Shareholder Short-termism, Corporate Control and Voluntary Disclosure

Online Appendix

1 Endogenous trading by shareholder

In the main model, we treat the shareholder's short-term incentive as exogenous and assume that the shareholder sells her shares with an exogenous probability η. In this section, we endogenize the shareholder's trading strategy. In particular, we assume that the shareholder holds $n \geq 2$ shares in the firm at $t = 3$. After the shareholder's intervention decision a, a market for trading the firm's shares opens at $t = 4$. Besides the shareholder, the market also includes a noise trader and a market maker. Adopting a binary trading structure as in Gao and Liang (2013), we model that the shareholder can either hold n shares or sell 1 share. We only allow the shareholder to sell but not buy in order to focus the analysis on the short-term incentive of the shareholder.[1] Such a trading restriction also represents the fact that it is costly for active shareholders to further buy shares once they are identified by the firm. This is because, on the one hand, the firm will closely monitor share purchases from the active shareholder; on the other hand, for a shareholder with more than 5% of voting shares, any material change in the amount or intent of ownership must be disclosed. The assumption that the shareholder will not further buy shares at $t = 4$ is also consistent with empirical evidence that the ownership of active shareholders is stable after their initial filing of activism (Gantchev, 2013).

We denote the shareholder's demand as $q_S \in \{-1, 0\}$, with $q_S = -1$ represents selling 1 share and $q_S = 0$ represents not trading and thus holding n shares. To prevent stock price from fully revealing the shareholder's private information, we assume that the noise trader may buy or sell 1 share, or not trade in the market. Hence, demand q_N from the noise trader is -1, 0 or 1 with equal probability. The market maker observes the total order flow $Q = q_S + q_N$, with $Q \in \{-2, -1, 0, 1\}$, but cannot distinguish whether the demand is from the shareholder or is from the noise trader. Taking into account the manager's disclosure decision d, the shareholder's intervention decision a, and the total order flow Q, the market maker clears the market and sets the stock price P equal

[1] As will be clear from the following analysis, allowing the shareholder to buy shares in the market can expand analyses that are not related to the short-term incentive of the shareholder. In particular, the option to buy shares will create another trading threshold in the shareholder's strategy where she is indifferent between holding and buying shares. This additional trading threshold will then expand the number of possible total order flows and thus the number of potential stock prices. But it will not qualitatively change the manager's voluntary disclosure decision, as the voluntary disclosure strategy only directly depends on the intervention threshold.

to the expected liquidation value:

$$P(d, a, Q) = E[V|d, a, Q], \tag{1}$$

where $V = a \cdot \mu + (1 - a) \cdot v$.

The shareholder's utility consists of payoffs from trading shares and liquidation payoffs from the shares she holds, which equals

$$U_S(a, q_S) = -q_S P + (n + q_S)V. \tag{2}$$

She maximizes her utility U_S when determining the intervention and trading strategies. In this setting, we denote the short-term incentive of the shareholder by the fraction $\frac{1}{n}$ of the shares she can sell in the short-term. As $n \to \infty$, the short-term incentive of the shareholder goes to zero. We assume that $\gamma \in [0, 1]$ so that the manager cares about both the stock price and the liquidation value. This allows us to show that adding shareholder trading does not qualitatively change our results in the more general setting with managerial myopia. The rest of the model stays the same as our main setting.

We again solve the model by backward induction, first deriving the shareholder's trading and intervention strategies, then the manager's disclosure strategy.

For the shareholder's trading strategy, given her intervention decision, the shareholder decides to hold or sell shares by comparing the expected trading payoffs and the expected liquidation payoffs. When the shareholder does not intervene, the liquidation value is determined by the current firm value v. The market maker prices the firm by inferring the value of v from the manager's disclosure strategy, that is

$$P(d, 0, Q) = E[v|d]. \tag{3}$$

As the shareholder has no information advantage about the current firm value v, the total order flow Q provides no information to the market maker, rendering the stock price P independent of Q. The stock price P is the same as the shareholder's expectation of the liquidation value. The shareholder is thus indifferent between holding or selling shares in the market.

When the shareholder intervenes, the liquidation value is determined by the alternative firm value μ. While the shareholder privately observes μ, the market maker only imperfectly infers the value of μ from the total order flow Q. When the shareholder sells 1 share, the total order flow Q can be 0, -1, or -2 with equal probability. When the shareholder holds n shares and does not trade, the total order flow Q can be 1, 0, or -1 with equal probability. Therefore, when $Q = -2$, the market maker knows that the shareholder has sold 1 share. Observing $Q = 1$, the market maker knows that the shareholder hasn't traded her shares. Lastly, when $Q \in \{-1, 0\}$, the total order flow provides no information about the alternative firm value μ. The corresponding stock prices are summarized below.

$$P(d, 1, -2) = E[\mu | d, a = 1, q_S = -1], \tag{4}$$

$$P(d, 1, 1) = E[\mu | d, a = 1, q_S = 0], \tag{5}$$

$$P(d, 1, -1) = P(d, 1, 0) = \tfrac{1}{2} \left[P(d, 1, -2) + P(d, 1, 1) \right]. \tag{6}$$

Based on the above stock prices, we can compare the shareholder's expected utility and derive her trading strategy. When the shareholder intervenes and sells 1 share, her expected utility equals

$$\begin{aligned} E[U_S(a = 1, q_S = -1) | \mu, d, a = 1, q_S = -1] =& \tfrac{1}{3} \left[P(d, 1, 0) + P(d, 1, -1) + P(d, 1, -2) \right] \\ &+ (n-1)\mu, \end{aligned}$$

whereas when she intervenes and holds n shares, her expected utility equals

$$E[U_S(a = 1, q_S = 0) | \mu, d, a = 1, q_S = 0] = n\mu.$$

Note that irrespective of the shareholder's trading strategy, her expected utility from intervention increases with μ.

The shareholder will sell rather than not trade her shares if and only if

$$E[U_S(a = 1, q_S = -1) | \mu, d, a = 1, q_S = -1] > E[U_S(a = 1, q_S = 0) | \mu, d, a = 1, q_S = 0].$$

Replacing the corresponding expected utility expressions yields that the shareholder will intervene and sell 1 share if and only if

$$P(d,1,0)+P(d,1,-1)+P(d,1,-2)>3\mu. \tag{7}$$

While the right hand side of the above inequality increases with μ, stock prices $P(d,1,0)$, $P(d,1,-1)$, and $P(d,1,-2)$ on the left hand side are determined by the market maker's expectation of μ. It is thus straightforward to show that when $\mu=0$, inequality (7) always holds, whereas when $\mu=\bar{\mu}$, inequality (7) never holds. Therefore, there exists a unique threshold $\mu_t'(d)$, below which the shareholder chooses to intervene and sell 1 share, and above which the shareholder intervenes, but doesn't trade. For $\mu=\mu_t'(d)$, the shareholder is indifferent between selling and not trading shares in the market, that is,

$$E[P(d,1,Q)|a=1,q_S=-1]+(n-1)\mu_t'(d)=n\mu_t'(d).$$

We name $\mu_t'(d)$ as the trading threshold.

Next, we analyse the shareholder's intervention strategy. Without intervention, the shareholder is indifferent between holding and selling shares, leading to her expected utility

$$E[U_S(a=0,q_S)|a=0,q_S]=nE[v|d], \tag{8}$$

which is independent of μ. In equilibrium, the shareholder chooses not to intervene if and only if it leads to a higher expected utility, that is,

$$E[U_S(a=0,q_S)|a=0,q_S]>E[U_S(a=1,q_S=-1)|\mu,d,a=1,q_S=-1], \tag{9}$$

and

$$E[U_S(a=0,q_S)|a=0,q_S]>E[U_S(a=1,q_S=0)|\mu,d,a=1,q_S=0]. \tag{10}$$

Analysis of the trading strategy indicates that for $\mu<\mu_t'(d)$, selling rather than holding shares gives the shareholder a higher expected utility. Therefore, for $\mu<\mu_t'(d)$, inequality (9) is a sufficient condition to ensure that the shareholder chooses not to intervene in the firm. This inequality always holds when $\mu = 0$.[2] Moreover, given that $E[U_S(a = 0, q_S)|a = 0, q_S]$ is independent of μ and $E[U_S(a = 1, q_S = -1)|\mu, d, a = 1, q_S = -1]$ increases with μ, we can show that there exists a unique threshold $\mu_t^*(d)$, below which the shareholder chooses not to intervene in the firm and above which the shareholder intervenes. When $\mu = \mu_t^*(d)$, the shareholder is indifferent between not intervening versus intervening and selling 1 share in the market, that is

$$E[P(d, 1, Q)|a = 1, q_S = -1] + (n-1)\mu_t^*(d) = nE[v|d].$$

We label $\mu_t^*(d)$ as the intervention threshold. As when the shareholder intervenes, her expected utility increases with μ. It implies that the shareholder is better off intervening than not intervening for all $\mu_t^*(d) \leq \mu \leq \bar{\mu}$.

Lastly, comparing the indifference conditions at $\mu_t^*(d)$ and $\mu_t'(d)$, one can infer that the intervention threshold $\mu_t^*(d)$ is lower than the trading threshold $\mu_t'(d)$. In particular, at $\mu = \mu_t^*(d)$, the shareholder is indifferent between not intervening and intervening followed by selling 1 share. At $\mu = \mu_t'(d)$, the shareholder is indifferent between the strategy of intervening and selling 1 share, and the strategy of intervening and holding shares. As the shareholder's expected utility from intervention increases with μ, it holds that $\mu_t^*(d) < \mu_t'(d)$. We summarize the shareholder's intervention and trading strategies below.

Lemma 1 *(Intervention and trading strategies) Given the manager's disclosure decision d, the shareholder does not intervene when $\mu \in [0, \mu_t^*(d))$, the shareholder intervenes and sells 1 share when $\mu \in [\mu_t^*(d), \mu_t'(d))$, the shareholder intervenes and does not trade her shares when $\mu \in [\mu_t'(d), \bar{\mu}]$, with*

$$\mu_t^*(d) = (1 + \tfrac{2}{3}\omega)E[v|d] - \tfrac{2}{3}\omega\bar{\mu}, \tag{11}$$

$$\mu_t'(d) = \tfrac{3+2\omega}{5}E[v|d] + \tfrac{2(1-\omega)}{5}\bar{\mu}, \tag{12}$$

$$\omega = \tfrac{3}{5n-2}. \tag{13}$$

Compared to our main setting, the shareholder's intervention threshold has similar features.

[2] To see this, note that $E[v|d] > \frac{\bar{\mu}}{2}$. Together with $n \geq 2$, we have $nE[v|d] \geq \bar{\mu}$. As $P(d, 1, Q) < \bar{\mu}$, inequality (9) always holds when $\mu = 0$.

There is again inefficient intervention as $\mu_t^*(d) < E[v|d]$, that is, the shareholder intervenes even when the alternative firm value is lower than the expected current firm value. In this case, the incentive comes from the possibility of selling 1 share and profiting from the market pricing.

For the manager's disclosure strategy, given disclosure decision d, the manager's expected utility is a weighted average of the expected stock price and the expected liquidation value, that is,

$$\gamma E[P(v, a, Q)|d] + (1 - \gamma)E[V|d].$$

The expected liquidation value $E[V|d]$ depends on the shareholder's intervention strategy and thus equals

$$E[V|d] = Pr(\mu \geq \mu_t^*(d))E[\mu|d, a = 1] + Pr(\mu < \mu_t^*(d))v.$$

The expected stock price $E[P(v, a, Q)|d]$ depends on both the shareholder's intervention and trading strategies. The manager does not know the alternative firm value μ, but he correctly anticipates the shareholder's strategies. The manager knows that for $\mu \in [0, \mu_t^*(d))$, the shareholder will not intervene and the stock price will equal $E[v|d]$. For $\mu \in [\mu_t^*(d), \mu_t'(d))$, the shareholder will intervene and sell 1 share. In this case, the stock price can be $P(d, 1, -2)$, $P(d, 1, -1)$ or $P(d, 1, 0)$ with equal probability. For $\mu \in [\mu_t'(d), \bar{\mu}]$, the shareholder will intervene and hold her shares. Then the stock price can be $P(d, 1, -1)$, $P(d, 1, 0)$ or $P(d, 1, 1)$ with equal probability. Considering all the above possibilities, the manager expects that the stock price equals

$$\begin{aligned} E[P(v, a, Q)|d] =& Pr(\mu < \mu_t^*(d))E[v|d] \\ &+ Pr(\mu_t^*(d) \leq \mu < \mu_t'(d))\tfrac{1}{3}[P(d, 1, -2) + P(d, 1, -1) + P(d, 1, 0)] \\ &+ Pr(\mu_t'(d) \leq \mu < \bar{\mu})\tfrac{1}{3}[P(d, 1, -1) + P(d, 1, 0) + P(d, 1, 1)]. \end{aligned}$$

In equilibrium, the manager chooses to disclose if and only if his expected utility given disclosure is higher than no disclosure. We characterize the disclosure equilibrium in the Proposition below.

Proposition 1 *(Equilibrium) When the shareholder can trade her shares after intervention, there exists a threshold value of managerial myopia γ denoted by γ_t and a threshold value of shareholder short-termism λ denoted by λ_t such that*

1. *when* $\gamma \in (0, \gamma_t]$ *and* $\lambda \in [0, \lambda_t]$*, for current firm value* $v \in ND = (v_{t1}, v_{t2})$*, the informed manager does not disclose the current firm value* v*; for* $v \in [\underline{v}, v_{t1}] \cup [v_{t2}, \bar{v}]$*, the informed manager discloses* v*, with*

$$v_{t1} = \frac{\frac{1}{2}+\frac{\omega}{3}-\gamma}{\frac{1}{2}-\frac{\omega}{3}} v_{t2} - \frac{\frac{2}{3}\omega(1+\frac{2}{3}\omega-\gamma)}{(1+\frac{2}{3}\omega)(\frac{1}{2}-\frac{\omega}{3})}\bar{\mu}; \tag{14}$$

$$v_{t2} = E[v|ND]; \tag{15}$$

2. *otherwise, for* $v \in ND = [\underline{v}, v'_t)$*, the informed manager does not disclose the current firm value* v*; for* $v \in [v'_t, \bar{v}]$*, the informed manager discloses* v*, with* $v'_t = E[v|ND]$*;*

3. *for a given nondisclosure region* ND*, the market's and the shareholder's beliefs about* v *equal*

$$E[v|ND] = \frac{pPr(v \in ND)E[v|v \in ND]}{pPr(v \in ND)+1-p} + \frac{(1-p)E[v]}{pPr(v \in ND)+1-p}; \tag{16}$$

4. *the shareholder's intervention and trading strategies are as characterized in Lemma 1.*

Proposition 1 shows that adding the shareholder's trading strategy does not qualitatively change our disclosure equilibrium. The disclosure equilibrium remains two-tailed when both the manager and the shareholder are relatively long-term oriented, and an upper-tailed one otherwise. Intuitively, the possibility of selling shares has a similar impact on the shareholder's intervention strategy as the exogenous short-term incentive λ in the main model. Therefore, the manager's disclosure strategy is also similar to the main model.

Proof of Lemma 1

The shareholder's intervention and trading strategies are analysed in the paper. We now derive the intervention threshold $\mu_t^*(d)$ and the trading threshold $\mu'_t(d)$.

Given the manager's disclosure decision d, at the intervention threshold $\mu_t^*(d)$, the shareholder is indifferent between intervention followed by selling 1 share and no intervention, that is

$$E[P(d,1,Q)|a=1, q_S=-1] + (n-1)\mu_t^*(d) = nE[v|d]. \tag{17}$$

At the trading threshold μ'_t, the shareholder is indifferent between intervention, selling 1 share and intervention, not trading shares, that is

$$E[P(d,1,Q)|a=1,q_S=-1]+(n-1)\mu_t'(d)=n\mu_t'(d). \tag{18}$$

For deriving the expected stock price, note that when the shareholder intervenes, the market's expectation that the shareholder will sell 1 share, denoted by ρ, is computed as

$$Pr(q_S=-1|a=1)=\rho=\frac{Pr(\mu_t^*(d)\leq\mu<\mu_t'(d))}{Pr(\mu_t^*(d)\leq\mu\leq\bar{\mu})}.$$

When $q_S = -1$, $Q \in \{-2,-1,0\}$; when $q_S = 0$, $Q \in \{-1,0,1\}$. When the market maker observes that $Q = -2$, he can directly infer that $q_S = -1$. In this case, the market maker sets the price as

$$P(d,a,-2)=E[\mu|\mu_t^*(d)\leq\mu<\mu_t'(d)]=\frac{\mu_t^*(d)+\mu_t'(d)}{2}.$$

Either when $Q = -1$ or when $Q = 0$, the market maker does not know whether the shareholder is selling or not. In this case, the price is set as

$$P(d,1,0)=P(d,1,-1)=\rho E[\mu|\mu_t^*(d)\leq\mu<\mu_t'(d)]+(1-\rho)E[\mu|\mu_t'(d)\leq\mu\leq\bar{\mu}],$$

which simplifies to

$$P(d,1,0)=P(d,1,-1)=\frac{\bar{\mu}+\mu_t^*(d)}{2}.$$

For the shareholder who expects to sell in the short-term, her expected price equals

$$E[P(d,1,Q)|q_S=-1]=\frac{1}{3}[P(d,1,-2)+P(d,1,-1)+P(d,1,0)]. \tag{19}$$

Replacing the above expression of the expected price into the indifference condition in equation (18) yields

$$\mu_t'(d)=\frac{1}{3}[P(d,1,-2)+P(d,1,-1)+P(d,1,0)],$$

which simplifies to

$$\mu_t'(d)=\frac{3}{5}\mu_t^*(d)+\frac{2}{5}\bar{\mu}.$$

Substituting the expected price in equation (19) into the indifference condition in equation (17) gives the following equation for the intervention threshold

$$(n-1)\mu_t^*(d) + \mu_t'(d) = nE[v|d],$$

which simplifies to

$$\mu_t^*(d) = \tfrac{5nE[v|d]-2\bar{\mu}}{5n-2}.$$

Now define $\omega = \frac{3}{5n-2}$. We can rewrite the intervention threshold as

$$\mu_t^*(d) = (1+\tfrac{2}{3}\omega)E[v|d] - \tfrac{2}{3}\omega\bar{\mu},$$

and rewrite the trading threshold as

$$\mu_t'(d) = \tfrac{3+2\omega}{5}E[v|d] + \tfrac{2(1-\omega)}{5}\bar{\mu}.$$

Note that $\omega \in (0,1]$ is a monotone increasing transformation of short-termism $\frac{1}{n}$. When $\frac{1}{n} \to 0$, short-termism is non-existent in which case $\omega = 0$. When $\frac{1}{n} = 1$, the shareholder is completely short-term oriented in which case $\omega = 1$.

Proof of Proposition 1

Let us first consider the case where the manager discloses v. The manager's expected stock price can be denoted by

$$\begin{aligned} E[P(v,a,Q)|d=v] = & Pr(\mu < \mu_t^*(v))v \\ & + Pr(\mu_t^*(v) \le \mu < \mu_t'(v))\tfrac{1}{3}\left[P(v,1,-2) + P(v,1,-1) + P(v,1,0)\right] \\ & + Pr(\mu_t'(v) \le \mu \le \bar{\mu})\tfrac{1}{3}\left[P(v,1,-1) + P(v,1,0) + P(v,1,1)\right]. \end{aligned}$$

Expanding and simplifying the above expression yields

$$\tfrac{\mu_t^*(v)}{\bar{\mu}}v + \tfrac{\bar{\mu}^2 - \mu_t^*(v)^2}{2\bar{\mu}}.$$

This is also the expected liquidation value when v is disclosed, because the liquidation value equals

v without intervention and equals $E[\mu|v, a = 1]$ when intervention occurs.

If the manager does not disclose, the expected price is

$$E[P(ND, a, Q)|d = ND] = \frac{\mu_t^*(ND)}{\bar{\mu}} E[v|ND] + \frac{\bar{\mu}^2 - \mu_t^*(ND)^2}{2\bar{\mu}},$$

and the expected liquidation value equals

$$E[V|d = ND] = \frac{\mu_t^*(ND)}{\bar{\mu}} v + \frac{\bar{\mu}^2 - \mu_t^*(ND)^2}{2\bar{\mu}}.$$

The manager discloses if and only if

$$\frac{\mu_t^*(v)}{\bar{\mu}} v + \frac{\bar{\mu}^2 - \mu_t^*(v)^2}{2\bar{\mu}} > \frac{\bar{\mu}^2 - \mu_t^*(ND)^2}{2\bar{\mu}} + \frac{\mu_t^*(ND)}{\bar{\mu}} (\gamma E[v|ND] + (1 - \gamma)v),$$

which simplifies to

$$(v - E[v|ND])\left(\frac{2}{3}\omega(1 + \frac{2}{3}\omega - \gamma)\bar{\mu} + \left(1 + \frac{2}{3}\omega\right)\left(\left(\frac{1}{2} - \frac{\lambda}{3}\right)v + \left(\gamma - (\frac{1}{2} + \frac{\omega}{3})\right)E[v|ND]\right)\right) > 0.$$

When we replace $\frac{2}{3}\omega$ with λ, the above condition is equivalent to the disclosure condition of the main model in equation (14) in the paper.

The condition for two-tailed disclosure strategy to exist is

$$\frac{2}{3}\omega(1 + \frac{2}{3}\omega - \gamma)\bar{\mu} + (1 + \frac{2}{3}\omega)((\frac{1}{2} - \frac{\omega}{3})v + (\gamma - (\frac{1}{2} + \frac{\omega}{3}))E[v|ND]) < 0.$$

If the disclosure strategy is two-tailed, then the upper threshold is given by $v_{t2} = E[v|ND]$ where

$$E[v|ND] = \frac{pPr(v_{t1}<v<v_{t2})}{pPr(v_{t1}<v<v_{t2})+1-p} E[v|v_{t1} < v < v_{t2}] + \frac{1-p}{pPr(v_{t1}<v<v_{t2})+1-p} E[v],$$

and the lower threshold is given by

$$\frac{2}{3}\omega(1 + \frac{2}{3}\omega - \gamma)\bar{\mu} + (1 + \frac{2}{3}\omega)\left((\frac{1}{2} - \frac{\omega}{3})v_{t1} + (\gamma - (\frac{1}{2} + \frac{\omega}{3}))v_{t2}\right) = 0.$$

Given the very similar expression for the disclosure thresholds, it is easy to verify that all the results from the main model continue to hold in this setting with trading.

2 Communication from manager to shareholder

In this section, we assume that, besides credibly revealing information through voluntary disclosure, the manager can also send a message m to the shareholder at $t = 2$. In practice, whether the manager can privately communicate with the shareholder or not varies case by case. For instance, the manager can privately communicate nonmaterial information about the firm to the shareholder. However, for material nonpublic information about the firm, such as information about earnings or new products, Reg FD forbids the firm from selectively disclosing the information. Hence, any such information shared with the shareholder should also be publicly disclosed. We therefore consider two communication settings. In the first setting, we assume that, besides the voluntary public disclosure, the manager can privately communicate a message $m \in [\underline{v}, \overline{v}]$ about the current firm value v to the shareholder. This represents a setting where the manager communicates nonmaterial information with the shareholder. In the second setting, we allow the manager to share a public message $m \in [\underline{v}, \overline{v}]$ about the current firm value v. This represents a setting where the manager shares material nonpublic information that is subject to Reg FD. In both settings, we model the communication as in Crawford and Sobel (1982), that is, the message m is not restricted to be truthful and an uninformed manager can also choose to send a message. The rest of the model is the same as our main setting. We use subscript 'M' to denote the setting with communication from the manager and to differentiate the intervention threshold and disclosure thresholds from our main setting.

We analyze both communication settings by backward induction, first determining the shareholder's intervention strategy, and then the manager's disclosure and communication strategies. Note that in both settings, the message provides no relevant information when the manager discloses v. It may be an informative signal about the firm when the manager chooses not to disclose. Therefore the analyses when the manager voluntarily discloses v are the same as our main setting. Discussions below focus on the case where the manager provides no public disclosure, that is, $d = ND$.

2.1 Private communication

When the manager privately sends a message m to the shareholder, the shareholder intervenes if and only if

$$\eta P(ND, a=1) + (1-\eta)\mu \geq \eta P(ND, a=0) + (1-\eta)E[v|ND, m].$$

At the intervention threshold $\mu_M^*(ND, m)$, the shareholder is indifferent between intervention and no intervention. Thus the intervention threshold given message m equals

$$\mu_M^*(ND, m) = E[v|ND, m] - \tfrac{\eta}{1-\eta}[P(ND, a=1) - P(ND, a=0)].$$

While the market does not know whether there is private communication between the manager and the shareholder and does not observe the message m when there is private communication, the market conjectures the messaging strategy of the manager and updates its beliefs based on the shareholder's intervention decision. The market also correctly conjectures that, for a given message m, the shareholder intervenes when $\mu \geq \mu_M^*(ND, m)$ and does not intervene otherwise. We can then write the stock prices as

$$P(ND, a=1) = E[\mu|ND, a=1] = \textstyle\sum_m \frac{\bar{\mu}+\mu_M^*(ND,m)}{2} Pr(m|a=1),$$

and

$$P(ND, a=0) = E[v|ND, a=0] = \textstyle\sum_m E[v|ND, m] Pr(m|a=0),$$

where $Pr(m|a)$ denotes the market's belief about the privately communicated message based on the observed intervention decision. The information asymmetry between the market and the shareholder, as well as the manner in which the market updates its beliefs about the message m greatly complicate the analysis and break down the tractability of the model. The loss of tractability makes it difficult to prove the existence of an equilibrium. Hence, we analyze the manager's disclosure and communication strategies below and then perform numerical analyses to illustrate the trade-off and to support the existence of the equilibrium.

As for the manager's disclosure and communication strategies, private communication provides relevant information only when there is no disclosure. Compared to no disclosure but privately communicating with the shareholder, a manager prefers to disclose v if and only if his expected utility is higher with disclosure. As the manager only cares about the liquidation value, the condition is equivalent to

$$Pr(\mu < \mu_M^*(v))v + Pr(\mu \geq \mu_M^*(v))E[\mu|\mu \geq \mu_M^*(v)]$$
$$> Pr(\mu < \mu_M^*(ND,m))v + Pr(\mu \geq \mu_M^*(ND,m))E[\mu|\mu \geq \mu_M^*(ND,m)],$$

which can be simplified to

$$\tfrac{1}{2}[\mu_M^*(ND,m)^2 - \mu_M^*(v)^2] > [\mu_M^*(ND,m) - \mu_M^*(v)]v.$$

When $\mu_M^*(ND,m) = \mu_M^*(v)$, that is, the shareholder's intervention strategy is the same irrespective of the manager's disclosure strategy, the manager is indifferent between disclosure and no disclosure with private communication. When $\mu_M^*(ND,m) - \mu_M^*(v) > 0$, the manager prefers to disclose if and only if the current firm value v is sufficiently low, that is,

$$v < \tfrac{1}{2}[\mu_M^*(ND,m) + \mu_M^*(v)].$$

On the other hand, when $\mu_M^*(ND,m) - \mu_M^*(v) < 0$, the manager prefers to disclose if and only if v is sufficiently high, that is,

$$v > \tfrac{1}{2}[\mu_M^*(ND,m) + \mu_M^*(v)].$$

The above two conditions imply that there can exist a two-tailed disclosure equilibrium. The intuition is similar to our main setting. When the value of v is really low, insufficient intervention from no disclosure leads to a lower expected liquidation value than excessive intervention from disclosure, the manager chooses to disclose v. Alternatively, when v is high, excessive intervention from disclosure is lower than excessive intervention from no disclosure, the manager also prefers to disclose v. We thus conjecture an equilibrium with disclosure in both the lower and upper tails, as well as no disclosure followed by private communication in the middle. Moreover, when shareholder short-termism is sufficiently high, the disclosure equilibrium is likely to be upper-tailed.

This is because as shareholder short-termism increases, insufficient intervention decreases whereas excessive intervention increases. Then for low values of v, having insufficient intervention from no disclosure can result in a higher expected liquidation value than having excessive intervention from disclosure, making the manager prefer not to disclose v.

For a manager who cares about the liquidation value, he prefers to send a message m to the shareholder only if such communication can improve intervention efficiency and thus the liquidation value. His private communication strategy cannot fully reveal the current firm value v in equilibrium. This is because fully revealing v can result in inefficient intervention from the shareholder. Then the manager has incentive to communicate a different value of v to reduce inefficient intervention. Specifically, when revealing v to the shareholder leads to excessive intervention, the manager is better off mimicking the communication strategy of a firm with a higher v to reduce excessive intervention. Alternatively, if the firm faces insufficient intervention after fully revealing v, the manager is better off mimicking the message of a firm with a lower v. Therefore, any equilibrium communication strategy must involve partial pooling. This further indicates that some informed managers will send a message that is different from an uninformed manager. If all informed nondisclosing managers send the same message as an uninformed manager, private communication does not convey any relevant information to the shareholder.

Among nondisclosing firms, managers with low values of v will prefer to separate from the uninformed manager, whereas managers with high values of v will prefer to mimic the communication strategy of the uninformed manager. To see this, recall from earlier analysis that nondisclosing firms with high values of v face excessive intervention from the shareholder. By privately sending a message to separate from the uninformed manager, these managers reduce the shareholder's expectation about v, which further increases the excessive intervention. Hence, nondisclosing firms with high values of v are better off pooling with the uninformed manager. On the other hand, for nondisclosing firms with low values of v that face insufficient intervention, separating from the uninformed manager and lowering the shareholder's expectation about v can reduce insufficient intervention and thus increase the expected liquidation value.

We also conjecture that informative private communication only exists when the shareholder short-termism is relatively low so that nondisclosing managers with low values of v face insufficient intervention. If shareholder short-termism is sufficiently high so that nondisclosing managers with low values of v also face excessive intervention, they have no incentive to send an informative message to separate from the uninformed manager, as the informative communication only further increases the excessive intervention.

In summary, among nondisclosing firms, a private communication strategy will entail managers who observe low current firm value sending a message to separate from the uninformed manager, while managers who observe high current firm value pooling with the uninformed manager. Such informative private communication only exists when shareholder short-termism is relatively low. For tractability purposes, we restrict our analysis to two partitions in the nondisclosure region. Specifically, we construct an equilibrium with thresholds denoted as $\underline{v} \leq v_{M1} < v_{M2} < v_{M3} \leq \bar{v}$. The disclosure strategy is such that informed managers with $v \in [\underline{v}, v_{M1}] \cup [v_{M3}, \bar{v}]$ choose to disclose the current firm value v, and informed managers with $v \in (v_{M1}, v_{M3})$ choose not to disclose v. The communication strategy is such that informed managers with $v \in (v_{M1}, v_{M2})$ send a private message m_1, and informed managers with $v \in [v_{M2}, v_{M3})$ and the uninformed manager send a private message m_2. Such disclosure and communication strategies imply the following indifference conditions at v_{M1}, v_{M2} and v_{M3}.

When $v = v_{M1}$, the manager is indifferent between disclosing v_{M1} and not disclosing followed by sending a message m_1, that is,

$$Pr(\mu < \mu_M^*(v_{M1}))v_{M1} + Pr(\mu \geq \mu_M^*(v_{M1}))E[\mu|\mu \geq \mu_M^*(v_{M1})] =$$
$$Pr(\mu < \mu_M^*(ND, m_1))v_{M1} + Pr(\mu \geq \mu_M^*(ND, m_1))E[\mu|\mu \geq \mu_M^*(ND, m_1)].$$

Simplifying the above condition yields that

$$v_{M1} = \tfrac{1}{2}[\mu_M^*(v_{M1}) + \mu_M^*(ND, m_1)],$$

where $\mu_M^*(ND, m_1) = E[v|ND, m_1] - \frac{\eta}{1-\eta}[P(ND, a = 1) - P(ND, a = 0)]$.

Similarly, when $v = v_{M2}$, the manager is indifferent between sending the message m_1 and m_2,

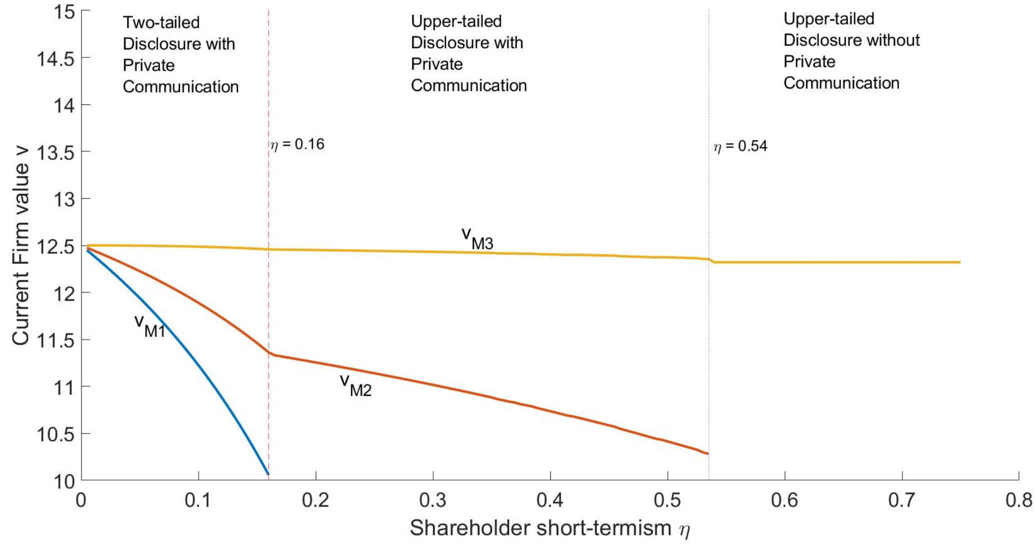

Figure 1: Numerical analysis of voluntary disclosure and private communication equilibrium with $\underline{v} = 10$, $\bar{v} = 15$, $\bar{\mu} = 15$, and $p = 0.25$. v_{M1} is the lower disclosure threshold, v_{M2} is the private communication message partition, and v_{M3} is the upper disclosure threshold.

which yields the following condition for v_{M2}

$$v_{M2} = \frac{1}{2}[\mu^*_M(ND, m_1) + \mu^*_M(ND, m_2)],$$

where $\mu^*_M(ND, m_2) = E[v|ND, m_2] - \frac{\eta}{1-\eta}[P(ND, a = 1) - P(ND, a = 0)]$.

Finally, when $v = v_{M3}$, the manager is indifferent between disclosing v_{M3} and not disclosing followed by sending the message m_2. This indifference condition yields that

$$\mu^*_M(v_{M3}) = \mu^*_M(ND, m_2).$$

Based on the above three indifference conditions, we perform numerical analysis to solve for the disclosure equilibrium. The equilibrium is presented in Figure 1. The results show that the disclosure equilibrium and also the existence of informative private communication depend on the extent of shareholder short-termism. When shareholder short-termism is sufficiently low ($\eta < 0.16$), there exists two-tailed disclosure equilibrium where both extremely low ($v \leq v_{M1}$) and extremely high ($v \geq v_{M3}$) values of v are voluntarily disclosed. Managers with intermediate values of $v \in (v_{M1}, v_{M2})$ engage in private communication. As shareholder short-termism increases ($\eta \geq 0.16$), the extent of excessive intervention from disclosure increases so that managers with low values of v prefer no disclosure over disclosure. In this case, the disclosure equilibrium is upper-tailed. For an intermediate level of shareholder short-termism ($0.16 \leq \eta < 0.54$), some nondisclosing managers continue to engage in informative private communication. When shareholder short-termism is sufficiently high ($\eta \geq 0.54$), however, there is no informative private communication. This occurs when nondisclosing managers with low values of v face excessive intervention without private communication. In this case, no manager has incentive to communicate to separate from the uninformed manager as it will further increase the excessive intervention.

2.2 Public communication

For the second setting, we consider a case where the information is material nonpublic information subject to Reg FD and thus cannot be selectively disclosed. We assume that, besides credibly revealing v via voluntary disclosure, the manager can also send a cheap-talk public message. A similar form of communication is also assumed by Kumar et al. (2012). As before, the message is only relevant when the manager does not disclose. Similar to the result in Kumar et al. (2012), we find that any message sent by the manager is uninformative about the current firm value in equilibrium and hence is ignored by the shareholder. To explain this, suppose some informed managers choose to separate from the uninformed manager by sending a message m. The shareholder will intervene if and only if intervention yields a higher expected utility, that is,

$$\eta E[P|ND, m, a = 1] + (1 - \eta)E[\mu|\mu] > E[v|ND, m].$$

Hence, the intervention threshold equals

$$\mu_M^*(ND, m) = \frac{2E[v|ND,m] - \eta\bar{\mu}}{2-\eta} < E[v|ND, m].$$

This implies that, when not disclosing v and sending a public message m, informed managers with $v > E[v|ND, m]$ face potential excessive intervention. Then these managers are better off disclosing v rather than sending the message, because compared to sending the message, revealing v increases the shareholder's belief about v and reduces excessive intervention. Hence, there is no informative communication when the message is publicly disclosed. Intuitively, when an informed manager chooses not to disclose but sends a message to separate from the uninformed manager, the standard unraveling argument applies. An informed manager with a higher value of v is better off disclosing v, rather than sending the message and pooling with informed managers with lower values of v. This is because sending the message and pooling with lower values of v leads to more excessive intervention than disclosing v directly. Hence only uninformative messages can be sustained in equilibrium. As the communication is uninformative, the shareholder's intervention strategy and the manager's disclosure strategy remain the same as our main setting.

Compared to the private communication setting, restricting to public messages makes the communication uninformative. The key driving force is the extent to which the message influences the stock price. When the message is public, the stock price becomes contingent on the message. The short-term shareholder has incentive to engage in excessive intervention, which then diminishes the manager's incentive to disclose an informative message. In contrast, with private communication, the message does not directly affect the stock price. For a manager with a low current firm value, private communication ensures that the market's belief about the current firm value is relatively high so that the expected added value from intervention is relatively low. This reduces the shareholder's incentive to intervene excessively and makes the extent of excessive intervention lower with private communication than with voluntary disclosure. Therefore, informative communication can be sustained in equilibrium. Interestingly, this suggests that Reg FD requirements can sometimes reduce informative communication and hence, impact efficiency.

In summary, we find that when the manager can communicate with the shareholder through channels other than voluntary disclosure, there can exist informative private communication about the current firm value. Such informative private communication is unlikely to occur when shareholder short-termism is sufficiently high. The disclosure equilibrium is similar to our main setting without other choices of communication, that is, a two-tailed disclosure equilibrium when shareholder short-termism is low and an upper-tailed disclosure equilibrium when shareholder short-termism is high. Any public message sent by the manager, however, is uninformative and is ignored by the shareholder.

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