\beta_2)\right)\cdot H-(1-\lambda)\cdot(\beta_1-\beta_2)\cdot s\cdot P_S^{M+D}\right]\cdot\theta'\left(e_S^{M+D}\right)=1,$$

where $P_S^{M+D} < P_S^M < P_S^{NM}$ *is the expected price that selling managers can expect to receive at T=3.*

Remark: The proof is similar to the proof of proposition 3 and is therefore omitted. The intuition for this result is as follows. As explained in the remarks following proposition 3, a manager who learns bad information will surely sell shares at T=3. Also, if liquidity motives are sufficiently strong, the

[8] The liquidity gains, $s\cdot\lambda\cdot d\cdot P_S^M$, that the manager enjoys regardless of the project's success do not affect effort.

manager will sell shares at T=3 if she experiences a liquidity shock even absent bad information.

The advance disclosure requirement ensures that the market will always know whether the manger is selling and thus reduces the expected price that the manager expects to receive if and when she learns that her company's prospects are grim. Because the manager will be selling sometimes even in the absence of bad information, however, the market will not infer from an announcement of a sale that the manger has received a bad signal. As a result, the manager will still be able to profit when she sells due to negative private information, which will result in an effort level below the effort level in the no-private-information case. Because the advance disclosure requirement reduces the price a selling manger can expect to obtain, however, it reduces the disincentive to exert effort produced by private information compared with the no-advance-disclosure case.

4.4 The Case of Weak Liquidity Motives

Let us examine the possibility of liquidity benefits that are not large in magnitude, starting first with the case where the manager can sell shares outside the market (proposition 2). When d is not sufficiently large, the manager will still sell all her shares whenever she learns bad information. However, she will not sell her s shares when she experiences a liquidity shock but does not receive a B signal. In such a case, the manager knows that the value of her shares, $\theta_{NB}(e)\cdot H$, is greater than the (market) price she can obtain if she sells her shares, $P=\theta(e)\cdot H$. Therefore, the manager will not sell her shares, unless the liquidity gain form selling compensates for this difference.

Since the manager's success payoff is higher than the success payoff in proposition 1, but the failure payoff is also higher, the effort level may be either lower or higher than e_S. And, clearly, the effort level will be higher than e_S^{NM}. The existence of private information eliminates some of the liquidity-based trading. For this reason the effort level may be as high or even higher than in the case where the manager has no private information. This conclusion, however, does not make allowing short-term selling especially attractive, for the elimination of some liquidity selling reduces the very benefits for which the freedom to sell shares might be used. Note, in any event, that the effort level is still lower than in the case where short-term selling is not permitted (e_{NS}).

Next consider the case where the manager must sell shares in the market, but without advance disclosure (proposition 3). As before, the manager will sell all her shares whenever she learns bad information, but when d is not sufficiently large she will not sell her s shares when she experiences a liquidity shock but does not receive a B signal. In such a case, the liquidity gain form selling will not make up for the informational cost (as reflected in the T=3 price). The informational rent that the market imposes on T=3 selling reduces the appeal of short-term selling even beyond the reduction described for the case where managers can sell outside the market. As in the case where managers can sell outside the market, the effort level may be either lower or higher than e_S. And, clearly, the effort level will be higher than e_S^{NM} and e_S^M, but still lower than in the case where short-term selling is not permitted (e_{NS}).

Finally, consider the case where managers must sell in the market with advance disclosure. When liquidity gains in the event of a liquidity shock are not sufficiently large, the unique equilibrium is for the manager to sell if and only if she (a) experiences a liquidity shock, and (b) observes a B signal. To show that this is an equilibrium, assume that the market believes that the manager will sell if and only if she observes a B signal. Given these beliefs (and our no sale in case of indifference assumption), it can be shown that the manager will indeed sell if and only if she both experiences a liquidity shock and observes a B signal. As a result, the equilibrium effort level is defined by the FOC:

$$\left[\left((m-s)+s\cdot(1-\lambda\cdot\beta_2)\right)\cdot H-\lambda\cdot(\beta_1-\beta_2)\cdot s\cdot P\right]\cdot\theta'(e)=1.$$

As in the previous two cases, the effort level may be either lower or higher than e_S. And, clearly, the effort level will be lower than in the case where short-term selling is not permitted (e_{NS}).

4.5 Implications

The analysis in the preceding sections of the case in which managers may learn some private information has the following implications. When managers have private information, allowing short-term selling has a further adverse effect on ex ante effort beyond the reduction identified in the no-private-information case (see corollary 2). Short-term selling based on private information leads to lower effort. Lower effort also implies a lower T=3 price and thus smaller liquidity gains.

Thus, the possible availability of private information operates to make contracts that permit short-term selling less attractive. The availability of private information expands selling to situation in which managers are motivated solely by informational considerations and not by liquidity reasons, which reduces ex ante effort without any accompanying liquidity gains.

Consequently, in the presence of private information, it is more likely that a contract permitting short-term selling will be inefficient and Pareto dominated by contracts that restrict such short-term selling. Therefore, if existing contracts are optimal, then executive compensation contract in companies where managers have more private information should permit less short-term selling.

Moreover, for any given amount of shares that the manager can sell in the short-run, companies in which managers have more private information should suffer from greater disincentives to managerial effort and thus from lower firm value.

Given the existence of private information, the inefficiency of different compensation arrangements, market conditions and disclosure requirements can be ranked as follows. The case where managers can sell outside the market (e.g. where managers hold phantom stock) is the least efficient, since the market can infer nothing from managerial selling. When managers must sell in the market without advance disclosure, the market can draw some inference from managerial selling, thus reducing the adverse impact of the informational asymmetry. Specifically, as the ratio of managers' holdings (and short-term sales) to the ordinary level of liquidity selling in the market (i.e. $s/\bar{l}$) increases, the inference that the market can draw from the managerial sale improves, reducing the efficiency cost of managers' private information. Finally, when advance disclosure is required, the efficiency cost associated with the managers' private information is minimal. However, even when managerial selling is disclosed in advance, managers still have private information regarding the existence of a liquidity shock. Consequently, even advance disclosure cannot restore the level of efficiency obtained in the no private information case.

When the liquidity motivation is weak (low d), private information might entail an additional adverse effect – it might (partially) prevent liquidity selling, by reducing the price a manager can get for her shares at T=3. Therefore, when the liquidity motivation is weak, the adverse effect of

private information on effort is smaller, but liquidity gains are also reduced. This result suggests the following testable prediction: When the liquidity motivation is weak (e.g. when managers have significant outside wealth), there will be less short-term selling when managers have to sell shares in the market (compared to selling outside the market) and even less selling with advance disclosure.

Recent legislation (the 2002 Sarbanes-Oxley Act) requires managers that sell shares to disclose their sales much more quickly following the sale than was previously the case. This requirement will ensure that the market will become aware much faster of any managerial attempt to sell a substantial amount of shares over a significant period of time. Our analysis indicates that this requirement will operate to increase managerial effort, which in turn will increase company value.

Our results also have the following testable prediction: the recent disclosure legislation should increase the average Tobin's Q in the market. Moreover, our analysis supports recent proposals to further enhance disclosure requirements, specifically to require advance disclosure.[9]

5. Incentives to Suppress Bad News

We have thus far assumed that the manager may receive a private signal B that is not observable to the market. Suppose, however, that bad news is observable in principle, but the manager can at a cost render the information unobservable. In particular, assume that, at T=2, if the manager receives a bad news signal B, the signal will be observed also by the market unless the manager takes action to render these bad news unobservable.

We allow for suppression of bad news to involve costs for the manger, the firm, or both. Specifically, we assume that suppressing bad news would involve a cost of $c \geq 0$ – in effort or expected penalty – to the manager personally.

Suppressing bad news might also be costly to the firm because it might require the manager to distort the company's operations (e.g. to generate higher short-term earnings) or to divert to suppression some of the effort and

[9] The Conference Board's Blue-Ribbon Commission on Public Trust and Private Enterprise issued a report proposing (among other things) advance notice of executive stock sales. A detailed proposal for such advanced disclosure was put forward in the academic literature by Fried (1998).

attention that would otherwise contribute to the firm's success. Erickson et al. (2002).) Roychowdhury (2003) provide evidence that suppression of bad news might indeed be costly to the company. Specifically, we assume that suppression of bad news would reduce the firm's expected value by a fraction $\phi \geq 0$, from $\theta \cdot H$ to $(1-\phi) \cdot \theta \cdot H$.

If the manager were prohibited from selling shares at T=2, then she would clearly have no motive to incur personal costs or costs for the company to suppress a received negative signal. However, when short-term selling is permitted, the manager will have an incentive to suppress bad news. This result is stated formally below for the case where liquidity gains are sufficiently large to induce short-term selling whenever the manager experiences a liquidity shock (even when there is no bad news).

Proposition 5: *If a manager is permitted to sell shares at T=3, there is a unique equilibrium in which the manager will suppress bad news if and only if*

$$c < s \cdot \left(P - (1-\phi) \cdot \theta_B \cdot H\right) - (m-s) \cdot \phi \cdot \theta_B \cdot H,$$

where $P \in \left\{P_S^{NM}, P_S^{M}, P_S^{M+D}\right\}$ and $e \in \left\{e_S^{NM}, e_S^{M}, e_S^{M+D}\right\}$. *The incentive to suppress bad news will be strongest when the manager can sell outside the market, weaker when the manager must sell on the market without advance disclosure, and weakest when the manager must sell on the market with advance disclosure.*

Remarks:

(1) *Intuition*: The intuition for this result, which is proved in the appendix, is as follows. When managers are permitted to sell shares, their ability to suppress a negative signal enables them to profit from short-term selling based on private information. In essence the manager sells what he knows to be low value stock for a price that exceeds the stock's true value. However, the manager must invest *c* in order to hide the bad information. Moreover, the manager loses from the reduction of firm value (caused by the suppression of bad news) on the shares that she cannot sell at T=3. When the informational rent is sufficiently large, the manager will invest in rendering bad information unobservable. Also, the manager is more likely to suppress bad news when she can sell a larger fraction of her holdings at T=3, i.e. when s/m is larger.

Since the T=3 price that the manager gets for her shares is highest when she sells outside the market, lower when she must sell on the market without advance disclosure and lowest when she must sell on the market with advance disclosure, the incentive to suppress bad news follows the same ordering.

(2) *Empirical implications*: The result stated in proposition 5 is consistent with existing empirical findings, and they provide testable predictions for future empirical work:

(i) Misreporting of earnings is more likely to occur in those cases in which managers are not precluded – by law or by their compensation contract and other contracts with the firm – from selling shares in the short-run. Furthermore, misreporting is more likely to occur in sectors or companies where managers are permitted to sell a larger fraction of their initial holdings.

Bergstresser and Philippon (2002) find evidence that managers whose compensation is more directly tied to share prices are more likely to manipulate earnings (see also Yablon and Hill (2001)). Because compensation schemes generally permit managers to unload vested options (Bebchuk, Fried, and Walker (2002)), we view these findings as generally consistent with the predictions of our model.

Ke (2002) also finds that managers with stock and exercisable stock options tend to engage in earnings manipulation. He also finds no evidence that managers with large amounts of unexercisable stock tend to manage earnings. This pattern sits well with the predictions of our model: it indicates that it is not more options and shares – but rather more options and shares that the manager may sell in the short-run – that produce incentives to engage in misreporting (see also Bebchuk and Bar-Gill (2002)).

More generally, the result stated in proposition 5 is consistent with recent evidence reported in Beneish, Press and Vargus (2003) that insider-trading opportunities increase the incidence of earnings management.

(ii) If managers can only sell shares in the market, then other things equal misreporting will be less likely to occur when the market can better identify managerial selling. In particular:

(a) When the volume of shares offered by liquidity sellers is smaller relative to the volume of shares that managers are permitted to sell in the short run, misreporting will be less likely to occur.

(b) Tightening disclosure requirements, and in particular requiring prompt disclosure by managers following a sale of shares, will reduce the incidence of misreporting.

(iii) The result stated in proposition 5 suggests that the recent disclosure legislation should reduce the incidence of suppression of bad news.

6. Extensions

6.1 Renegotiation

We have thus far assumed that, if at T=0 the executive compensation contract prohibits short term selling, then this prohibition will not be renegotiated in a later period. One could justify such an assumption on grounds that the board of directors can credibly commit not to renegotiate the compensation contract. Renegotiation of this kind is in fact not observed in practice.

Dropping this assumption introduces the problem of renegotiation in agency contracts that is well known and much studied (see Fudenberg and Tirole (1990)).[10] After the agent exerts effort, the principal and the agent will generally find it mutually beneficial to renegotiate the contract between them. In the present context, after the manager exerts effort, the incentive role of a 'no short term selling' clause disappears, and both the firm and the manager can now benefit from allowing the manager to sell shares at T=3 and enjoy the resulting liquidity gains, $\lambda \cdot d \cdot P$.[11]

When the parties cannot commit not to renegotiate, the prospect of renegotiation dilutes the incentives created by a 'no short term selling' clause. Specifically, at equilibrium the manager will adopt a mixed strategy with respect to her choice of effort, and a menu of different contracts will be offered for each effort level (see Fudenberg and Tirole (1990)).

The advantage of a commitment not to renegotiate, in terms of providing more high-powered incentives to the manager, and the potential inability of the board to make such a commitment suggest a new role for public policy. If legal rules can help generate a credible commitment not to renegotiate the 'no short term selling' clause, such rules can enhance efficiency (this commitment generating role for public policy is important even if one believes that boards design optimal executive compensation contracts). For instance, the recent proposal by Senator John McCain to create a tax disincentive for short term selling can generate a credible commitment not to renegotiate by imposing an external cost on such renegotiation (see also recent proposals by The Conference Board in the same spirit).

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[10] In our framework, as in Fudenberg and Tirole (1990), the renegotiation problem arises in a one-period moral hazard model. Deriving the optimal contract, absent a commitment not to renegotiate, becomes even more complex in repeated moral hazard models. See, e.g., Chiappori et al. (1994).

[11] Alternatively, if the manager is risk-averse, then after the effort choice has been made, the firm and the manager can benefit from renegotiating the contract to relieve the manager from the risk-bearing costs by allowing short-term selling.

6.2 Borrowing

We have thus far focused on the possibility that managers may sell shares at T=3, but we have abstracted from the possibility that they might borrow against their shares. We now explore the implications of allowing such borrowing. In particular, assume that while short-term selling of shares is prohibited, the manager can borrow using her shares as collateral. While such borrowing may seem innocuous at first glance, it can in fact generate efficiency costs similar to those generated by short term selling.

To illustrate, consider the no private information case, where a manager might experiences a liquidity shock, but instead of selling shares for $s \cdot P$ the manager borrows the sum $s \cdot P$ offering her shares as collateral. Assuming a no recourse loan against the shares, the manager will have to repay a sum $s \cdot P/\theta$ if the company's project succeeds. Thus, if the project succeeds, the manager ends up with $m \cdot H - s \cdot P/\theta$; and if the project fails the manager ends up with a zero payoff. Consequently, the manager will choose an effort level that satisfies the FOC: $[m \cdot H - s \cdot \lambda \cdot P/\theta] \cdot \theta'(e) = 1$. Since $P = \theta \cdot H$, this is precisely the FOC that defines the level of effort, e_S, in proposition 1. As in the selling of shares case, allowing the manager to borrow against her shares dilutes the manager's incentive to exert effort.

6.3 Contracts that Set the Sale Price

We have thus far focused on standard contracts, where if the manager can sells shares at T=3 she sells them for the current market price. However, in principal, the executive compensation contract can set more sophisticated price formulas. In particular, since the firm knows (or can know) that a manager is selling shares, it has the same information that the market would have in the advance disclosure case. Therefore, the executive compensation contract can allow the manager to sell at T=3 for a price equal to P_S^{M+D} (see proposition 4), and thus induce an effort level of e_S^{M+D}.

7. Conclusion

This paper has analyzed the costs of permitting corporate managers to sell shares that they hold prior to the end of their service at the company. Permitting such selling reduces managers' ex ante level of effort and provides them with incentives to suppress bad news. Our results identify how these costs depend on disclosure obligations, trading volume, the terms of compensation contracts, and the size of managers' holdings. These results

have implications for corporate governance and the optimal design of compensation arrangements. They also provide testable predictions that can explain existing evidence as well as provide a basis for future empirical work.

Appendix

Proof of Proposition 1:

We first demonstrate that the outcome described in proposition 1 is an equilibrium:

(1) Assuming that the market anticipates an effort level $\hat{e} = e_S$, and the manager sells if and only if she experiences a liquidity shock, then the manager will choose an effort level that solves $\max_e \langle [(m-s)+s\cdot(1-\lambda)]\cdot\theta(e)\cdot H + s\cdot\lambda\cdot(1+d)\cdot\theta(\hat{e})\cdot H - e\rangle$, i.e. she will choose $e = e_S$.

(2) Assuming that the chosen effort level is e_S and that $P_S = \theta(e_S)\cdot H$, absent a liquidity shock the manager is indifferent between holding her shares and selling at T=3 and will therefore decide not to sell. Hence, the manager will sell if and only if she experiences a liquidity shock.

(3) Assuming that the chosen effort level is e_S, the market sets $P_S = \theta(e_S)\cdot H$ in the rational expectations equilibrium.

We next show that the outcome described in proposition 1 is the unique equilibrium. Suppose that there is an equilibrium in which the manager chooses $\hat{e} \neq e_S$. In this equilibrium the market price would be $P = \theta(\hat{e})\cdot H$, and the manager would thus sell at T=3 if and only if she experiences a liquidity shock. Under these conditions, however, it would not be optimal for the manager to choose $\hat{e} \neq e_S$ (she would choose e_S), which contradicts the assumption that this is an equilibrium.[12] QED

Proof of Corollary 2:

(i) Comparing overall value when T=3 selling is and is not permitted, we find that short-term selling is inefficient if and only if $\theta(e_S)\cdot H + s\cdot\lambda\cdot d\cdot\theta(e_S)\cdot H - e_S < \theta(e_{NS})\cdot H - e_{NS}$, which (after some rearranging) yields the condition stated in corollary 2(i).

(ii) Comparing the payoffs under the two contracts, we find that the manager is always better off under the $(m+s\cdot\lambda\cdot d, 0)$ contract, since $(m+s\cdot\lambda\cdot d)\cdot\theta(e_{NS}^{m+s\cdot\lambda\cdot d})\cdot H - e_{NS}^{m+s\cdot\lambda\cdot d} > m\cdot\theta(e_S)\cdot H + s\cdot\lambda\cdot d\cdot\theta(e_S)\cdot H - e_S$ (note that the

[12] For completeness we rule out also the possibility that the manager sells at T=3 regardless of the occurrence of a liquidity shock. This cannot be an equilibrium given the assumption that in case of indifference, the manager will not sell.

manager can always choose $e_{NS}^{m+s\cdot\lambda\cdot d} = e_S$). And, the shareholders are better off under the $(m+s\cdot\lambda\cdot d,0)$ contract whenever $\left[1-(m+s\cdot\lambda\cdot d)\right]\cdot\theta(e_{NS}^{m+s\cdot\lambda\cdot d})\cdot H > (1-m)\cdot\theta(e_S)\cdot H$. This condition (after some rearranging) yields the condition stated in corollary 2(ii).

(iii) Comparing the payoffs under the two contracts, we find that the manager is always better off under the $(m,0)$ contract with an initial cash payment $k = s\cdot\lambda\cdot d\cdot\theta(e_S)\cdot H/\left(1+\lambda\cdot d\right)$, since $m\cdot\theta(e_{NS})\cdot H + \left(1+\lambda\cdot d\right)\cdot k - e_{NS} > m\cdot\theta(e_S)\cdot H + s\cdot\lambda\cdot d\cdot\theta(e_S)\cdot H - e_S$ (note that the manager can always choose $e_{NS} = e_S$). And, the shareholders are better off under this contract whenever $(1-m)\cdot\theta(e_{NS})\cdot H - k > (1-m)\cdot\theta(e_S)\cdot H$. This condition (after some rearranging) yields the condition stated in corollary 2(iii). QED

<u>Proof of Proposition 2</u>:

Existence and uniqueness of the equilibrium described in proposition 2 is proved as detailed in the proof of proposition 1, subject to the following adjustments:

(i) The manager will sell her shares if she observes the *B* signal. After observing *B*, the manager knows that the company's project will succeed with probability $\theta_B(e) < \theta(e)$. Since the market learns nothing, the manager can get $P_S^{NM} = \theta\left(e_S^{NM}\right)\cdot H$ by selling at T=3. The manager will also sell her shares if she experiences a liquidity shock, even absent a *B* signal, when *d* is sufficiently large. Specifically, if the manager sells her *s* shares, she will get $\left(1+d\right)\cdot s\cdot\theta\left(e_S^{NM}\right)\cdot H$, and if she retains her *s* shares, she will get $s\cdot\theta_{NB}\left(e_S^{NM}\right)\cdot H$. Therefore, the manager will sell when $d > \theta_{NB}\left(e_S^{NM}\right)/\theta\left(e_S^{NM}\right) - 1$.

(ii) If the company's project succeeds, the manager receives: $\left((m-s)+s\cdot(1-\lambda)\cdot(1-\beta_2)\right)\cdot H$. If the project fails, the manager receives: $(1-\lambda)\cdot(\beta_1-\beta_2)\cdot s\cdot P_S^{NM}$.[13] Therefore, the manager chooses her effort level to solve: $\max_e \left\langle \theta(e)\cdot\left((m-s)+s\cdot(1-\lambda)\cdot(1-\beta_2)\right)\cdot H + \left(1-\theta(e)\right)\cdot(1-\lambda)\cdot(\beta_1-\beta_2)\cdot s\cdot P_S^{NM} - e\right\rangle$. The FOC is: $\left[\left((m-s)+s\cdot(1-\lambda)\cdot(1-\beta_2)\right)\cdot H - (1-\lambda)\cdot(\beta_1-\beta_2)\cdot s\cdot P_S^{NM}\right]\cdot\theta'\left(e_S^{NM}\right) = 1$. Comparing this FOC to the FOC stated in proposition 1, we find that $e_S^{NM} < e_S < e_{NS}$. QED

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[13] The manager also enjoys a liquidity gain of $s\cdot\lambda\cdot d\cdot P_S^{NM}$, which is independent of the project's success.

Proof of Proposition 3:

(i) After observing a B signal the manager will sell all s shares (even absent a liquidity shock). To see this note that absent a liquidity shock, a manager who learns bad news will sell a number of shares x that solves:

$$\max_x \; x \cdot \left[\Pr\left(l + x > \bar{l}\right) \cdot P_1 + \Pr\left(l + x \le \bar{l}\right) \cdot P_2\right],$$

where $P_1 = \Pr\left(H \middle| v > \bar{l}\right) \cdot H$ *and* $P_2 = \Pr\left(H \middle| v \le \bar{l}\right) \cdot H$. We can rewrite the manager's objective function as: $x \cdot \left[x/\bar{l} \cdot P_1 + \left(1 - x/\bar{l}\right) \cdot P_2\right]$, or $x \cdot P_2 + \left(x^2/\bar{l}\right) \cdot \left(P_1 - P_2\right)$. Taking the derivative of the objective function with respect to x we obtain: $P_2 - 2 \cdot \left[\left(P_2 - P_1\right)/\bar{l}\right] \cdot x$, or $P_1 + \left(P_2 - P_1\right) \cdot \left(1 - 2 \cdot x/\bar{l}\right)$. Since $s < \bar{l}/2$, the manager will sell all her shares.[14] When d is sufficiently large, the manager will also sell all s shares when she does not learn any bad news if she experiences a liquidity shock. To see this note that in such a case the manager will sell a number of shares x that solves:

$$\max_x \; x \cdot \left[x/\bar{l} \cdot P_1 + \left(1 - x/\bar{l}\right) \cdot P_2\right] \cdot (1 + d) + (s - x) \cdot \theta_{NB} \cdot H .$$

The derivative of the objective function with respect to x is: $\left[P_1 + \left(P_2 - P_1\right) \cdot \left(1 - 2 \cdot x/\bar{l}\right)\right] \cdot (1 + d) - \theta_{NB} \cdot H$. When d is sufficiently large, this derivative is always positive, implying that the manager will sell all her shares.

(ii) If the company's project succeeds, the manager receives: $\left((m - s) + s \cdot (1 - \lambda) \cdot (1 - \beta_2)\right) \cdot H$. If the project fails, the manager receives: $(1 - \lambda) \cdot (\beta_1 - \beta_2) \cdot s \cdot P_S^M$, where $P_S^M = \Pr\left(v > \bar{l} \middle| sell\right) \cdot P_1 + \Pr\left(v \le \bar{l} \middle| sell\right) \cdot P_2$.[15] Therefore, the manager chooses her effort level to solve: $\max_e \left\langle \theta(e) \cdot \left((m - s) + s \cdot (1 - \lambda) \cdot (1 - \beta_2)\right) \cdot H + \left(1 - \theta(e)\right) \cdot (1 - \lambda) \cdot (\beta_1 - \beta_2) \cdot s \cdot P_S^M - e \right\rangle$.

The FOC is: $\left[\left((m - s) + s \cdot (1 - \lambda) \cdot (1 - \beta_2)\right) \cdot H - (1 - \lambda) \cdot (\beta_1 - \beta_2) \cdot s \cdot P_S^M\right] \cdot \theta'\left(e_S^M\right) = 1$. Comparing this FOC to the FOCs stated in propositions 1 and 2, we find that $e_S^{NM} < e_S^M < e_S < e_{NS}$. In particular, note that $P_S^M < P_S^{NM}$ (recall that $P_S^M = \Pr\left(v > \bar{l} \middle| sell\right) \cdot P_1 + \Pr\left(v \le \bar{l} \middle| sell\right) \cdot P_2$, where $\Pr\left(v > \bar{l} \middle| sell\right) = \Pr\left(l + s > \bar{l}\right) = s/\bar{l}$ and $\Pr\left(v \le \bar{l} \middle| sell\right) = \Pr\left(l + s \le \bar{l}\right) = 1 - s/\bar{l}$).

QED

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[14] In fact, a weaker condition would suffice: $s < \left[1 + P_1/\left(P_2 - P_1\right)\right] \cdot \bar{l}/2$.

[15] The manager also enjoys a liquidity gain of $s \cdot \lambda \cdot d \cdot P_S^M$, which is independent of the project's success.

Proof of Proposition 5:

When the manager learns bad information and does not invest c in rendering the information unobservable to the market, she will sell at T=3 only if she experiences a liquidity shock, gaining $s \cdot \lambda \cdot d \cdot P$. When the manager learns bad information and invests c in rendering the informational unobservable to the market, she will sell shares at T=3, earning $s \cdot [\lambda \cdot d \cdot P + (P - (1-\phi) \cdot \theta_B \cdot H)] - (m-s) \cdot \phi \cdot \theta_B \cdot H$. Therefore, the manager will invest suppressing bad news if and only if $c < s \cdot (P - (1-\phi) \cdot \theta_B \cdot H) - (m-s) \cdot \phi \cdot \theta_B \cdot H$. QED

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