

Stock Market Speculation and Managerial Myopia*

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Abstract

This paper extends the analysis of managerial share price concerns by allowing informed trading in the stock market. It is shown that because they decrease the manager's information advantage vis-à-vis the stock market, individual investors who trade on private information improve the efficiency of corporate investment. This improvement does, however, fall short of first-best efficiency. Moreover, a stronger managerial share-price concern increases the expected profit from informed trading. Hence, by encouraging individual investors to collect information about corporate decisions and trade on it, managerial myopia tends to automatically bring forth a partial solution to the problems that it causes.

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1 Introduction

Does the stock market discipline corporate managers to stay on the straight and narrow or does it lead their decision-making astray? The answer depends on how much the stock-market knows about corporate decisions: a well-informed stock market can provide accurate incentives that lead to profit-maximizing decisions, but an ill-informed one distorts incentives away from profit-maximization. The question therefore arises as to how the stock market can obtain information that enhances its ability to provide managerial incentives. The purpose of this paper is to study one natural way this can happen, namely through speculative trading by individual investors with access to private information about corporate decisions.

The importance of information for stock market incentives has been analyzed in the literature on so-called managerial myopia, which is when corporate managers care not only about the long-run profit of their firms, but about their short-run valuation in the stock market as well (see Grant, King, and Polak 1996 for a survey). This research concludes that even a stock market that is adept at processing information in the sense that its valuations reflect all available information cannot guide corporate decisions unless it fully understands them. In particular, if a manager has private information about corporate investment decisions – either because the stock market cannot discern these decisions or because it lacks information about their consequences – then managerial myopia can lead to inefficient investment. The reason is that the manager attempts to use her investment to fool the stock market and boost the short-run share price at the expense of long-run profits. If her private information consists of hidden actions, then the manager tries to generate good news in the short run by distorting investment towards projects where the market is better at discerning it (Paul 1994; Stein 1989). If her private information consists of hidden information, then the manager tries to hide bad news temporarily from the market by over-investing in projects with a high *ex ante* expected profit (Bizjak, Brickley, and Coles 1993; Brandenburger and Polak 1996; Brennan 1990;

Stein 1988). The end result is under-investment in projects that the stock market either is unable to see or does not want to see.

Even though they point to the information that the stock market has access to as a key determinant of corporate decision-making, all existing models of managerial myopia take it as exogenously given. The contribution of this paper is to allow stock market information to be affected by individual investors by introducing informed stock market trading into a hidden-information model of managerial share-price concern. This provides two important results. The first is a characterization of the effect of informed trading on corporate investment decisions. The model confirms the intuition that informed stock market trading can alleviate the inefficiencies caused by managerial myopia: with access to more of her information, the market makes the manager bear more of the cost of her inefficient investment in the form of foregone long-run profit. However, since all private information cannot be revealed if trading on it is to be profitable, first-best efficiency is not restored completely even when traders are as well-informed as the manager. Specifically, corporate investment is always weakly more efficient with informed trading than without it, and strictly so when three conditions are satisfied. First, the fraction of informed traders in the market must be high enough to allow the information that they reveal to make enough of a difference. Second, the extent of managerial myopia must be high enough to make investment inefficient, but at the same time low enough to prevent the manager from persisting in her inefficient behavior when the market becomes better informed. Third, the market's preference for its favorite project must be strong enough to make it worth the manager's while to pursue it inefficiently, but at the same time weak enough to make her willing to abandon it when the market becomes better informed.

The second significant result that the analysis produces is that one should in fact expect rational and self-interested individual traders to prevent myopic managers from letting their decision-making stray too far from the norm of profit-maximization. The comparative statics analysis shows that the expected profit from

informed trading increases with the manager's concern with the short-run share price. Hence, the new assumption made in this paper that managers with share-price concerns interact with informed stock market traders is in fact quite reasonable because managerial myopia gives traders the incentive to become informed. Or, to put it differently, when informed stock market trading is possible, the ills of managerial myopia tend to automatically bring forth an antidote: the more serious is the problem caused by managerial share-price concerns, the stronger is the profit motive for individual traders to provide a partial solution by acquiring and trading on the manager's information.

The rest of the paper is organized in the following way. In the next section, I present and analyze the model. It is a variation on the one-period model in Brandenburger and Polak (1996), amended with informed stock market trading using a special case of the general framework developed in Glosten and Milgrom (1985). After setting up the model, I turn to the equilibrium analysis. I start out by replicating the standard managerial-myopia benchmark under the assumption that there are no informed investors in the stock market. I then turn to the main analysis in which an informed investor is allowed to trade in the stock market. I conclude the paper with a short discussion of the analysis.

2 The Model

2.1 Setup

The model has two time periods and features a single, completely equity-financed firm run by a manager, along with the stock market in which its shares are traded. All agents are risk-neutral. In the first period, the manager makes an all-or-nothing investment decision. In the second period, stock market trading takes place, followed by the realization of the profit from investment and the reversal of the initial stock market trade.

The firm's only asset is an investment project. In period one, the manager can either undertake or else forego this investment, a decision that is publicly observable.

The extent to which the manager chooses to exploit the project is denoted by $i \in \{0, 1\}$. She can mix these two pure strategies with the probability that she invests being denoted by $\beta \equiv \Pr(i = 1)$.

The alternative of not investing is risk-free and its payoff is normalized to zero. The investment, on the other hand, is subject to uncertainty. With equal probability its profitability is either low or high, denoted by $I \in \{L, H\}$. The low payoff is normalized to -1 and the high one is parametrized by $r > 0$. The normalization of payoffs and the fact that one alternative is risk-free are innocuous assumptions that are made to simplify the exposition.

By virtue of her position inside the firm, the manager has private information about the firm's investment project: she knows with certainty whether its profitability is high or low. The assumption that the manager's information is noiseless makes the analysis simpler and her information advantage starker. However, the economic argument of the paper goes through as long as the manager has more information than the stock market. The manager is risk-neutral and maximizes the expected value of a utility function that is a convex combination of the firm's profit, denoted by π , and its price in the stock market at the beginning of period two, denoted by p .¹ The chosen utility function captures the intuition that the manager is affected not only by the profit consequences of her decision, but by the stock market's short-term perceptions of them as well. Throughout the analysis, dependence on the resolution of the uncertainty and on the manager's investment decision will be denoted by a superscript and a subscript, respectively. The manager's objective is thus denoted by $M^I(\beta)$:

$$M^I(\beta) \equiv \mathbb{E}\{\alpha p(\beta) + (1 - \alpha)\pi(\beta) | I\}$$

The manager's concern with the current share price should be thought of as a reduced-form representation of some unresolved agency problem, the severity of which is parametrized by $\alpha \in (0, 1)$. This assumption, which is standard in the

¹With a slight abuse of terminology, I will take the liberty of referring to p as "the share price."

literature on the consequences of managerial myopia, is crucial to the analysis, and will be discussed further in Section 3.

The efficiency issue in the model concerns the manager's use of her information about the profitability of the project. To maximize the expected payoff from investment, the manager must invest if and only if the project's profitability is high. Denote this first-best optimal investment strategy by $\beta^{**} = \{\beta^{H^{**}} = 1, \beta^{L^{**}} = 0\}$. It yields an *ex ante* expected profit that is equal to $E\{\pi(\beta^{**})\} = \frac{r}{2}$.

In the stock exchange, two assets, a risk-free bond with price normalized to unity and the shares of the firm, are traded by three classes of agents: a single informed investor, a single market maker, and liquidity traders.² The informed investor has the same noiseless information about the firm's investment possibility as the manager, and trades with the objective of maximizing expected profit. Other agents in the stock market have no private information. The market maker is subject to competitive pressure that forces each of her trades to generate an expected profit that is equal to zero. The liquidity traders come in two extreme incarnations: half of them have a completely price-inelastic preference for the bond, while the other half of the population has a completely price-inelastic preference for shares in the firm.

The trading mechanism works as follows. At the beginning of the second period, the market maker encounters a single trader who is offered to trade a fixed amount of shares, for notational simplicity normalized to the entire firm: either buy the firm at an ask-price, A , (short-)sell the firm at a bid-price, B , or else refrain from trading altogether. The quantity of the firm that the trader can choose to trade, which is thus restricted to only three values, is denoted by $x \in \{-1, 0, 1\}$. The market maker does not know whether she is facing an informed investor or a liquidity trader. She does know, however, the probability that the trader is informed, which is given by the fraction of informed traders in the market.³ This fraction is denoted by $\delta \in [0, 1)$,

²In particular, the manager is not permitted to trade in the stock market, a restriction that will be discussed in Section 3.

³The underlying presumption here is that all traders have the same chance of getting to trade.

the reciprocal of which can be thought of as a measure of the level of noise in the stock market trading. At the end of period two, after the investment uncertainty is resolved, the position taken in the initial trade is reversed. The market maker's zero-profit condition implies that in this reversal trade, the price of the firm must be equal to its realized profit.

The informed investor's trading strategy, which can make use of both the manager's choice of investment, i , and its profitability, I , is denoted by $s_i^I(x) \equiv \Pr(x|i, I)$. This strategy is chosen with the objective of maximizing the expected profit from trading, denoted by S_i^I :

$$S_i^I(s_i^I) \equiv \mathbb{E} \left\{ \delta \sum_x x s_i^I(x) [\pi_i^I - p_i(x)] \right\}$$

The *ex ante* expected profit when this objective is maximized through the choice of s_i^I averaged over the fraction of informed traders provides a measure of individual traders' profit incentive to collect information. It is denoted by $S^* \equiv \frac{\mathbb{E}\{S_i^I(s_i^{I*})\}}{\delta}$, where the expectation is taken with respect to the investment uncertainty, I , the realization of which also determines the manager's investment strategy, β^I .⁴

2.2 Corporate Investment Without Informed Trading

To recreate the Brandenburger-Polak result as a benchmark, consider first the case of no informed trading, i.e., $\delta = 0$. In this situation, the equilibrium is unique and may be inefficient: the manager always invests when the project is profitable, but may fail to refrain from investing when it is unprofitable.⁵ The reason is that if

⁴It may help the reader to think about the model as a type of signaling game with two privately informed senders, the manager and the informed trader, and one receiver, the market-maker. At the start of the game, Nature picks the profitability of the project, and with it both types of senders. The manager then sends her perfectly observable signal in the form of her investment decision. The next move belongs to Nature that selects whether or not the informed investor gets to trade. If she does, the informed investor then sends her signal in the form of her demand for securities. Finally, the market maker responds to the signals of investment choice and demand for securities by setting ask- and bid-prices in the stock market. Notice, however, that the presence of noise traders makes it private information to the informed trader whether or not she actually gets the chance to trade, thus preventing the market-maker from perfectly observing the informed trader's signal.

⁵Equilibrium uniqueness relies on universal divinity to restrict the stock market's out-of-equilibrium beliefs.

the project is abandoned, then the stock market lowers its forecast of future profits, and with it its short-run valuation of the firm. Therefore, inefficient over-investment occurs when the manager's share-price concern is strong and successful investment is highly profitable so that the stock market's assessment of the firm's future profit drops substantially if the project is abandoned.

To derive this conclusion, start from the end of the game. In the stock market, the market maker can learn nothing from the trading patterns that she observes. The competitive pressure that she is under therefore forces her to set both the ask- and the bid-price of the firm equal to its expected profit, conditional on the manager's investment decision. The zero-profit conditions for trades in which the market maker sells and buys the firm, respectively, look as follows:

$$A_i^* - E\{\pi_i|i\} = 0 \Leftrightarrow A_i^* = E\{\pi_i|i\}$$

$$E\{\pi_i|i\} - B_i^* = 0 \Leftrightarrow B_i^* = E\{\pi_i|i\}$$

It is common knowledge that the profit from rejecting the investment opportunity is deterministically equal to zero, which must therefore also be the share price following no investment, i.e., $p_{i=0}^* = 0$. The profit from investment, on the other hand, is subject to uncertainty, so the market maker must infer the expected profit from the manager's choice:

$$\begin{aligned} p_{i=1}^*(\beta) &= E\{\pi_{i=1}(\beta)|i=1\} = \Pr(I=H|i=1)r + [1 - \Pr(I=H|i=1)](-1) = \\ &= \left(\frac{\beta^H}{\beta^H + \beta^L}\right)(1+r) - 1 \end{aligned}$$

From the stock market's point of view, investment is good (bad) news about firm value if it is made by a manager with good (bad) news about the investment's profitability. Therefore, the share price is increasing in the extent to which a manager with good news invests, β^H , and decreasing in the extent to which a manager with bad news invests, β^L .

Moving back to the manager's investment decision, recall that she derives utility from the long-run payoff from investment. This implies that a manager who knows

that the project is profitable, referred to as an H -manager, has a stronger incentive to invest than a manager who knows that it is not, referred to as an L -manager. Therefore, assume for the time being that the H -manager makes the efficient choice of exploiting the investment opportunity, i.e., that $\beta^H = \beta^{H^{**}} = 1$.

Turn next to the L -manager's decision problem. Her efficient choice is to abandon the investment project. However, doing so would reveal to the stock market that its prior assessment of the firm's profit prospects was overly optimistic, and would thus lead to a fall in the market value of the firm. Hence, the L -manager finds herself in a quandary: making the efficient choice increases long-run profits, but decreases the short-run share price, both of which generate utility for her. Hence, the L -manager has an incentive to invest against her better judgement because by doing so she can temporarily hide her disappointing news that the project is a losing proposition from the stock market, thus propping up the share price in the short run. Of course, this benefit comes at a cost in the form of a lower long-run profit. The L -manager's trade-off between the two is captured by her expected net payoff from investing as a function of her own strategy, β^L , given that the H -manager invests efficiently:⁶

$$\begin{aligned} M_{i=1}^L(\beta^L, \beta^{H^{**}}) &= \alpha p_{i=1}^*(\beta^L, \beta^{H^{**}}) + (1 - \alpha) \pi_{i=1}^L = \\ &= \alpha \left\{ \left[\left(\frac{1}{1 + \beta^L} \right) (1 + r) - 1 \right] - (-1) \right\} - 1 = \alpha \left(\frac{1}{1 + \beta^L} \right) (1 + r) - 1 \end{aligned}$$

The second term captures the cost of inefficient investment because long-run profits fall from zero to -1 . The first term captures the benefit of inefficient investment because the uninformed stock market over-estimates the firm's profits at the beginning of period two: the market puts the probability that the investment payoff is r rather than -1 at $\left(\frac{1}{1 + \beta^L} \right)$, whereas the L -manager knows that it is equal to zero. This benefit from temporarily deceiving the market is, by definition, strictly increasing in the manager's share-price concern, α . It is also strictly increasing in the profitability of successful investment, r . The reason is that an increase in the

⁶Since the payoff from the foregone alternative of not investing is normalized to zero, the net and gross payoff from investment are identical.

prior expected profitability of investment effectively makes the efficient choice of abandoning it more of a disappointment to the stock market.

The L -manager's expected payoff from investing as a function of her own strategy, given that the H -manager invests efficiently, is illustrated in Figure 1. It is strictly decreasing in β^L because investment by the L -manager dilutes the good news about the firm's investment project that the market can infer. At the left-hand intercept, $\beta^L = 0$ so that the L -manager does not invest at all. Here the stock market can conclude that all investment that is undertaken is profitable, making the net benefit equal to $\alpha(1+r) - 1$. At the right-hand intercept, $\beta^L = 1$ so that the L -manager invests with certainty. Here investment tells the stock market nothing new and leaves the probability that the project is profitable at the prior of one half, making the net benefit equal to $\alpha\left(\frac{1}{2}\right)(1+r) - 1$.

Since $M_{i=1}^L(\beta^L, \beta^{H^{**}})$ depends on α and r , their magnitudes determine the L -manager's equilibrium strategy. If a high share price is sufficiently unimportant to the manager or if successful investment has sufficiently low profitability, then the L -manager behaves efficiently and refrains from investment. In Figure 1, this happens if α or r is small enough to push the net benefit curve down so far that the left-hand intercept falls below zero, i.e., if $\alpha(1+r) \leq 1$. At the other extreme, if the share price concern is sufficiently strong and successful investment is sufficiently profitable, then the L -manager ignores her information completely and invests with certainty. In Figure 1, this happens if α and r are large enough to push the net benefit curve up so far that the right-hand intercept exceeds zero, i.e., if $\alpha(1+r) \geq 2$. Finally, for intermediate levels of share-price concern and potential investment profitability, the L -manager plays a not-fully-inefficient mixed strategy of investing with a positive probability that leaves her indifferent between her two alternatives:

$$\begin{aligned} M_{i=1}^L(\beta^{L^*}, \beta^{H^{**}}) &= 0 \\ \Leftrightarrow \beta^{L^*} &= \alpha(1+r) - 1 \end{aligned}$$

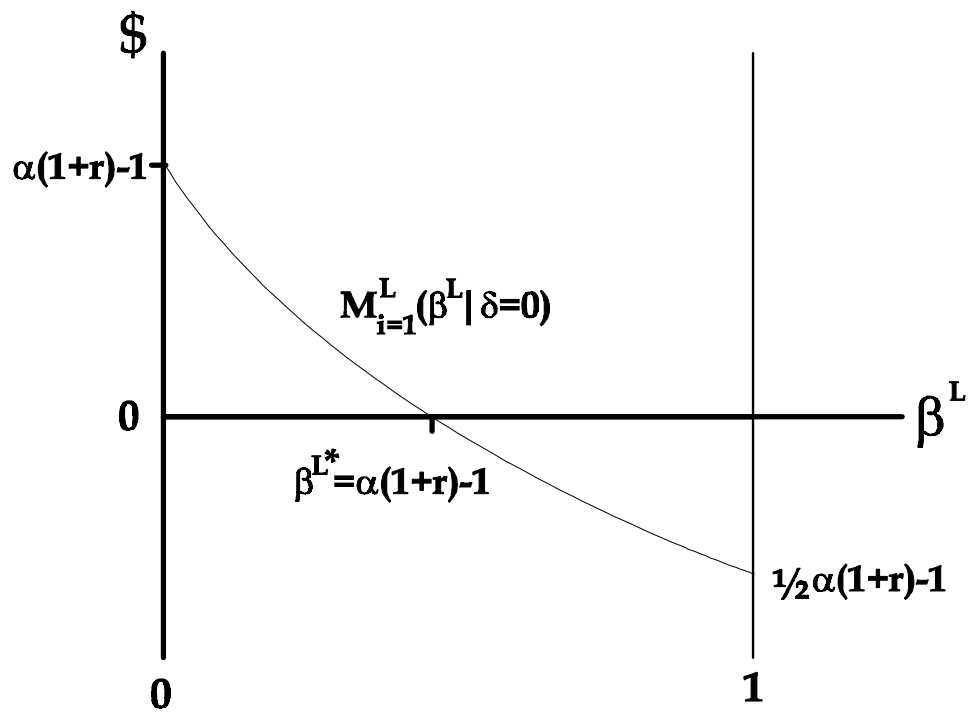


Figure 1: The L -manager's expected net benefit from investment without informed stock market trading.

This intermediate case is depicted in Figure 1. It happens if α and r are large enough so that the left-hand intercept is above zero, but one of them is small enough so that the right-hand intercept is below zero, i.e., if $\alpha(1+r) \in (1, 2)$.

The possibly inefficient rational behavior on the part of the L -manager that was just derived along with the H -manager's efficient strategy of investing with certainty yields an *ex ante* expected payoff from the investment project that is equal to $E\{\pi(\beta^*)\} = \frac{1}{2}(r - \beta^{L*})$. Moreover, this strategy profile does indeed constitute an equilibrium because the H -manager has no incentive to deviate from her strategy. To see this, notice that when she invests inefficiently, the L -manager's net benefit from investing is non-negative. The corresponding net benefit for H -manager, who enjoys a positive rather than negative long-run profit, must therefore be strictly positive, making investment with certainty her unique rational choice. When the L -manager efficiently refrains from investment, then investment reveals perfectly that it is profitable. Therefore, the market value of a firm that invests must be equal to r , which makes the H -manager's net benefit from investment strictly positive.

The comparative statics analysis of the equilibrium confirms economic intuition. If the manager plays a mixed equilibrium strategy, then the extent to which investment is inefficient, β^{L*} , increases with both α and r . This is because an increase in α or r boosts the L -manager's benefit from hiding information from the stock market. To offset this heightened incentive to invest inefficiently, the L -manager must decrease the expected share price by increasing β^{L*} to garble the stock market's inference after seeing investment. For the same reason, the expected payoff also decreases with α if a mixed strategy is used by the L -manager. But the expected payoff always increases with r . This is because even though more profitable investment gives the L -manager a stronger incentive to invest inefficiently, the H -manager wastes none of the added potential profit, so the net effect on realized profit is positive. This analysis of the equilibrium in the absence of informed trading is summarized in Proposition 1, with the omitted steps spelled out in the Appendix.

Proposition 1: Without informed trading, the manager invests efficiently when she knows that the project generates a profit. However, she invests inefficiently when she knows that the project generates a loss if her share-price concern is sufficiently strong and successful investment is sufficiently profitable. The extent of the inefficiency increases with the return from successful investment and with the manager's share price concern if the L -manager plays a mixed strategy. The *ex ante* expected equilibrium profit always increases with the return from successful investment and decreases with the manager's share-price concern if the L -manager plays a mixed strategy.

Proof: See Appendix.

2.3 Corporate Investment With Informed Trading

To illustrate how informed trading can enhance the stock market's ability to discipline the manager by providing it with information about corporate investment decisions, the informed investor will now be reintroduced into the model. From now on, it will therefore be assumed that $\delta \in (0, 1)$. Once again, derivation of the equilibrium starts from the end of the game with the trading in the stock market at the beginning of period two. Here there are two sub-games to consider. In the first one, the manager has chosen not to invest. This makes the informed trader's private information irrelevant: the firm's profit, and with it the ask- as well as the bid-price, are all deterministically equal to zero. In the second – and more interesting – sub-game, the manager has chosen to invest. The market maker can now extract information about the profitability of the investment not only from the manager's behavior, but from the trading patterns in the stock market as well.

The informed investor maximizes expected profit and therefore buys and sells the firm if she knows that the investment is profitable and unprofitable, respectively. As a consequence, the market maker faces an adverse-selection problem: if she sets the price equal to her own forecast of firm profit, then she can expect to lose money

every time she trades with the informed investor. To compensate for this, the market maker must increase the ask-price above and decrease the bid-price below her previous assessment of the firm's long-run profit so that she makes money when she trades with the liquidity traders. The market maker's zero-profit condition for trades in which she sells the firm looks as follows:

$$\delta \Pr(I = H|i = 1) [A_{i=1}^* - r] + (1 - \delta) \left(\frac{1}{2}\right) \{A_{i=1}^* - \mathbb{E}[\pi_{i=1}|i = 1]\} = 0$$

The first term represents the expected loss from trading with the informed trader and the second term the expected profit from trading with the noise traders. A few steps of algebra give the equilibrium ask-price, which reflects the market maker's rational expectation of the firm's future profits:

$$A_{i=1}^* = \left(\frac{\beta^H (1 + \delta)}{\beta^H (1 + \delta) + \beta^L (1 - \delta)}\right) (1 + r) - 1 = \mathbb{E}[\pi_{i=1}|i = 1, x = 1]$$

The corresponding zero-profit condition for trades in which the market maker buys the firm yields the equilibrium bid-price:

$$\begin{aligned} \delta \Pr(I = L|i = 1) [(-1) - B_{i=1}^*] + (1 - \delta) \left(\frac{1}{2}\right) \{\mathbb{E}[\pi_{i=1}|i = 1] - B_{i=1}^*\} &= 0 \Leftrightarrow \\ \Leftrightarrow B_{i=1}^* &= \left(\frac{\beta^H (1 - \delta)}{\beta^H (1 - \delta) + \beta^L (1 + \delta)}\right) (1 + r) - 1 = \mathbb{E}[\pi_{i=1}|i = 1, x = -1] \end{aligned}$$

There are several things worth noticing about these equilibrium prices.⁷ First, if the manager's behavior is perfectly revealing so that the market maker already knows the profitability of investment for sure, i.e., if $\beta^H = 1$ and $\beta^L = 0$, then informed trading does not matter and $A_{i=1}^* = B_{i=1}^* = \mathbb{E}[\pi_{i=1}|i = 1] = r$. Second, both prices are continuous in the extent of informed trading, δ , and collapse on the expected investment profit without informed trading if $\delta = 0$. Finally, $A_{i=1}^*$ is increasing in δ , while $B_{i=1}^*$ is decreasing in δ . This is the key observation about the stock market equilibrium: informed trading increases the ask-price and decreases the

⁷They are, in fact, equilibrium prices because they make it rational for the informed investor to pursue the assumed trading strategy of buying and selling the firm when the investment project is profitable and unprofitable, respectively. The details of that argument is relegated to the Appendix.

bid-price because the informed trader's systematic use of her superior knowledge makes demand for stocks and bonds good and bad news, respectively, about the firm's future profits.

Given the subsequent stock-market equilibrium, consider the manager's investment decision in the first period. The main point of the paper is that the leakage of her private information by the informed investor strengthens the manager's incentive to invest efficiently. As a consequence, the presence of informed individual traders in the stock market weakly enhances the efficiency of corporate investment.

It is through the share price that can be expected after investment that the introduction of informed trading affects the manager's decision. Without informed trading the expected share price is independent of the manager's information. By contrast, with informed trading the expected share price is higher for the H -manager than for the L -manager: since the informed investor buys the firm in the high state, but sells it in the low state, the transaction price is more likely to be the higher ask-price in the high state and the lower bid-price in the low state. The higher expected market value of the firm increases the H -manager's expected net benefit from investing. Since she invested efficiently without informed trading, she will continue to do so with informed trading as well. By contrast, the L -manager's benefit from investing falls with the lower expected share price.

This is illustrated in Figure 2, which, just as Figure 1, graphs the L -manager's net benefit from investing as a function of her own strategy, given that the H -manager behaves efficiently. The prospect of having the informed investor reveal part of her private information shifts the net benefit curve down, except when there is no private information because the L -manager's behavior is perfectly revealing, i.e., at the left-hand intercept where $\beta^L = 0$. Naturally, this downward shift increases with δ because less trading noise allows the market maker to extract more of the manager's information from the informed investor.

The subsequent transfer of her information to the stock market by the informed trader obviously cannot affect the manager's behavior if α or r is so small that

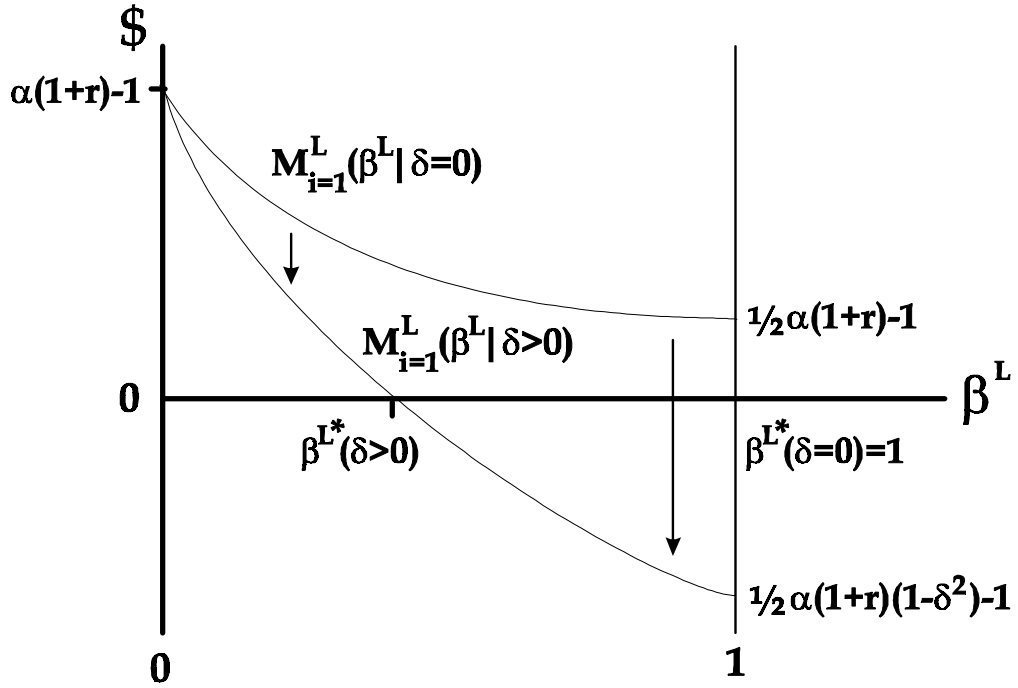


Figure 2: The L -manager's expected net benefit from investment with informed stock market trading.

investment is efficient even in the absence of informed trading. Moreover, it also leaves the L -manager's decision-making unchanged if α and r are so large and δ is so small that she plays a perfectly pooling, fully inefficient equilibrium, i.e., $\beta^{L^*} = 1$, even in the presence of informed trading. But for intermediate values of α and r and sufficiently large values of δ , informed trading on the manager's information induces a more efficient production decision, either by making an otherwise pooling manager mix – the case illustrated in Figure 2 – or by making an otherwise mixing manager put more weight on the efficient action "Do not invest." As without informed trading, the expected profit from investment is equal to $E\{\pi(\beta^*)\} = \frac{1}{2}(r - \beta^{L^*})$. The equilibrium with informed trading is formally stated and derived in Proposition 2.

Proposition 2: An informed trader buys the firm when she knows that the investment is profitable and sells the firm when she knows that it is unprofitable. This increases the ask-price and decreases the bid-price compared to the case of no informed trading. As a consequence, the introduction of informed trading makes investment weakly more, but not first-best, efficient. If investment is inefficient in its absence, then the introduction of informed trading makes investment strictly more efficient if the level of trading noise is sufficiently low, and the manager's share price concern is sufficiently weak or the profitability of successful investment is sufficiently low.

Proof: See Appendix.

Proposition 3 provides the comparative statics analysis on the equilibrium with informed trading. The efficiency of investment is affected by changes in the environment only if the L -manager's behavior is responsive to such changes because she plays a mixed strategy. If this is the case, then a stronger share-price concern or a higher investment profit makes investment behavior less efficient, just as without any informed trading. By contrast, more informative trading, i.e., a higher δ , of course

weakens the manager's benefit from concealing information and makes investment behavior more efficient.

The introduction of informed trading does not change the qualitative dependence of the *ex ante* expected profit from investment on r and α : a higher potential investment payoff always increases the expected profit, whereas a stronger share price concern decreases it to the extent that such a change makes investment more inefficient. More informative trading increases the expected investment profit if it makes investment more efficient.

The informed investor's *ex ante* expected speculative profit if she gets to trade, S^* , is an economically important variable because it provides a measure of the profit motive of individual traders to acquire the private information that is the focus of this paper. S^* decreases with δ : not only is there less noise to conceal the informed investor's trading, but the manager is weakly induced to reveal more information as well. Moreover, S^* increases with r : not only is a given amount of information more valuable, but the manager is weakly induced to conceal more of it as well. Economically most significant is that in a partially separating equilibrium where the L -manager plays a mixed strategy, the *ex ante* expected speculative profit increases with α through its effect on β^{L^*} : less efficient investment hides more of the manager's private information, leaving more of it for informed investors to use for speculative trading. Inefficient investment from managerial myopia therefore provides an incentive for traders to collect and trade on the information that the manager is trying to hide from the stock market. In this sense, informed stock market trading serves as an automatic partial corrective mechanism for the problem of managerial myopia: the manager's attempt to hide bad news from the stock market prompts individual stock market traders to thwart her effort to do so by collecting and trading on her private information.

Proposition 3: The extent of inefficient investment, β^{L^*} , is weakly increasing in α and r and weakly decreasing in δ , and strictly so if $\beta^{L^*} \in (0, 1)$. The *ex ante* expected profit from investment, $E\{\pi(\beta^*)\}$, is strictly increasing in r . It is weakly

decreasing in α and weakly increasing in δ , and strictly so if $\beta^{L^*} \in (0, 1)$. The *ex ante* expected profit from informed trading, S^* , is strictly decreasing in δ and strictly increasing in r . It is weakly increasing in α , and strictly so if $\beta^{L^*} \in (0, 1)$.

Proof: See Appendix.

3 Discussion

3.1 Results

In this paper, I have extended the standard analysis of the implications of managerial myopia under asymmetric information to allow the stock market's information to be influenced by individual traders with private information about the firm's decision-making. I have confirmed the intuition that these traders can contribute to the stock market's ability to discipline corporate management. This echoes the standard results in the rational-expectations literature that informed trading enhances economic efficiency through the dissemination and aggregation of information. However, in the context considered here, better stock market information does more than allow for a more efficient allocation of resources across different investment alternatives; it also improves how investment alternatives are managed because it enables the stock market to provide more effective managerial incentives.

Even though the presence of private information in the hands of stock market traders was taken as exogenous in the model analyzed here, it should be considered the outcome of a rational choice. If information collection were endogenized in this way, the extent to which individual traders have private information that can enhance stock-market incentives would depend on their costs and benefits of collecting and trading on different competing types of information about corporate decisions. Hence, when managers care about the short-term stock market valuations of their firms, the efficiency of corporate decisions will in general depend on the preferences of the individual investors that trade in the market. This observation may be relevant for two important economic problems.

The first of these issues is the design of managerial incentive contracts. Such a contract must take as its point of departure the manager's naked costs and benefits of different choices. In the standard principal-agent setup, these are determined primarily by technology and managerial preferences, so information about those features of the economic environment are necessary inputs into the contract. But these information requirements are likely to be much more stringent if individual stock market traders influence the manager's costs and benefits of different choices. In particular, a contract that must work in conjunction with incentives provided by the stock market will in general depend on the extent to which trading in the stock market is informed – parametrized by δ in the model – which, in turn, is determined by the preferences of those who trade. Hence, the contract now requires knowledge of any aspect of the preferences of the entire population of potential stock market traders that might affect their willingness to collect the relevant information about the firm's decision-making. Needless to say, this is a formidable demand on the information needed to construct the contract. One way to get around it is to devise a contract that induces the manager to reveal her private information completely and therefore leaves no role for stock market incentives to influence corporate decisions. However, it seems likely that in many situations there are competing considerations that would prevent such a perfect contractual solution, and when this is the case, the informational requirements on the contract design problem will be dramatically tightened if individual traders can collect private information at a cost.

The second question where the efficiency-relevance of information collection may be of consequence concerns whether a short-term orientation among stock market traders can lead to inefficient corporate investment. Claims to this effect by practitioners and policy-makers has, for the most part, left academic economists unimpressed because the precise connection between short-termist investor preferences and inefficient corporate behavior has remained unclear.⁸ However, the results

⁸ Arguments for investor short-sightedness having negative effects on corporate investment can be found in Jacobs (1991) and Porter (1992). Typical counter-arguments are provided by Kaplan (1994), Kaplan and Ramseyer (1996), and Marsh (1992).

in this paper point to what one such link might look like. I have established that anything in investor preferences that influences their trade-off between different types of information may affect the efficiency of corporate investment decisions. Therefore, investor time-preferences could matter to corporate investment to the extent that they influence individual investors' decisions about what information to gather and trade on. And, indeed, Froot, Scharfstein, and Stein (1992) show that a preference for short-term speculative profits may bias this choice towards information about short-lived uncertainty. By shunning information about long-run investment alternatives, short-sighted stock market traders might therefore leave the stock market ill-informed about them. Hence, in light of the model developed here, it is not inconceivable that because they choose to collect and trade on information that make for better stock-market incentives, long-sighted investors enhance the efficiency of corporate investment more than their short-sighted counterparts do.

The results presented here may also have something to say about the pros and cons of insider trading. Implicitly, the model assumes that the informed trader who helps discipline management is a corporate outsider who does not participate in the decision-making of the firm. Another possibility, of course, is that the informed trader is an insider, effectively the manager herself. Could such insider trading replicate the results from the model and produce more efficient corporate decisions? In general, giving a myopic corporate manager the opportunity to trade in the stock market has the advantage of providing her with a channel other than her efficiency-relevant investment decision through which she can communicate her information to the market. Moreover, if she cares enough about earning speculative profits compared to achieving a high market valuation of the firm in the short run, then she would prefer to reveal her information through trading to concealing it through inefficient investment. The important caveat to this argument that the model studied in this paper suggests is that an opportunity to trade at the wrong time might actually distort investment further. If the trade were to take place before the investment decision, then the manager's profit motive should lead her to communicate some of

her information to the stock market and make her subsequent investment decision more efficient. But if the trade were to take place after the investment decision, then the possibility of earning speculative profits on private information could strengthen the manager's incentive to invest inefficiently in order to hide information from the stock market. Therefore, the timing of the manager's trading opportunity relative to her investment decision seems important to the benefits and costs of insider trading in the face of managerial myopia.

3.2 Assumptions

The model is strikingly simple, so it is natural to wonder which features are essential for the results. Many of the specific assumption are merely heuristic and the results go through even if they are relaxed. For example, rather than making a choice between investing or not, the manager could choose between different investment projects as in Brandenburger and Polak (1996). The assumption that there are only two alternatives from which the manager can choose is also unimportant. With more than two investment alternatives, there would be the same incentive to choose the stock market's favorite one in an attempt to avoid that disappointing news comes out. That the investment project is indivisible is not restrictive either since investing in less than the full project would never be used in equilibrium.⁹

As for the information structure, the private information could include noise and vary across the manager and the informed trader as long as the signals of the two agents were correlated with the true state of the world. It is also unlikely that the conclusions depend on the specific choice of model of stock market trading. For the economic argument to go through, it suffices that trading in the stock market impounds some of the informed investor's private information into the price of the firm while still allowing her to make a strictly positive expected profit, both features that are standard in noisy rational expectations models.

⁹If the *H*-manager invests fully, which she will in equilibrium, then partial investment by the *L*-manager reveals that investment generates a loss, giving her a strictly negative payoff. Therefore, the *L*-manager would rather not invest than invest partially.

There are, however, two assumptions that do drive the results. First, the manager must know more than the stock market about the investment decision. Given her position as expert inside the firm, this assumption seems to be the natural one. Second, the manager must care not only about the firm's long-run profit, but about its short-term valuation in the stock market as well. Four standard motivations have been proposed for the presence of such managerial myopia. First, a high share price can be a means of deterring hostile takeovers (Stein 1988). Second, a high share price makes it cheaper to raise new equity capital. Third, if the manager is separated from the firm, the labor market may use the share price to infer the value of her human capital (Giannetti 2003; Jeon 1998; Narayanan 1985; Palley 1997). Finally, the short-run share price can be used as a proxy for overall firm performance in a managerial incentive contract.¹⁰ Garvey, Grant, and King (1999) demonstrate that this may be optimal if the manager can trade in the stock market. This is because the possibility of selling shares affords the manager with a means to escape the risk-exposure of stock compensation. But if she were to avail herself of this opportunity, her incentives would also be diluted and the firm's profits lowered. The shareholders therefore want to discourage the manager from selling out, and short-run share price compensation accomplishes this because it exposes the manager to the decrease in expected profit that a sale of her shares would give rise to.

4 Conclusion

This research has shown that individual investors may enhance the efficiency of corporate investment decisions in the face of managerial myopia by providing the

¹⁰Several authors have studied the opposite problem, i.e., how managerial incentive contracts instead can be used to neutralize existing managerial myopia. Not surprisingly, to counter managerial short-sightedness, contracts should try to defer profit-based compensation – through restricted stocks or stock options, for example – in order to make the manager more concerned with the long-run performance of the firm (see, for example, Bizjak, Brickley, and Coles 1993, Darrrough 1987, Giannetti 2003, and Hagerty, Ofer, and Siegel 1993). However, there may be limits to the use of this approach because pushing compensation forward in time may violate a managerial limited-liability constraint in the short run (Campbell and Marino 1994).

stock market with missing information about the manager's decisions. Such an improvement of stock market incentives can be achieved when the informed investors constitute a sufficiently strong market presence and when the manager's incentive to invest inefficiently is neither too strong nor too weak. Moreover, a more pronounced managerial share-price concern strengthens the incentive in the form of expected speculative profits for individual traders to expend resources to become informed and undo the problems of managerial myopia. In addition to what the analysis formally demonstrates, it also suggests ramifications for the design of explicit incentive contracts, for the role of investor time-preferences in providing stock market incentives, and for the costs and benefits of insider trading. However, the formal analyses of these issues cannot fit comfortably within the current study and are therefore left for future research.

Appendix

The appendix contains the proofs of the propositions to the extent that they were omitted in the text.

Proof of Proposition 1: It remains to be shown that the equilibrium is unique. No other equilibrium in which $\beta^{H^*} = 1$ exists because the L -manager's net benefit from investing given $\beta^{H^*} = 1$ is strictly decreasing in β^L . Furthermore, if both types invest, then the L -manager's net benefit from doing so is strictly smaller than that of the H -manager. This implies that no equilibria exist in which $\beta^{L^*} > 0$ and $\beta^{H^*} < 1$. And $\beta^{L^*} = 0$ and $\beta^{H^*} \in (0, 1)$ cannot be an equilibrium either because it would allow investment to reveal perfectly that it is profitable and thus make the H -manager strictly prefer investment over abandonment.

The only remaining possibility is a perfectly pooling equilibrium in which $\beta^{L^*} = \beta^{H^*} = 0$, but it is eliminated if out-of-equilibrium beliefs are refined using universal divinity. For a manager with information I , the expected net payoff from deviating from the proposed equilibrium strategy and instead pursuing the investment project looks as follows:

$$M_{i=1}^I = \mathbf{E} \{ \alpha p_{i=1}^* + (1 - \alpha) \pi_{i=1}^I | I \} = \alpha \mathbf{E} [\pi_{i=1} | i = 1] + (1 - \alpha) \pi_{i=1}^I$$

Since $\pi_{i=1}^H > \pi_{i=1}^L$, the set of market maker responses in the form of a profit forecast that provokes deviation is strictly greater for the H -manager than for the L -manager, which means that under universal divinity the only admissible interpretation of the deviation on the part of the market maker is that it was made by the H -manager. After observing deviation, the market maker must therefore believe that the probability that the investment is profitable is equal to one, so that $\mathbf{E}[\pi_{i=1} | i = 1] = \pi_{i=1}^H = r$. But this makes the H -manager's expected payoff from investment equal to $r > 0$, so that it is no longer sequentially rational for her to play the proposed equilibrium strategy. *Q.E.D*

Proof of Proposition 2: For the stock market equilibrium it remains to be shown that the informed investor has no incentive to deviate. Notice that stock market trading is noisy, so unless the manager's investment decision is perfectly revealing, the ask- and bid-price are both strictly lower than the profit in the high state, r , and strictly higher than the profit in the low state, -1 . This implies that for the H -type investor the expected profit is always strictly positive when buying the firm and strictly negative when selling the firm, and vice versa for the L -type investor. Hence, the proposed equilibrium strategies are strictly dominant strategies, so the equilibrium is unique (unless the manager's investment decision completely reveals the private information, in which case the informed investor is indifferent between all her trading strategies).

Turn next to the L -manager's investment decision. Given the equilibrium ask- and bid-price, she expects a price in the stock market that looks as follows:

$$\begin{aligned} \mathbb{E} [p_{i=1}^* (\beta^L) | L] &= \Pr(x = 1|L) A_{i=1}^* (\beta^L) + \Pr(x = -1|L) B_{i=1}^* (\beta^L) = \\ &= \left(\frac{1 - \delta}{2} \right) \left\{ \left(\frac{\beta^H (1 + \delta)}{\beta^H (1 + \delta) + \beta^L (1 - \delta)} \right) (1 + r) - 1 \right\} + \\ &+ \left(\frac{1 + \delta}{2} \right) \left\{ \left(\frac{\beta^H (1 - \delta)}{\beta^H (1 - \delta) + \beta^L (1 + \delta)} \right) (1 + r) - 1 \right\} = \\ &= \left\{ \frac{(1 - \delta^2) \beta^H (\beta^H + \beta^L)}{(\beta^H + \beta^L)^2 - \delta^2 (\beta^H - \beta^L)^2} \right\} (1 + r) - 1 \end{aligned}$$

This makes her expected net benefit from investing equal to

$$\begin{aligned} M_{i=1}^L (\beta^L) &= \alpha \{ \mathbb{E} [p_{i=1}^* (\beta^L) | L] - \pi_{i=1}^L \} + \pi_{i=1}^L = \\ &= \alpha \left\{ \frac{(1 - \delta^2) \beta^H (\beta^H + \beta^L)}{(\beta^H + \beta^L)^2 - \delta^2 (\beta^H - \beta^L)^2} \right\} (1 + r) - 1 \end{aligned}$$

Assume for the time being that the H -manager invests efficiently, i.e., that $\beta^H =$

1. The L -manager's expected net benefit from investing then simplifies to

$$M_{i=1}^L (\beta^L) = \alpha \left\{ \frac{(1 - \delta^2) (1 + \beta^L)}{(1 + \beta^L)^2 - \delta^2 (1 - \beta^L)^2} \right\} (1 + r) - 1$$

$\beta^L = 0$ is rational for the L -manager if it gives her a non-positive net benefit from investing:

$$M_{i=1}^L(\beta^L) \leq 0 \Leftrightarrow \alpha(1+r) \leq 1$$

$\beta^{L*} = 1$ is rational for the L -manager if it gives her a non-negative net benefit from investing:

$$M_{i=1}^L(\beta^L) \geq 0 \Leftrightarrow \alpha(1+r) \geq 2 \left(\frac{1}{1-\delta^2} \right)$$

Hence, the part of the (α, r) parameter space that allows a fully inefficient perfectly pooling investment equilibrium is strictly smaller with informed trading than without it.

Finally, $\beta^{L*} \in (0, 1)$ is rational for the L -manager if $\alpha(1+r) \in \left(1, 2 \left(\frac{1}{1-\delta^2}\right)\right)$, which implies that neither of the pure strategies are rational. Furthermore, the L -manager's expected net benefit from investment is strictly decreasing in β^L :

$$\begin{aligned} \frac{\partial M_{i=1}^L}{\partial \beta^L} &= \\ &= -\alpha \left\{ \frac{(1-\delta^2) \left[(1+\beta^L)^2 + \delta^2(1-\beta^L)(3+\beta^L) \right]}{\left[(1+\beta^L)^2 - \delta^2(1-\beta^L)^2 \right]^2} \right\} (1+r) < 0 \end{aligned}$$

It therefore follows that $\beta^{L*} \in (0, 1)$ is unique and defined by the indifference condition:

$$M_{i=1}^L(\beta^L) = 0 \Leftrightarrow \left\{ \frac{(1-\delta^2)(1+\beta^L)}{(1+\beta^L)^2 - \delta^2(1-\beta^L)^2} \right\} \alpha(1+r) - 1 = 0$$

Notice that the L -manager's expected net benefit from investment is continuous and strictly decreasing in δ :

$$\frac{\partial M_{i=1}^L}{\partial \delta} = -\alpha \left\{ \frac{8\delta\beta^L(1+\beta^L)}{\left[(1+\beta^L)^2 - \delta^2(1-\beta^L)^2 \right]^2} \right\} (1+r) < 0$$

The Implicit Function Theorem therefore implies that the mixed strategy β^{L*} is smaller with informed trading than without it.

The H -manager has no incentive to deviate from her assumed first-best efficient investment strategy. If the L -manager does not invest, then investment is perfectly revealing so that the H -manager's expected net benefit from investing is equal to the long-run expected profit from investment, $r > 0$. If the L -manager does invest, then her expected net benefit from doing so must be non-negative. But this implies that the H -manager's net benefit from investment is strictly positive because she enjoys a long-run profit that is positive rather than negative and an expected stock market price that puts more weight on the higher ask-price and less weight on the lower bid-price:

$$\begin{aligned} \mathbb{E}[p_{i=1}^*|H] &= \Pr(x = 1|H) A_{i=1}^* + \Pr(x = -1|H) B_{i=1}^* = \\ &= \left\{ \left(\frac{1+\delta}{2} \right) A_{i=1}^* + \left(\frac{1-\delta}{2} \right) B_{i=1}^* \right\} (1+r) - 1 \end{aligned}$$

Again, by the same argument as in Proposition 1, the managerial equilibrium is unique if universal divinity is used to restrict out-of-equilibrium beliefs.

Finally, consider the informed investor's *ex ante* expected profit given her private information:

$$\begin{aligned} S^* &= \frac{\Pr(I = H) S^{H^*} + \Pr(I = L) S^{L^*}}{\delta} = \left(\frac{1}{2\delta} \right) [S^{H^*} + S^{L^*}] = \\ &= \left(\frac{1}{2\delta} \right) \left\{ \delta\beta^{H^*} [r - A_{i=1}^*] - \delta\beta^{L^*} [(-1) - B_{i=1}^*] \right\} = \\ &= \left(\frac{1}{2} \right) \beta^{H^*} \left(\frac{\beta^{L^*} (1+\delta)}{\beta^{H^*} (1+\delta) + \beta^{L^*} (1-\delta)} \right) (1+r) + \\ &+ \left(\frac{1}{2} \right) \beta^{L^*} \left(\frac{\beta^{H^*} (1-\delta)}{\beta^{H^*} (1-\delta) + \beta^{L^*} (1+\delta)} \right) (1+r) = \\ &= \left(\frac{1-\delta}{2} \right) \left(\frac{2\beta^{L^*} (1+\beta^{L^*})}{(1+\beta^{L^*})^2 - \delta^2 (1-\beta^{L^*})^2} \right) (1+r) \end{aligned}$$

Q.E.D

Proof of Proposition 3: β^{L^*} is implicitly defined by the indifference condition

$$M_{i=1}^L(\beta^L) = 0 \Leftrightarrow \left\{ \frac{(1-\delta^2)(1+\beta^L)}{(1+\beta^L)^2 - \delta^2(1-\beta^L)^2} \right\} \alpha(1+r) - 1 = 0$$

It has already been established that the expected net benefit on the left-hand side is strictly decreasing in β^L and δ . Its other partial derivatives look as follows:

$$\frac{\partial M_{i=1}^L}{\partial r} = \alpha \left\{ \frac{(1-\delta^2)(1+\beta^L)}{(1+\beta^L)^2 - \delta^2(1-\beta^L)^2} \right\} > 0$$

$$\frac{\partial M_{i=1}^L}{\partial \alpha} = \left\{ \frac{(1-\delta^2)(1+\beta^L)}{(1+\beta^L)^2 - \delta^2(1-\beta^L)^2} \right\} (1+r) > 0$$

The statements about β^{L*} and $E\{\pi(\beta^*)\}$ now follow from the Implicit Function Theorem and from the fact that $\frac{\partial E M_{i=1}^L}{\partial r} < 1$.

Finally, turn to the informed investor's *ex ante* expected average profit. It is strictly increasing in β^{L*} :

$$\begin{aligned} \frac{\partial S^*}{\partial \beta^{L*}} &= (1-\delta)(1+r) \frac{\partial}{\partial \beta^{L*}} \left\{ \left(\frac{\beta^{L*}(1+\beta^{L*})}{(1+\beta^{L*})^2 - \delta^2(1-\beta^{L*})^2} \right) \right\} = \\ &= (1-\delta)(1+r) \left\{ \frac{\left((1+\beta^{L*})^2 - \delta^2(1-\beta^{L*})(1+3\beta^{L*}) \right)}{\left[(1+\beta^{L*})^2 - \delta^2(1-\beta^{L*})^2 \right]^2} \right\} > \\ &> (1-\delta)(1+r) \left\{ \frac{\left((1+\beta^{L*})^2 - (1-\beta^{L*})(1+3\beta^{L*}) \right)}{\left[(1+\beta^{L*})^2 - \delta^2(1-\beta^{L*})^2 \right]^2} \right\} = \\ &= (1-\delta)(1+r) \left\{ \frac{4(\beta^{L*})^2}{\left[(1+\beta^{L*})^2 - \delta^2(1-\beta^{L*})^2 \right]^2} \right\} > 0 \end{aligned}$$

The derivatives of the informed investor's *ex ante* expected average profit consists of the direct effect and the indirect effect through the L -manager's equilibrium behavior:

$$\begin{aligned} \frac{dS^*}{d\delta} &= \frac{\partial S^*}{\partial \delta} + \frac{\partial S^*}{\partial \beta^{L*}} \frac{\partial \beta^{L*}}{\partial \delta} = \\ &= - \left\{ \frac{\beta^{L*}(1+\beta^{L*}) \left[(1+\beta^{L*})^2 - \delta(1-\beta^{L*})^2 \right]}{\left[(1+\beta^{L*})^2 - \delta^2(1-\beta^{L*})^2 \right]^2} \right\} (1+r) + \frac{\partial S^*}{\partial \beta^{L*}} \frac{\partial \beta^{L*}}{\partial \delta} < 0 \end{aligned}$$

$$\frac{dS^*}{dr} = \frac{\partial S^*}{\partial r} + \frac{\partial S^*}{\partial \beta^{L^*}} \frac{\partial \beta^{L^*}}{\partial r} = (1 - \delta) \left(\frac{\beta^{L^*} (1 + \beta^{L^*})}{(1 + \beta^{L^*})^2 - \delta^2 (1 - \beta^{L^*})^2} \right) + \frac{\partial S^*}{\partial \beta^{L^*}} \frac{\partial \beta^{L^*}}{\partial r} > 0$$

$$\frac{dS^*}{d\alpha} = \frac{\partial S^*}{\partial \alpha} + \frac{\partial S^*}{\partial \beta^{L^*}} \frac{\partial \beta^{L^*}}{\partial \alpha} = \frac{\partial S^*}{\partial \beta^{L^*}} \frac{\partial \beta^{L^*}}{\partial \alpha} \geq 0$$

Q.E.D.

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