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1 Introduction

Informed managers have access to many alternate mechanisms by which they can strategically control information flow to financial markets. For instance, managers of undervalued firms can either choose to engage in direct disclosures or repurchase shares. There is a vast literature in accounting and finance that examine disclosure equilibria which arise when managers can make credible direct disclosures and address the consequent valuation and real effects. The finance literature is also replete with studies that investigate information implications of financial policy choices. It offers several possible motivations for why managers might engage in share repurchases, but an often cited motive is the information or signaling hypothesis (see, e.g. Vermaelen, 1981). These literatures on direct disclosures and share repurchases have emerged largely in isolation of each other. A question naturally arises as to the type(s) of equilibrium disclosure and repurchasing behavior that would emerge when informed managers can use both channels to communicate their private information.

Motivated by this question, in this paper, we study the choice of disclosure and share repurchase strategies of informed managers. Using a model that captures how direct disclosures and share repurchases differentially impact short and long-term stock value, we analyze the joint determination of disclosure and repurchase strategies by informed managers.

We focus on share repurchase because corporations world-wide undertake major share repurchases routinely; share repurchases have increased in the last few decades (Fama and French, 2001); in the U.S.; repurchases have replaced dividends as the main cash payout instrument.\(^1\) By repurchasing undervalued stock managers can deploy their positive inside information to advance the firm’s long term value. Indeed, CFOs cite undervaluation as the primary motive behind repurchases (Brav et al., 2005).

Repurchasing undervalued shares transfers wealth from the short-term shareholders who sell their shares at a discount to the long-term investors that hold on to the stock and benefit from the firm purchasing shares at a discount. Meanwhile, repurchasing overvalued shares results in a wealth transfer from long-term to short-term shareholders. It is also possible however that a firm

\(^1\)In 2013, share repurchases accounted for 60% of cash equity returns of U.S. corporations. Moreover, companies in the S&P 500 index bought $500 million of their own shares, which is about 33 cents of every dollar of cashflow (Economist, 2014).
will care primarily about its short-term shareholders — for example, when managers have vesting shares (Bonaime et al. 2014). Such a firm may repurchase overvalued shares to the benefit of short-term shareholders at the expense of long-term firm value (Gaspar et al. 2012).

Of course, managers can induce over-valuation by withholding adverse information from markets. They can also engage in credible direct disclosures to reveal the true equity value to the market (Dye, 1985; Verrecchia, 1983). The attendant increase in stock price would benefit short-term shareholders at no direct expense to long-term shareholders (as long as there are no direct disclosure costs). However, long-term shareholders do realize the opportunity cost of the foregone repurchase of undervalued stock. The resolution of these tradeoffs in equilibrium is the main focus of our analysis.

We consider a model in which the manager of a firm is perfectly (privately) informed of its value ahead of the decision to disclose or repurchase. If direct disclosure is the only avenue available (i.e., absent the repurchase option), the standard unraveling result holds and there will only be full disclosure in equilibrium (Grossman, 1981; Milgrom, 1981). However, when the manager can also repurchase shares, we find that both direct disclosure and share repurchase policies emerge in equilibrium in different regions of firm value.

In particular, the range of possible firm values is endogenously demarcated into three intervals depending the channel of communication the manager chooses in equilibrium. Firms in the lowest value region neither disclose nor repurchase. Managers of firms with intermediate values disclose but do not repurchase. Finally, managers of firms with values in the highest region undertake share buybacks but do not disclose. Thus, the upper-tailed disclosure region in classic voluntary disclosure models does not obtain in the presence of the repurchase option. We also show that it is never optimal to simultaneously disclose and repurchase.

The valuation cutoffs (or thresholds) of the three intervals depend on the weight the manager places on the welfare of short-term versus long-term investors, on the microstructure of trading in the firm’s stock, and on the cost of disclosure (Verrecchia, 1985). Specifically, the greater the weight the manager places on the welfare of long-term shareholders, the narrower (wider) is the range for which disclosure (share repurchase) is optimal. That is, less myopic managers—who favor the long-term shareholders over the short-term shareholders—ceteris paribus are, first, less likely to communicate private information and, second, more likely to repurchase shares.

We find that the firm’s stock liquidity (in the sense of Kyle, 1985), is positively related to the optimal disclosure interval. That is, the more illiquid the market for the firm’s stock, the narrower is
the valuation range for which disclosure is optimal. Indeed, when disclosure is assumed to be costly there are sufficiently high levels of illiquidity for which the optimal disclosure range disappears. Instead, there is a valuation threshold above which informed managers do share repurchases, but below which the firm neither discloses nor repurchases. Moreover, the higher the cost of disclosure, the narrower is the optimal disclosure range; indeed, above a threshold level of disclosure cost, it is never optimal to disclose. Hence, illiquidity has the same impact as disclosure cost.

Intuitively, the comparative advantage of repurchases increases with the discount of the short-term (or current) stock price relative to the true firm value. For any given level of repurchases, the greater is the level of undervaluation, the higher is the post-repurchase or long-term equity value. Hence, we expect the optimal repurchase policy to be upper-tailed — that is, once repurchasing becomes optimal, it must remain so for higher firm values. Next, from the voluntary disclosure literature (Grossman, 1981; Milgrom, 1981; Verrecchia, 1983; Dye, 1985), we also expect that disclosure becomes optimal beyond a threshold value. However, the novel aspect of our analysis is to show that when informed managers optimally design communication strategies through disclosure and repurchases, then the optimal disclosure policy is two-tailed, that is, disclosure is optimal for an intermediate range of firm values only. This follows from the result that it is not beneficial to simultaneously repurchase and disclose.

The level of managerial myopia relative to the fraction of shares traded by the liquidity traders plays an important role in equilibrium. In particular, the above results hold when the manager is far-sighted or when she has a low level of myopia. However, when the manager is more myopic she is willing to repurchase overvalued stock in order to promote the short-term stock price. As a result, the manager’s disclosure strategy becomes upper tailed - i.e., there is a level of firm value above which the manager finds it optimal to disclose information. In turn, this upper tailed disclosure strategy together with the fact that the manager is perfectly informed leads to a full-disclosure equilibrium ala. Grossman (1981) and Milgrom (1981).

To our knowledge, we provide among the first analysis of optimal information communication by firms when they design their disclosure and share repurchase policies together. We offer a framework that integrates disclosure and information-theoretic share repurchase literatures (Verrecchia, 1983; Dye, 1985; Vermaelen, 1981). In particular, the “disclosure only” and “repurchase only” strategies that are considered in different literature streams emerge endogenously in our framework. Furthermore, while equilibrium analysis of stock prices with informed trading has been widely considered (Glosten and Milgrom, 1984; Kyle, 1985), in our setting the informed trader is
the manager conducting open market share repurchases.

Our analysis shows that the joint consideration of disclosure and share repurchases has significant impact on the design of these strategies. For example, the optimal disclosure policy is two-tailed and not one-tailed as generally derived in the disclosure literature; managers with good inside value-related information may use repurchases rather than disclosure. Our analysis yields empirical predictions on the relative likelihood of using disclosure or repurchases in terms of firms’ empirically measurable stock liquidity (see, e.g., Amihud, 2002) and the impact of long-term stock prices on managerial compensation through equity or stock option holdings.

The paper proceeds as follows. Section 2 describes the model. In Section 3, we derive our main disclosure-repurchase equilibrium for the far-sighted manager while in Section 4 we analyze the case of the myopic manager. In Section 5, we extend our analysis to include a general distribution of the liquidity shock and to consider the case of costly disclosures. In Section 6 we conclude.

2 The Model

2.1 Preliminaries

Consider a firm with a single terminal cash flow \( x \). The firm is controlled by a manager who privately observes \( x \) perfectly, i.e., there is an information event. The manager can credibly disclose this signal at no cost (Grossman, 1981). The manager can also withhold this information from markets and trade on her private information by repurchasing shares—we assume that the firm has an open market repurchase plan in place prior to the information event (Vermaelen, 1981).

We consider a simple model with three dates \( t \in \{0, 1, 2, 3\} \). At \( t = 0 \), the share of an all equity firm—with total number of outstanding shares normalized to 1—has a market price of \( p_0 \). Market participants are rational and prices reflect the expected value of the terminal cash flow (ignoring the the time value of money).

\[
p_0 = E(x).
\]

In addition to the current shareholders, other agents can also trade in the stock. (Henceforth, the shareholders and these agents will be referred to as “investors”.) At this initial date \( t = 0 \), there is symmetric information regarding the value of the firm.

At \( t = 1 \), the manager becomes privately informed regarding the value of the firm or the realized cash flow \( x \). At this date, the manager can choose to disclose this information to the market. At
$t = 2$, following the manager’s choice of disclosure, trade takes place and the so called short-term stock price is determined.

For simplicity, we utilize a binary representation of the Kyle (1985) market mechanism (e.g., Bernhardt et al., 1995). Specifically, at the beginning of $t = 2$, shareholders receive an uninsurable liquidity shock and must sell $q \in \{l, h\}$ shares $0 = l < h < 1$. The liquidity shock $q$ is low (high) with probability $\alpha (1 - \alpha)$ for some $\alpha \in (0, 1)$ and is independent of the value $x$. The manager does not observe the liquidity shock, but can repurchase shares $r \geq 0$. Thus, the aggregate order flow in the stock is

$$F \equiv r - q.$$  \hspace{1cm} (1)

The market maker is risk neutral and only observes the aggregate order flow — that is, $r$ and $q$ are not directly observable. Thus, the offered price $P_2$ is contingent only on the aggregate order flow, and we write this as $P_2(F) \equiv P_2(r - q)$. We assume free entry in market making (Kyle, 1985). Hence, prices are set so that the market maker breaks even on average; we will make this explicit below.

We can now calculate the terminal stock price (i.e., at $t = 3$) following cash flow realization of $x$ and given a repurchase of $r$ shares at price $P_2$. Note, the value of shares after trade depend on both the terminal value $x$ and any gains or losses in the case the manager repurchases shares; a repurchase of $r$ shares at price $P_2$ will cost the firm $rP_2$ resulting a net asset value of $x - rP_2$ spread over $1 - r$ outstanding shares. Therefore, the price per share following repurchase is,

$$P_3(r, x, P_2) = \frac{x - rP_2}{1 - r}. \hspace{1cm} (2)$$

Note that purchasing undervalued equity (i.e., $x > P_2$) increases this terminal stock price, while the reverse is true for overvalued equity.

We suppose the manager cares about the price at which shareholders sell their equity (in case of a liquidity shock) and the price of equity held by investors until the long term cash flow is realized. Thus, the manager cares both about the so called short-term ($P_2$) and the long-term ($P_3$) stock prices. Let $\beta \in (0, h)$ be the welfare weight the manager places on short-term stock performance

\footnote{The assumption that $l, h$ are positive is without loss of generality. That is, our results are not affected if we allow for liquidity shocks that result in uninformed buying.}
that we refer to as the level of *myopia*.$^3$

$$V^m = \beta P_2 + (1 - \beta) P_3. \quad (3)$$

The boundaries on the manager’s payoff allow us to focus on the most interesting equilibrium outcome in which repurchase of stock and selective disclosure of information are equilibrium outcomes.

We relax this structure later, to examine its impact on our results.

The sequence of events is as follows:

$t = 0$ The manager observe the information event or not.

$t = 1$ Manager discloses or withholds information $x$.

$t = 2$ Manager and liquidity traders place orders simultaneously and the market maker sets the short-term price $P_2$ as a function of the order flow.

$t = 3$ Cash flow $x$ becomes public and long-term price $P_3$ is realized.

### 2.2 Equilibrium concept

We analyze the Perfect Bayesian equilibrium (PBE) of the game set up by the time line above. To define a PBE concisely, we establish some notation. The PBE consists of:

**Manager’s Disclosure Strategy:** The manager’s disclosure strategy is denoted by $s : x \rightarrow \{D, ND\}$, with $D$ denoting voluntary disclosure of information $x$ by the manager, and $ND$ denoting non-disclosure.

**Repurchase Strategy:** The manager’s repurchase $r$ is optimal given her information $x$ and her Bayes-consistent beliefs on the market maker’s pricing function $P_2(F)$.

**Market Maker:** The short-term price $P_2(F)$ is set such that the market maker breaks even on average given her Bayes-consistent beliefs on the manager’s disclosure and repurchase strategies.

A PBE, then, is the profile $S^* = (s, r, P_2(F))$ where the manager’s disclosure strategy and repurchase strategy are optimal given the competitive prices $(P_2(F), P_3)$, and the market maker’s pricing is optimal given the manager’s strategy.

We begin by analyzing the trading game that takes place at $t = 2$. Of course, all adverse selection is removed from the market following disclosure of $x$ by the manager. In this case, prices

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$^3$The manager might care both about short-term and long-term stock prices since some of current shareholders might have to sell their shares early depending on whether there is a liquidity shock or not, or alternatively the manager might be compensated based on short- and long-term performance. See also Einhorn and Ziv (2007) and Langberg and Sivaramakrishnan (2010) for similar payoff structure.
reflect this information and \( P_2 = P_3 = x \) regardless of the order flow. It is then, without loss of
generality, optimal for the manager not to repurchase shares (i.e., \( r = 0 \)).

Following non-disclosure, however, the market maker does not know firm value and must base
his expectations on his beliefs on the disclosure strategy of the manager. In turn, the manager will
choose to repurchase shares or not and disclose information or not while taking into account the
pricing schedule of the market maker and the true value of the firm.

### 2.3 Manager’s disclosure and repurchase strategy

Since we consider a binary version of the classic Kyle (1985) model (adapted from Bernhardt
et al., 1995), the market maker cannot (perfectly) identify informed trading by the manager by
observing the order flow if the manager sometimes repurchases either \( r = h \) or \( r = 0 \). If the
manager repurchases shares in a way that perfectly reveals her private information then she cannot
gain from trading against the uninformed.\(^4\) Consequently, we look for a pure-strategy equilibrium in
which the manager either repurchases \( r = h \) or does not repurchase at all following non-disclosure.

Three levels of order flow stem are possible with this strategy of the manager:

\[
F|_{r=0} = \begin{cases} 
-h & \text{when } q = h \text{ w.p. } 1 - \alpha \\
0 & \text{when } q = 0 \text{ w.p. } \alpha 
\end{cases}, \quad F|_{r=h} = \begin{cases} 
0 & \text{when } q = h \text{ w.p. } 1 - \alpha \\
h & \text{when } q = 0 \text{ w.p. } \alpha 
\end{cases}.
\]

The market maker faces uncertainty regarding the level of trading by the manager only when order
flow is intermediate, i.e., \( F = 0 \). Whenever \( F = -h \), the manager would not have repurchased
shares; when \( F = h \), the manager would have repurchased shares. The market maker will use
this information from order flow together with her beliefs regarding the manager’s disclosure and
repurchase strategy. Note that the order flow’s information content does not related to the size of
the liquidity shock, \( h \), but rather to the uncertainty associated with the shock, \( \alpha \).

Let the price levels corresponding to the three order flows be:

- \( P_2(h) \equiv P^H \) when the manager repurchases \( h \) and there is no liquidity shock;
- \( P_2(0) \equiv P^M \) when the manager repurchases \( h \) and the liquidity traders sell \( h \), or when the
  manager does not repurchase and the liquidity traders do not sell;
- \( P_2(-h) \equiv P^L \) when the manager does not repurchase shares and the liquidity trader sells \( h \).

\(^4\)It is possible that the manager deploys a mixed strategy and we discuss this possibility in more detail subsequently.***
We establish an equilibrium in which these prices are monotone in order flow (equilibrium-condition C1).

\[[C1]: \ P^H \geq P^M \geq P^L \text{ [Prices are monotone in order flow]}\]

At the time the manager submits her order to purchase shares she is committed to trade but does not know the actual price of her transaction (Kyle, 1985). Similarly, when the manager does not place an order, she does not know the future stock price as it fluctuates with the order flow. Thus, the manager bases her disclosure and her repurchase decisions on the expected price following repurchase (non-repurchase) given by \( \bar{P} (P) \):

\[
\bar{P} \equiv E(P_2 | r = h) = \alpha P^H + (1-\alpha) P^M, \text{ and } \tag{4}
\]

\[
P \equiv E(P_2 | r = 0) = \alpha P^M + (1-\alpha) P^L. \tag{5}
\]

When repurchasing shares and/or disclosing information, the manager takes into account the benefits from trade to long-term investors (reflected in the realized price \( P_3 \)) and the benefits from higher price to short-term investors selling their shares at price \( P_2 \). In particular, the manager can increase the long-term share price by repurchasing shares, and can improve the price at which short-term shareholder sell their holdings by disclosing information.

The payoff to a manager of type \( x \) from a repurchase of \( r = h \) shares given market prices \( \langle P^H, P^M, P^L \rangle \) is given by

\[
E(V^m | ND, r = h, x) = E[\beta P_2 + (1-\beta)P_3 | ND, r = h, x] \\
= \beta \bar{P} + (1-\beta) \frac{x - h\bar{P}}{1-h} = \left( \frac{1-\beta}{1-h} \right) x - \left( \frac{h-\beta}{1-h} \right) \bar{P}. \tag{6}
\]

As one would expect, the expected payoff to the manager from repurchasing shares is increasing in the realized value of cash flows \( x \), and more so when (i) the manager puts less weight on the short term price (i.e., lower \( \beta \)), and (ii) when the liquidity shock \( h \) is higher (because then the manager can repurchase more shares without being fully detected by the market maker). In particular, we can conveniently write the above expression as

\[
E(V^m | ND, r = h, x) = x + \left( \frac{h-\beta}{1-h} \right) \left( x - \bar{P} \right) .
\]

From this expression, it is clear that for \( \beta < h \), the manager’s expected payoff is increasing in
the level of undervaluation $x - \overline{P}$. Because a lower value of $\beta$ corresponds to a greater weight on the terminal price $P_3$, the manager of an undervalued firm has a more pronounced incentive to repurchase shares, acting less myopic as it were, as long as $h \in (\beta, 1)$. In other words, if there is a sufficiently large number of liquidity traders acting even more myopically than the manager so to speak (as reflected by the liquidity shock $h > \beta$), then the manager benefits by repurchasing shares and propping up terminal price $P_3$.

On the other hand, if the liquidity shock is small i.e., $h \leq \beta$, $E(V^{m}|ND, r = h, x) < x$, repurchasing does not help correct the undervaluation problem, and the manager has an incentive to be “overly” myopic (as we will see below). $^5$

In light of the fact that the manager’s behavior is markedly different in the two regions characterized by $\beta \in (0, h)$ and $\beta \in (h, 1)$, we analyze them separately.

3 Analysis: Far-sighted Manager (\(\beta \in (0, h)\))

3.1 Manager’s strategies

In the previous section, we have established that when $\beta \in (0, h)$, the manager potentially benefits from repurchasing shares to prop up the terminal price, $P_3$. For this behavior to obtain in equilibrium, we need to compare her expected payoffs from repurchasing shares with her expected payoffs from disclosing her information directly, and from withholding information and not repurchasing shares. These expected payoffs are

$$E(V^{m}|D, x) = x, \text{ and}$$

$$E(V^{m}|ND, r = 0, x) = \beta P + (1 - \beta)x.$$  \hspace{1cm} (7)

Once the manager discloses information, there is no information asymmetry between the market maker, investors, or the manager. Thus, following disclosure, whether the manager repurchases shares or not has no implication for prices.

$^5$Interestingly, it is not just the absolute magnitude of $\beta$ that determines whether the manager behaves myopically or not; it also depends on the short-termism in the market as reflected by the size of the liquidity trading population.
Following non-disclosure, the benefit from repurchasing shares as opposed to not doing so is,

\[
E(V^m|ND, r = h, x) - E(V^m|ND, r = 0, x) = \left( \frac{h(1 - \beta)}{1 - h} \right) x - \left( \frac{h - \beta}{1 - h} \right) \overline{P} - \beta \overline{P}.
\]

It follows immediately that the manager prefers share repurchase over non-repurchase when the firm value \(x\) exceeds a certain threshold, which turns out to be a weighted average of the market prices \((\overline{P}, \overline{P})\):

\[
x > \frac{(h - \beta)}{h(1 - \beta)} \overline{P} + \frac{\beta(1 - h)}{h(1 - \beta)} \overline{P} \quad [\langle ND, R \rangle \text{ dominates } \langle ND, NR \rangle]
\]

Intuitively, the manager will not find it optimal to repurchase shares (following non-disclosure) if the value of the firm is below the price \(\overline{P}\), and will repurchase shares if the value is above \(\overline{P}\). The repurchase cutoff in (8) lies between the expected price following repurchase and that following non-repurchase.

To see this, recall that \(h \in (\beta, 1)\). At its lower bound \(h = \beta\), and the above condition simply reduces to the inequality \(x > \overline{P}\), while at the other extreme, \(h = 1\), a higher firm value is required in order for repurchase to dominate, i.e., \(x > \overline{P}\). It also follows from (8) that the repurchase cutoff is increasing in the size of the liquidity shock.

In order for repurchase to be optimal for an informed manager, she must not only prefer repurchase over non-repurchase, but also prefer non-disclosure over disclosure. Thus, we compare the payoff \(x\) (following disclosure by the informed manager) to the expected payoff from non-disclosure followed by repurchase of shares \(E(V^m|ND, r = h, x)\). Thus, repurchase and non-disclosure is preferred over disclosure by an informed manager when (for \(h \in (\beta, 1)\)),

\[
E(V^m|ND, r = h, x) \geq x
\]

\[
\Leftrightarrow \beta \overline{P} + (1 - \beta) \frac{x - h \overline{P}}{1 - h} \geq x, \text{ or } x \geq \overline{P} \quad [\langle ND, R \rangle \text{ dominates } D]
\]

While both conditions (9) and (8) must be satisfied for the manager to repurchase shares in
equilibrium, it is easy to verify that condition (9) binds. Thus, we define the repurchase cutoff as,

\[ \bar{x} = \mathcal{P}. \]  

(10)

Next, we explore whether non-repurchase, that yields expected payoff to the manager of \( \beta \mathcal{P} + (1 - \beta)x \), dominates disclosure, that yields payoff of \( x \). Since the long-term share value is not affected when shares are not repurchased, the manager will choose non-disclosure for relatively low value realizations. Formally,

\[ x \leq \mathcal{P}. \ [\text{\( \langle ND, NR \rangle \) dominates \( D \)}] \]  

(11)

Now, since condition (8) follows directly from condition (11), the cutoff below which the manager does not disclose information and does not repurchase shares is,

\[ \bar{x} = \mathcal{P}. \]  

(12)

The best response of the manager to prices \( \langle \mathcal{P}_H, \mathcal{P}_M, \mathcal{P}_L \rangle \) satisfying \( \text{(C1)} \)—in terms of her disclosure and repurchase strategies—is summarized as follows: This analysis leads to the following best-response repurchase strategy,

**Proposition 1 [Two Tailed Disclosure and Repurchase Strategy]** In any candidate equilibrium in which prices following non-disclosure \( \langle \mathcal{P}_H, \mathcal{P}_M, \mathcal{P}_L \rangle \) satisfy condition C1 and \( \beta \in (0, h) \), the manager will withhold information and not repurchase shares for sufficiently low cash flow realizations, \( x \leq \bar{x} \), will disclose information for intermediate realizations, \( x \in (\bar{x}, \bar{x}) \), and will withhold information and repurchase shares otherwise, \( x \geq \bar{x} \).

A noteworthy implication of Proposition 1 is that the upper-tailed disclosure outcome that typically emerges in traditional disclosure equilibria (Dye, 1985; Verrecchia, 1983) does not obtain in the presence of the repurchase option. While higher cash flow realizations do give rise to an incentive to disclose information, the incentive to withhold information and repurchase shares to secure a better long-term price is even stronger in the upper tail of the cash flow distribution. These strategies are depicted pictorially in Figure 1.

(Insert Figure 1 here)
3.2 Market prices

The market maker’s beliefs about the strategy of the manager in equilibrium, i.e., her disclosure and repurchase cutoffs \( (\bar{x}, \bar{\bar{x}}) \), determine the market prices, as a function of order-flow and or disclosure, that are consistent with competitive markets (i.e., zero expected profits to the market maker).

The prices following extreme order flows, i.e., \( P^H = P_2(h) \), and \( P^L = P_2(-h) \), precisely reflect the manager’s repurchase action. In particular, given the market maker’s conjecture \( (\bar{x}, \bar{\bar{x}}) \), prices must satisfy: \( P^H = E(x|r = h) = E(x|x \geq \bar{x}) \), and \( P^L = E(x|r = 0) = E(x|x \leq \bar{x}) \). When a repurchase takes place and is identified as such by the market maker, then by selling \( h \) shares at the price \( P^H = E(x|r = h) = E(x|x \geq \bar{x}) \), the market maker’s expected payoff is

\[
P^H - E \left[ \frac{x - hP^H}{1 - h} \middle| x \geq \bar{x} \right] = 0.
\]

When order flow is intermediate, however, the market maker does not know whether the manager repurchased shares and liquidity traders do not sell or vice versa. Therefore, of concern is the conditional probability that the manager repurchased shares given the observation of intermediate order flow (of course, following non-disclosure). Thus, we define:

\[
\theta \equiv \Pr(r = h|F = 0).
\]

Given this posterior probability, the market maker’s expected payoff is

\[
P^M = \theta E \left[ \frac{x - hP^H}{1 - h} \middle| x \geq \bar{x} \right] + (1 - \theta)P^L.
\]

Therefore, in order to obtain zero expected profit given intermediate order-flow,

\[
P^M = \theta P^H + (1 - \theta)P^L.
\]

**Lemma 1 [Market Prices and Order Flow]** In any candidate equilibrium with disclosure and repurchase cutoffs \( (\bar{x}, \bar{\bar{x}}) \) and and \( h \in (\beta, 1) \), the prices \( \langle P^H, P^M, P^L \rangle \) satisfy condition C1 are
given by:

\[ PH = E(x|x > \bar{x}), \quad PL = E(x|x < \bar{x}) \text{ and } PM = \theta PH + (1-\theta) PL, \]  
(13)

where \( \theta = \frac{Pr(x > \bar{x})(1-\alpha)}{Pr(x > \bar{x})(1-\alpha) + Pr(x < \bar{x})\alpha}. \)

Therefore, in any equilibrium, the disclosure and repurchase cutoffs \( (\bar{x}, \bar{\pi}) \) and market prices \( \langle PH, PM, PL \rangle \) are a solution to (4), (5), and (13).

3.3 Important Benchmarks

Before we proceed to construct the equilibrium, we consider the benchmark cases in which the manager cannot trade (i.e., can only decide whether to disclose her information or not) and in which the manager cannot credibly disclose her information (i.e., she can repurchase shares).

In the case in which the manager has no option to repurchase, the standard unraveling result holds (Grossman, 1981; Milgrom, 1981), leading to a full disclosure equilibrium.\(^6\) The reason is in our model, there is neither a proprietary cost to disclosure (Verrecchia, 1983), nor is there any uncertainty as to whether the manager is informed (Dye, 1985), to prevent unraveling and support a partial disclosure equilibrium.

**Proposition 2 /Benchmark: No Repurchase Market/\]** When the manager cannot repurchase shares, then there is full disclosure.

Next, in the case in which disclosure is impossible or prohibitively costly, the market maker learns on the trading activity of the informed trader via the order flow. Prices adjust as managers with favorable information repurchase undervalued stock and push up the expected market price, and does not repurchase shares otherwise. From our earlier analysis, the repurchase cutoff given prices set by the market maker is

\[ \bar{x} = \frac{(h - \beta)}{h(1-\beta)} \bar{P} + \frac{\beta(1-h)}{h(1-\beta)} P. \]

In turn, the market maker sets the prices given the manager’s repurchase strategy, as in Lemma 1 (for the case \( \bar{x} = \bar{\pi} = \bar{\pi} \)).

\(^6\)See also, Viscusi [1978], Grossman and Hart [1980], Milgrom and Roberts [1986].
Proposition 3 \textbf{[Benchmark: No Possibility of Disclosure]} When the manager cannot credibly disclose information (or it is prohibitively costly to do so), there exists an equilibrium threshold \( \bar{x} \) above which the manager repurchases shares and the market maker sets prices:

\[
\begin{align*}
    P^H &= E(x|x > \bar{x}), \quad P^L = E(x|x < \bar{x}) \quad \text{and} \quad P^M = \theta P^H + (1 - \theta) P^L, \quad (14) \\
    \text{where} \quad \theta &= \frac{\Pr(x > \bar{x})(1 - \alpha)}{\Pr(x > \bar{x})(1 - \alpha) + P(x < \bar{x})\alpha},
\end{align*}
\]

and where the threshold is implicitly given by the solution to,

\[
\bar{x} = \frac{(h - \beta) \bar{P}}{h(1 - \beta)} + \frac{\beta(1 - h)}{h(1 - \beta)} P, \quad \text{and} \quad \langle \bar{P}, \bar{P} \rangle \quad \text{are given by (4) and (5)}. \quad (15)
\]

3.4 Equilibrium

We are now able to construct the main equilibrium which considers the best response of the manager to the prices set by the market maker based on order-flow (Proposition 1) and the best response of the market maker (Lemma 1).

\textbf{Equilibrium \textbf{[Two Tailed Disclosure and Repurchase Equilibrium]}} For level of myopia \( \beta \in (0, h) \), there exists an equilibrium with monotone prices in which the manager does not disclose information and repurchases shares when \( x > \underline{x} \), does not disclose information and does not repurchase shares when \( x < \underline{x} \), and discloses her private information when \( x \in (\underline{x}, \bar{x}) \). The cutoffs \( \underline{x}, \bar{x} \) satisfy \( x_{\min} < \underline{x} < \bar{x} < x_{\max} \) and are implicitly given by,

\[
\begin{align*}
    \underline{x} &= \alpha \theta E(x|x > \bar{x}) + (1 - \alpha \theta) E(x|x < \underline{x}), \\
    \bar{x} &= (\alpha + \theta - \alpha \theta) E(x|x > \bar{x}) + (1 - \alpha)(1 - \theta) E(x|x < \underline{x}).
\end{align*}
\]

The market prices set by the market maker are,

\[
\begin{align*}
    P^H &= E(x|x > \bar{x}), \quad P^L = E(x|x < \underline{x}) \quad \text{and} \quad P^M = \theta P^H + (1 - \theta) P^L, \\
    \text{where} \quad \theta &= \frac{(1 - \alpha) \Pr(x > \bar{x})}{(1 - \alpha) \Pr(x > \bar{x}) + \alpha \Pr(x < \underline{x})}.
\end{align*}
\]

The above equilibrium implies that full disclosure does not obtain in equilibrium when a perfectly informed manager can repurchase shares. That is, there does not exist an equilibrium in
which the disclosure region is the full support $\mathcal{X}$. Instead, there is partial disclosure in equilibrium since the manager can hide behind, so to speak, the uncertainty regarding market demand for the firm’s stock. In particular, the uncertainty about the liquidity needs of shareholders allows informed managers to withhold adverse information from markets or alternatively to trade on this information without being detected by the market maker—without such uncertainty, the market maker can perfectly identify trade by the manager and the unraveling argument holds, leading to full-disclosure.

(Insert Figure 2 here)

To illustrate this partial disclosure and repurchase equilibrium, we present an example with $x \sim \text{U}(0, 1)$. In this example, the equilibrium cutoffs are given by $\bar{x} = \frac{1}{1+2\alpha(1-\alpha)}$, and $\underline{x} = \frac{2\alpha(1-\alpha)}{1+2\alpha(1-\alpha)}$ (see appendix). This equilibrium is depicted in Figure 2. Notice that the manager is more likely to disclose her private information and less likely to repurchase shares when the level of uncertainty $\alpha$ is lower. The disclosure region expands when the uncertainty regarding the liquidity shock, $h$, is reduced. Intuitively, the manager, while being completely informed, exploits this uncertainty faced by the market maker to hide information. But, once this uncertainty diminishes, the manager will be compelled to disclose more information in equilibrium. At the limit, when the liquidity shock is completely predictable, i.e., $\alpha = 0$, then the equilibrium converges to a full disclosure equilibrium.

**Corollary 4 [Disclosure and Liquidity Shock]** The equilibrium approaches that of full disclosure (with no repurchase) as uncertainty on the liquidity shock diminishes to zero, that is, $\langle \bar{x}, \underline{x} \rangle \to \langle x_{\text{min}}, x_{\text{min}} \rangle$ as $\alpha \to 0$ or 1.

Interestingly, when we consider the case of costly disclosures, we show the intermediate disclosure region need not exist in equilibrium for all illiquidity levels and the aforementioned limiting case will no longer yield full disclosure. Moreover, the equilibrium behavior of the manager depends also on the size of the liquidity shock and the level of managerial myopia when disclosures are costly.

**4 Analysis: Myopic Manager ($\beta \in (h, 1)$)**

Next, we consider the case in which the size of the liquidity shock ($h$) is small relative to the weight the manager places on the short-term price in her objective function ($\beta$). As we noted
earlier, the expected payoff to the manager from repurchasing shares is

\[
E(V^m|ND, r = h, x) = x + \left( \frac{h - \beta}{1 - h} \right) (x - \mathcal{P}).
\]

With \( h \leq \beta \), the manager does not benefit from repurchasing undervalued shares as her expected payoff would be less than the value of her private information \((x)\). In this case, the manager might as well disclose \( x \) directly and benefit from propping up short-term price. In other words, the manager has an incentive to be overly myopic. The myopic manager’s payoffs from disclosure and/or repurchase are depicted in Figure 3.

(Insert Figure 3 here)

Indeed, as the following proposition establishes, with \( h \leq \beta \), the only equilibrium is one of full disclosure.

**Proposition 5 [Equilibrium: High Managerial Myopia]** When \( \beta \in (h, 1) \), the only equilibrium that exists is one of full disclosure. Off-equilibrium-path prices following non-disclosure are set to be \( P^H = P^M = P^L = x_{\min} \).

To see this, we consider first the best response of such an overly myopic manager. Her expected payoff from repurchasing shares is increasing in the expected short-term stock price \( \mathcal{P} \). Intuitively, a higher expected short-term price benefits the liquidity traders because they can sell their shares at a higher price at the expense of long-term shareholders. Thus, the manager cares more about the gain to liquidity traders than the cost to long-term investors.

Similarly, the expected payoffs to the manager from not repurchasing shares (following non-disclosure), \( E(V^m|ND, r = 0, x) = \beta \mathcal{P} + (1 - \beta)x \), is increasing in the value of the firm \( x \) at a lower rate than that of the expected payoff from repurchasing shares. And, of course, disclosure yields an expected payoff of exactly \( x \).

This implies that the benefit from repurchasing shares relative to non-repurchase (following non-disclosure),

\[
E(V^m|ND, r = h, x) - E(V^m|ND, r = 0, x) = \left( \frac{h(1 - \beta)}{1 - h} \right) x + \left( \frac{\beta - h}{1 - h} \right) \mathcal{P} - \beta \mathcal{P},
\]

16
is increasing in $x$. Moreover, the benefit from disclosure relative to repurchasing share,

$$E(V^m|D,x) - E(V^m|ND,r = h,x) = x - \left[ \left( \frac{1 - \beta}{1 - h} \right) x + \left( \frac{\beta - h}{1 - h} \right) P \right] = \left( \frac{\beta - h}{1 - h} \right) (x - P),$$

is also increasing in firm value $x$. Consequently, for a highly myopic manager ($\beta > h$), there exists a sufficiently large firm value for which disclosure is the best response. In particular, the threshold for disclosure is given by the expected price following repurchase, $\overline{P} \equiv E(P_2|r = h)$, and the manager will disclose information whenever

$$x \geq \overline{P} \equiv E(P_2|r = h).$$

But such a cutoff implies all repurchasing firms lie to the left of $\overline{P}$, and $\overline{P}$ cannot represent the expected value of the group of managers that choose to repurchase stock—any manager of type higher than $\overline{P}$ discloses and therefore at most the value of a manager that does not disclose is given by $\overline{P}$. As a result, the only equilibrium that exists here is one in which $\overline{P} = x_{\text{min}}$, i.e., a full disclosure equilibrium.

## 5 Extensions

In this section, we present some extensions that address some key structural aspects of our model. First, we show the upper-tailed repurchase strategy result (Proposition 1) that we established using a binary representation of the liquidity shock is robust to more general specifications. Second, we examine how our main equilibrium is affected when disclosures are costly.

### 5.1 General distribution of liquidity shock

In this section, we generalize the result in Proposition 1 by establishing the impossibility of the upper-tailed disclosure strategy in equilibrium even after incorporating a general distribution of the liquidity shock.

Suppose a general distribution for the liquidity shock $q \sim Q$, and a general pricing rule determined by the market maker that is based on the observed order flow, $P(F)$. The manager’s strategy then is to repurchase shares at rate $r(x)$ and the consequent order flow is given by $r(x) + q$. The
The market maker’s pricing rule following non-disclosure satisfies $P(F) = E(x|r(x) + q)$. To show that a cutoff disclosure strategy cannot be part of an equilibrium, it suffices to show that in any such suggested equilibrium the manager has an incentive to deviate and repurchase shares instead of disclosing information.

Suppose, instead, that the manager discloses all information above a cutoff $x'$. Then, the prices set by the market maker following non-disclosure and order flow $F = r(x) + q$ satisfy the property $P(r(x) + q) = E(x|r(x) + q) \leq x'$. Now, we establish that the manager has an incentive to withhold information and repurchase shares for all $x > x'$, contradicting the proposed cutoff disclosure strategy. The payoff from repurchasing $r(x) > \beta$ shares for the manager of type $x$ is

$$E(V^m|ND, r(x), x) = \left(1 - \frac{\beta}{1 - r(x)}\right) x - \left(\frac{r(x) - \beta}{1 - r(x)}\right) E(P(F)|r(x)),$$

while the payoff from disclosure is $x$. Therefore, the advantage to disclosing information is given by

$$x - E(V^m|ND, r(x), x) = x - \left(1 - \frac{\beta}{1 - r(x)}\right) x + \left(\frac{r(x) - \beta}{1 - r(x)}\right) E(P(F)|r(x)).$$

The manager will choose to disclose information when $x - \left(1 - \frac{\beta}{1 - r(x)}\right) x + \left(\frac{r(x) - \beta}{1 - r(x)}\right) E(P(F)|r(x)) > 0$. Or if simplified, disclosure is optimal only if $E(P(F)|r(x)) > x$. But, since $E(P(F)|r(x)) \leq x'$ disclosure cannot be optimal for $x > x'$ leading to a contradiction. We formally state this result in the following proposition.

**Proposition 6 [Impossibility of Cutoff Disclosure Strategy]** If the liquidity shock is distributed according to the general distribution function $Q$, there does not exist a cutoff disclosure equilibrium in which disclosure occurs for all $x \geq x'$ for some $x' \in \mathcal{X}$.

### 5.2 Costly disclosures

The introduction of costly disclosure $c \in (0, \beta)$ alters the manager’s best response to market prices, set by the market maker. In particular, we assume that following disclosure of $x$ the value of the firm is $x(1 - c)$ or that the value $c$ represents the percentage lost in the event of disclosure.\(^7\)

\(^7\)Note that when $c > \beta$ the manager will always prefer non-disclosure over disclosure due to the relatively high cost associated with disclosure. Therefore, we restrict attention in this section to the case of lower disclosure costs.
The manager is willing to repurchase shares for lower valuations and to choose non-disclosure for higher valuations now that disclosure is costly. In addition to the incentive to repurchase under-valued stock, the manager now will also repurchase stock that is under-valued as long as the loss due to this under-valuation does not exceed the cost of disclosure. Or formally, the manager will repurchase shares for

$$x \geq \bar{x} = \frac{P - \frac{h - \beta}{h - \beta + (1 - h)c}}{h - \beta + (1 - h)c} \ [\text{Repurchase is optimal}].$$

Notice that when the disclosure cost is zero the above condition coincides with our previous analysis and the manager repurchases only under-valued stock. But, since \(\frac{h - \beta}{h - \beta + (1 - h)c} < 1\) for \(c > 0\), it follows that the manager repurchases also over-valued stock. Similarly, the manager will prefer non-disclosure over disclosure for higher value realizations due to the cost associated with disclosure. Formally, non-disclosure is optimal when,

$$x \leq \bar{x} = \frac{\beta}{\beta - c} \ [\text{Non-disclosure and non-repurchase is optimal}].$$

Notice that a myopic manager (a higher \(\beta\)) is more willing to disclose information and bare the disclosure cost relative to a far sighted manager.

Of course, in an equilibrium with partial disclosure, the upper cutoff must be higher than the lower cutoff, or formally (where \(\Delta \equiv \frac{\beta}{\beta - c} \frac{h - \beta + (1 - h)c}{h - \beta}\)),

$$\bar{x} \leq \bar{\pi} \iff \Delta P \leq P.$$

Intuitively, if for any given prices set by the market maker \(\Delta P > P\), then the manager’s best response is never to disclose information, repurchase above a cutoff, and not repurchase otherwise, as in the benchmark case when disclosure is not possible. Indeed, the higher the cost of disclosure the higher is the value of \(\Delta\).

**Proposition 7** ([Equilibrium with Costly Disclosure]) When disclosure is costly, i.e., \(c > 0\), the equilibrium can be one of two types while \((\bar{P}, \bar{\pi})\) are given by (4)-(5), \(P^H = E(x|x > \bar{x})\), \(P^L = E(x|x < \bar{x})\), \(P^M = \theta P^H + (1 - \theta) P^L\) and \(\theta \equiv \frac{(1 - \alpha) \Pr(x > \bar{x})}{(1 - \alpha) \Pr(x > \bar{x}) + \alpha \Pr(x < \bar{x})}\): (where \(\Delta \equiv \frac{\beta}{\beta - c} \times \frac{h - \beta + (1 - h)c}{h - \beta}\)):

**No-Disclosure** For sufficiently high disclosure cost a non-disclosure equilibrium that is identical to benchmark case in Proposition 3 emerges. The manager repurchases shares only for \(x >\)
\( \bar{x} = \underline{x} = x^c \) and expected prices satisfy \( \bar{P} < \Delta P \).

**Partial Disclosure** For sufficiently small disclosure cost a two tailed repurchase and disclosure equilibrium similar to that presented in section 3.4 emerges. Namely, The manager does not disclose and does not repurchase shares for sufficiently low cash flow realizations, \( x \leq \underline{x} = \frac{\beta}{\beta - c} \), discloses information for intermediate realizations, \( \underline{x} < x < \bar{x} \), and withholds information and repurchase shares otherwise, \( x \geq \bar{x} = \frac{\bar{P} \frac{h - \beta}{h - \beta + (1 - h)c}}{\bar{P} \frac{h - \beta}{h - \beta + (1 - h)c}} \) provided that \( (\bar{P} > \Delta P) \).

To shed light on this partial disclosure and repurchase equilibrium we consider the Uniform distribution over the unit interval, \( x \sim U(0, 1) \). When two equilibrium thresholds exist, this implies the following equilibrium conditions (where \( \tau_1 = 1 + \frac{c}{h - \beta} \), and \( \tau_2 = 1 - \frac{c}{h - \beta} \)): \( P^H = \frac{x + 1}{2}, P^L = \frac{x}{2}, P^M = \theta P^H + (1 - \theta) P^L, \theta \equiv \frac{(1 - \alpha)(1 - \tau)}{(1 - \alpha)(1 - \tau) + \alpha \tau} \) and,

\[
\begin{align*}
\bar{x} \tau_1 &= \alpha P^H + (1 - \alpha) P^M, \\
\bar{x} \tau_2 &= \alpha P^M + (1 - \alpha) P^L.
\end{align*}
\]

In the other case, when the manager does not disclose information in equilibrium, the repurchase cutoff is given by the solution to: \( P^H = \frac{x + 1}{2}, P^L = \frac{x}{2}, P^M = \theta P^H + (1 - \theta) P^L, \theta \equiv \frac{(1 - \alpha)(1 - x^c)}{(1 - \alpha)(1 - x^c) + \alpha x^c} \) and (where \( \gamma = \frac{h - \beta}{h} \))

\[
x^c = \frac{P}{1 - \gamma} + \bar{P} \gamma.
\] (16)

(Insert Figure 4 here)

Figure 4A plots the equilibrium cutoffs for the case of Uniform distribution as a function of the cost of disclosure. As one might expect, there is less disclosure of unfavorable or middle levelled news since the cost of disclosure increases, ala. Verrecchia (1983). But also, one can see that as a result of an increase in the cost of disclosure there is less disclosure of good news, since the manager instead prefers to repurchase shares for these valuations. Figure 4B plots the disclosure and repurchase equilibrium as a function of the likelihood of a liquidity shock. As can be seen from the figure, the equilibrium is one of no-disclosure when there is most uncertainty regarding the liquidity shock. As the level of uncertainty increases, or the likelihood of a liquidity shock approaches one half, the upper disclosure cutoff decreases and the lower disclosure cutoff increases,
that is, there is less information disclosed. Intuitively, as the level of uncertainty increases, the
manager can with a higher probability hide her trades from the market maker and this reduces
the disclosure region. Notice, while the manager’s best response to a given pricing schedule as a
function of order flow, set by the market maker, does not depend on the likelihood of the liquidity
shock, in equilibrium, the market maker sets prices while facing less uncertainty when \( \alpha \) is extreme,
and this, in turn, affects the equilibrium outcome.

Figure 4C plots the disclosure and repurchase cutoffs as a function of the size of the liquidity
shock \( h \). As shown in this plot, the equilibrium contains an intermediate disclosure region when
the size of the liquidity shock is above a cutoff level and this region is increasing in the size of
the liquidity shock afterwards. This follows since the manager starts to repurchase shares instead
of disclosing information when the stock is not yet under-valued (due to the alternative of costly
disclosure) and the effective cost from repurchase in terms of long-term value is increasing in the
number of shares repurchased. Consequently, the higher the number of shares repurchased the
more costly is the repurchase transaction and the higher is the equilibrium upper cutoff.

The solution to the above equilibrium conditions and comparative statics are given as follows:

**Lemma 2** If value is uniformly distributed, then in equilibrium, higher uncertainty about the liq-
uidity shock, i.e. \( \alpha \) closer to \( \frac{1}{2} \), and lower liquidity shock, \( h \), lead to less disclosure (and possibly
no-disclosure); the relation between the likelihood of disclosure and the level of managerial myopia
is inverted U shaped, in the interval \( \beta \in (c,h) \). Moreover, higher disclosure costs lead to less
disclosure (and possibly no disclosure). Finally, the equilibrium with partial disclosure of inter-
mediate information is given by the solution to \( \alpha = \frac{\alpha}{1-\alpha} \left( \frac{\pi(2\tau_1-\alpha)}{2\tau_2-1+\alpha} \right) \) and \( (2\tau_1 - 1 - z(2\tau_1 - \alpha)^2)\bar{x}^2 + \bar{x} (-2\tau_1 + 2z(2\tau_1 - \alpha)\alpha) + 1 - z\alpha^2 = 0 \) where \( z = \frac{\alpha^2}{[1-\alpha]^{2}\left[2\tau_2-1+\alpha\right]} \); while, the equilibrium
with no-disclosure is given by the repurchase cutoff \( x^c \) that satisfies \( [x^c - \alpha \gamma][1 - \alpha - x^c + 2\alpha x^c] = (1 - \alpha)(1 - x^c)[\gamma + \alpha - 2\gamma \alpha] \).

6 Conclusion

In the voluntary disclosure literature, it has been shown that an informed manager’s incentive
to withhold bad news may actually lead to the unraveling of information or full disclosure in
equilibrium. However, informed managers have other avenues to exploit their private information
given their incentives. For instance, managers of undervalued firms often repurchase shares to the
extent they care about long-term shareholders. In this paper, we model a manager’s choice to either
directly disclose her private information or to engage in repurchasing. While the unraveling results suggests that informed managers cannot exploit their private information - as all information is disclosed - we show that the ability of the manager to repurchase stock, together with the stochastic need of some investors to liquidate shares, leads to a partial disclosure strategy in equilibrium.

This partial disclosure strategy emerges because the repurchase of undervalued stock dominates the disclosure of information for sufficiently favorable realizations as long as the manager is not too myopic and cares about the long-term gains from purchasing undervalued stock - a realistic assumption given the prevalence of stock repurchases. As we have shown, the manager can exploit her information advantage over the market maker in two important ways: first, the manager can withhold information from the market maker by choosing not to disclose information (Dye, 1985; Verrecchia, 1983), and. second, the manager can privately trade or repurchase shares because the market maker must set prices based on aggregate order flow (Kyle, 1985).

We derive a two-tailed disclosure and repurchase equilibrium. For sufficiently high valuations the manager repurchases stock to the benefit of long-term investors; for sufficiently low valuations, the manager withholds her information from markets in order to sustain a favorable short-term price and also chooses not to repurchase shares because the stock would be over-valued; for intermediate value realizations that are still below the expected short-term market price following repurchase, the manager discloses information to increase the short term price. This strategy is sustained in equilibrium because the market maker cannot perfectly infer the manager’s repurchase strategy based on aggregate order flow. Indeed, we show the level of uncertainty faced by the market maker plays a crucial role in determining the disclosure and repurchase cutoffs—as the market maker is more uncertain, the manager discloses less information and repurchases shares more often, and the intermediate disclosure region shrinks.

The level of managerial myopia relative to the amount of shares required to be repurchased also plays a role in equilibrium. In particular, for any given level of managerial myopia the manager will prefer to repurchase shares for highly undervalued stock to prop up terminal price as long as the amount of shares traded exceeds the level of managerial myopia, otherwise the manager would prefer to disclose this information to advance the short-term price. Indeed, we show that when the level of managerial myopia is higher that the high realization of the liquidity shock, the equilibrium is one of full disclosure.

We extend our analysis in two ways to provide robustness of our results and broaden their scope. We show the result that favorable information is not disclosed, but leads to repurchase
instead, is not driven by the simple binary representation of the liquidity shock we used in our main analysis; this result extends to a general distribution as well. While we do not solve the equilibrium for this more general setting, our purpose is to show that an upper-tailed disclosure strategy cannot be part of an equilibrium when we allow for the repurchase option. Second, we extend our analysis to include a cost associated with disclosure. As one would expect, we explicitly show for the Uniform distribution case that more costly disclosures lead to a reduction in the intermediate disclosure region. Eventually, if disclosure costs are high enough, a non-disclosure equilibrium results. From a robustness point of view, our analysis confirms that the introduction of a disclosure cost does not alter the main properties of our equilibrium, as long as the disclosure cost is sufficiently low. It can also be shown that incorporating uncertainty regarding the information endowment of the manager (Dye, 1985) does not qualitatively change the manager’s disclosure and repurchase strategy in equilibrium. In such a setting, however, an issue that arises is whether the uninformed manager would repurchase shares or not. This strategy of the uninformed manager will in turn have implications for the pricing mechanism of the market maker and for the equilibrium thresholds.
Appendix

Proof of Proposition 1: For any given expected prices following repurchase and non-repurchase \( \langle P, \overline{P} \rangle \) such that \( P \leq \overline{P} \) and for level of managerial myopia that is sufficiently low \( \beta \in (0, h) \) the manager’s expected payoff from repurchasing shares (together with non-disclosure) dominates the two alternatives of (i) disclosure, and (ii) not repurchasing shares (together with non-disclosure) for sufficiently high value realization. Formally, for \( x > \overline{P} \) we have,

\[
E(V^m|ND, r = h, x) > \max [E(V^m|D, x), E(V^m|ND, r = 0, x)].
\]

or more precisely,

\[
x + \left( h - \frac{\beta}{1-h} \right) (x - \overline{P}) > \max [x, \beta \overline{P} + (1 - \beta)x] \quad \text{for all} \quad x > \overline{P} \quad \text{(when} \quad \beta \in (0, h)\text{)}.
\]

One can also verify that non-disclosure and non-repurchase is the manager’s best response when \( x < \underline{P} \):

\[
E(V^m|ND, r = 0, x) > \max [E(V^m|D, x), E(V^m|ND, r = h, x)] \quad \text{for all} \quad x < \underline{P} \quad \text{(when} \quad \beta \in (0, h)\text{)}.
\]

And finally, that disclosure is optimal for the intermediate range of \( x \in (\underline{P}, \overline{P}) \). Q.E.D

Proof of Lemma 1: The market prices set by the competitive market maker follow directly from the manager’s equilibrium disclosure and repurchase cutoffs \( \langle \underline{x}, \overline{x} \rangle \) and the requirement of zero expected rents to the market maker, that is, prices reflect the expected value of the firm from the perspective of the market maker that observes order flow but does not directly observe the trading behavior of the firm or the liquidity traders. When order flow is extreme, the market maker can perfectly infer the amount of shares repurchased by the manager and \( P^H = E(x|x > \overline{x}) \), \( P^L = E(x|x < \underline{x}) \). But, when order flow is intermediate the market maker sets the price based on the likelihood \( \theta \) that the manager repurchased shares, \( \theta = \Pr(r = h|F = 0) \). Namely,

\[
\theta = \Pr(r = h|F = 0) = \frac{\Pr(r = h, F = 0)}{\Pr(F = 0)} = \frac{\Pr(r = h)}{\Pr(r = h) \Pr(F = 0|r = h) + \Pr(r = 0) \Pr(F = 0|r = 0)}.
\]
\[
\begin{align*}
\text{Pr}(r = h) \text{Pr}(q = h) & = \frac{\text{Pr}(r = h) \text{Pr}(q = h)}{\text{Pr}(r = h) \text{Pr}(q = h) + \text{Pr}(r = 0) \text{Pr}(q = 0)} \\
& = \frac{\text{Pr}(x > x)(1 - \alpha)}{\text{Pr}(x > x)(1 - \alpha) + P(x < x)\alpha}.
\end{align*}
\]

Therefore, \(P^M = \theta P^H + (1 - \theta) P^L\). \textbf{Q.E.D}

**Proof of Proposition 2:** The full-disclosure equilibrium outcome in this benchmark (without the possibility of repurchase) represents the well known unraveling result (e.g., see Dye (1986) for the special case of \(\lambda = 1\)) and therefore proof is not provided.

**Proof of Proposition 3:** Let the equilibrium threshold \(\bar{x}\) represent the type of manager for which the expected payoff from repurchasing shares equals that from non-repurchase. Formally, this requires (see (8))

\[
\bar{x} = \frac{(h - \beta)}{h(1 - \beta)} P + \frac{\beta(1 - h)}{h(1 - \beta)} P_0, \text{ and } \langle P, P \rangle \text{ are given by (4) and (5)}.
\]

The above implies that,

\[
\bar{x} = \gamma P + (1 - \gamma) = \phi(\bar{x}) E(x|x > \bar{x}) + (1 - \phi(\bar{x})) E(x|x < \bar{x}).
\]

where \(\gamma \equiv \frac{(h - \beta)}{h(1 - \beta)} \in (0, 1)\) and \(\phi(\bar{x})\) is given by,

\[
\phi(\bar{x}) = \gamma [(\alpha + (1 - \alpha))] + (1 - \gamma)\alpha = \theta [\gamma - 2\gamma\alpha + \alpha] + \gamma\alpha
\]

\[
= \frac{\text{Pr}(x > \bar{x})(1 - \alpha)}{\text{Pr}(x > \bar{x})(1 - 2\alpha) + \alpha [\gamma - 2\gamma\alpha + \alpha] + \gamma\alpha}.
\]

For the Uniform distribution one can show that the above implies the following simplification,

\[
2\bar{x} = \phi(\bar{x})(1 + \bar{x}) + (1 - \phi(\bar{x}))\bar{x} = \phi(\bar{x}) + \bar{x} \Rightarrow \bar{x} = \phi(\bar{x}).
\]
Consequently, \( \bar{x} = \phi(\bar{x}) \) implies that,

\[
\begin{align*}
\bar{x} &= \frac{(1 - \bar{x})(1 - \alpha)}{(1 - \bar{x})(1 - 2\alpha) + \alpha} [\gamma - 2\gamma\alpha + \alpha] + \gamma\alpha \\
\bar{x} \left[ (1 - \bar{x})(1 - 2\alpha) + \alpha \right] &= (1 - \bar{x})(1 - \alpha) [\gamma - 2\gamma\alpha + \alpha] + \gamma\alpha (1 - \bar{x})(1 - 2\alpha) + \alpha
\end{align*}
\]

\[
\bar{x} - \bar{x}^2 \frac{(1 - 2\alpha)}{(1 - \alpha)} = [\gamma - 2\gamma\alpha + \alpha] - \bar{x} \left[ \gamma - 2\gamma\alpha + \alpha \right] + \gamma\alpha \frac{(1 - 2\alpha)}{(1 - \alpha)} \Rightarrow
\]

\[
0 = -\bar{x}^2 \frac{(1 - 2\alpha)}{(1 - \alpha)} + \bar{x} \left[ 1 + \gamma - 2\gamma\alpha + \alpha + \frac{\gamma\alpha (1 - 2\alpha)}{(1 - \alpha)} \right] - [\gamma - 2\gamma\alpha + \alpha]
\]

Finally, for the Uniform distribution we obtain \( \bar{x} \) as the solution to,

\[
\bar{x}^2 \frac{1 - 2\alpha}{1 - \alpha} - 2\bar{x} + 1 = 0.
\]

**Derivation of Equilibrium** Using Proposition 1, and Lemma 1, we can derive the equilibrium cutoffs \( (\underline{x}, \bar{x}) \). Namely, \( \underline{x} = P = \alpha P^M + (1 - \alpha) P^L \) and \( \bar{x} = \bar{P} = \alpha P^H + (1 - \alpha) P^M \) where:

\[
P^H = E(x|x > \bar{x}), \quad P^L = E(x|x < \underline{x}), \quad \text{and} \quad P^M = \theta P^H + (1 - \theta) P^L
\]

\[
\theta = \frac{(1 - \alpha) \Pr(x > \bar{x})}{(1 - \alpha) \Pr(x > \bar{x}) + \alpha \Pr(x < \underline{x})}.
\]

Thus,

\[
\bar{x} = \alpha E(x|x > \bar{x}) + (1 - \alpha) \left( \theta E(x|x > \bar{x}) + (1 - \theta) E(x|x < \underline{x}) \right),
\]

and

\[
\underline{x} = \alpha \left( \theta E(x|x > \bar{x}) + (1 - \theta) E(x|x < \underline{x}) \right) + (1 - \alpha) E(x|x < \underline{x}).
\]

A direct application of the Fixed Point Theorem establishes the existence of a solution to the above two equations, i.e., existence of the cutoffs \( (\underline{x}, \bar{x}) \). In particular, this follows from the compactness of the support of firm value \( \mathcal{X} \equiv [x_{\min}, x_{\max}] \subset \mathbb{R}^+ \), the fact that \( E(x|x \in A) \in \mathcal{X} \) for all \( A \subset \mathcal{X} \), and the continuity in \( (\underline{x}, \bar{x}) \) of the functions at hand. Q.E.D.

**Proof of Corollary 4:** As uncertainty on the liquidity shock diminishes to zero, that is \( \alpha \to 0 \), the conditional likelihood of a repurchase of shares by the manager upon observation of intermediate order flow by the market maker is given by

\[
\lim_{\alpha \to 0^+} \theta = \lim_{\alpha \to 0^+} \frac{(1 - \alpha) \Pr(x > \bar{x})}{(1 - \alpha) \Pr(x > \bar{x}) + \alpha \Pr(x < \underline{x})} = 1 \text{ for any } (\underline{x}, \bar{x}) \subset \mathcal{X}.
\]
Now, since the cutoffs also depend on $\alpha$ we obtain that they are given by the solution to the following two equations at the limit:

$$\bar{x} = \theta E(x|x > \bar{x}) + (1 - \theta)E(x|x < \bar{x}) \rightarrow E(x|x > \bar{x}), \quad \underline{x} = E(x|x < \bar{x}).$$ (24)

Therefore, the solution $(\underline{x}, \bar{x})$ converges to $(\underline{x}_{\text{min}}, \bar{x}_{\text{min}})$ as $\alpha \to 0$. \textbf{Q.E.D.}

**Derivation of closed form solution for Uniform Distribution case $\beta \in (0, h)$:**

$$\mathcal{P} = \alpha P^H + (1 - \alpha)P^M \Leftrightarrow P^M = \frac{\bar{x} - \alpha P^H}{1 - \alpha} = \frac{\bar{x}(2 - \alpha) - \alpha}{2(1 - \alpha)}$$

and,

$$\bar{x} = \alpha P^M + (1 - \alpha)P^L = \alpha \left( \frac{\bar{x}(2 - \alpha) - \alpha}{2(1 - \alpha)} \right) + (1 - \alpha)\frac{\bar{x}}{2} \Leftrightarrow$$

$$\underline{x} = \frac{\alpha(2 - \alpha)\bar{x} - \alpha^2}{1 - \alpha^2}. \quad (25)$$

This implies that,

$$\bar{x} = \alpha P^H + (1 - \alpha)P^M$$

$$= \alpha \left( \frac{1 + \bar{x}}{2} \right) + (1 - \alpha) \left( \frac{(1 - \alpha) \Pr(x > \bar{x}) E(x|x > \bar{x})}{(1 - \alpha) \Pr(x > \bar{x}) + \alpha \Pr(x < \bar{x})} + \frac{\alpha \Pr(x < \bar{x}) E(x|x < \bar{x})}{(1 - \alpha) \Pr(x > \bar{x}) + \alpha \Pr(x < \bar{x})} \right)$$

$$= \frac{\alpha}{2} (1 + \bar{x}) + \frac{(1 - \alpha)}{2} \left( \frac{(1 - \alpha)(1 - \bar{x}^2) + \alpha \bar{x}^2}{(1 - \alpha)(1 - \bar{x}) + \alpha \bar{x}} \right).$$

This can be further simplified to,

$$((2 - \alpha)\bar{x} - \alpha) ((1 - \alpha)(1 - \bar{x}) + \alpha \bar{x}) = (1 - \alpha) \left( (1 - \alpha)(1 - \bar{x}^2) + \alpha \bar{x}^2 \right) \Leftrightarrow$$

$$2\bar{x}(1 - \alpha) - \bar{x}^2 (2 - \alpha - 1 + \alpha)(1 - \alpha) - \alpha(1 - \alpha) + \alpha \bar{x}(2 - \alpha) \bar{x} - \alpha = (1 - \alpha)^2 + \alpha(1 - \alpha) \bar{x}^2$$

Since $\underline{x} = \frac{\alpha}{1 - \alpha^2} [(2 - \alpha)\bar{x} - \alpha]$ the above implies that,

$$2\bar{x} - \bar{x}^2 - \alpha + \frac{\alpha \bar{x}(2 - \alpha)\bar{x} - \alpha}{1 - \alpha} = (1 - \alpha) + \alpha \bar{x}^2 \Leftrightarrow$$

$$2\bar{x} - \bar{x}^2 - \alpha + \bar{x}^2 (1 + \alpha) = (1 - \alpha) + \alpha \bar{x}^2 \Leftrightarrow$$

$$\bar{x} = 1 - \bar{x}$$
Finally, we obtain the solution,

\[ \bar{x} = \frac{1}{1 + 2\alpha(1 - \alpha)}, \quad \bar{z} = \frac{2\alpha(1 - \alpha)}{1 + 2\alpha(1 - \alpha)} \]

The equilibrium prices are,

\[ P_H = \frac{1 + \alpha(1 - \alpha)}{1 + 2\alpha(1 - \alpha)}, \quad P_L = \frac{\alpha(1 - \alpha)}{1 + 2\alpha(1 - \alpha)}, \]

\[ P_M = \frac{\bar{x} - \alpha P_H}{1 - \alpha} = \frac{\frac{1 - \alpha - \alpha^2 + \alpha^3}{1 + 2\alpha(1 - \alpha)}}{1 - \alpha} = \frac{1 - \alpha^2}{1 + 2\alpha(1 - \alpha)}. \]

This implies the following expected price differential following repurchase or non-repurchase:

\[ \bar{P} - P = \frac{1 - 2\alpha(1 - \alpha)}{1 + 2\alpha(1 - \alpha)}. \]

**Proof of Proposition 5:** As before, let \( \bar{P} = E(P_2| r = h) \) and \( P = E(P_2| r = 0) \) and the manager’s payoffs are:

\[ E(V^m| ND, r = h, x) = x - \left( \frac{\beta - h}{1 - h} \right) (x - \bar{P}) \]
\[ E(V^m| ND, r = 0, x) = x + \beta (P - x) \]
\[ E(V^m| D, x) = x \]

This implies that,

\[ E(V^m| ND, r = h, x) - E(V^m| ND, r = 0, x) = \left( \frac{h(1 - \beta)}{1 - h} \right) x + \left( \frac{\beta - h}{1 - h} \right) \bar{P} - \beta P, \]
\[ E(V^m| D, x) - E(V^m| ND, r = h, x) = \left( \frac{\beta - h}{1 - h} \right) (x - \bar{P}), \]

Since \( \beta \in (h, 1) \), disclosure is the manager’s best response for sufficiently high valuations and is dominated otherwise,

\[ x \geq \bar{P} \equiv E(P_2| r = h) \iff \text{Disclosure is optimal.} \]

But, since all information above \( \bar{P} \) is disclosed by the manager, the market maker’s valuation following non-disclosure for a given order flow must be lower than this cutoff. Moreover, it must
be strictly lower if \( \overline{P} > x_{\text{min}} \), as \( ND \Rightarrow x \in (x_{\text{min}}, \overline{P}) \). Therefore, for any \( \overline{P} > x_{\text{min}} \), the expected price \( P_2 \) following non-disclosure and repurchase \( E(P_2 | r = h) \) must also be strictly lower than this cutoff. Therefore, the cutoff \( \overline{P} \) is not consistent with zero profits for the market maker and we reach a contradiction. Consequently, the only equilibrium that exists is one in which \( \overline{P} = x_{\text{min}} \), i.e., a full disclosure equilibrium. Q.E.D

**Proof of Proposition 7:** First, start with the case of no-disclosure, i.e., we have a single cutoff that refers to the manager’s repurchase strategy. Using Proposition 1, and Lemma 1, the conditions for prices in equilibrium when there is no disclosure simplify to (cutoffs \( x, \overline{x} \) are both equal to \( x^c \)):

\[
P^H = E(x | x > x^c), \quad P^L = E(x | x < x^c), \quad \text{and} \quad P^M = \theta P^H + (1-\theta)P^L
\]

\[
\theta = \frac{(1-\alpha)\Pr(x > x^c)}{(1-\alpha)\Pr(x > x^c) + \alpha \Pr(x < x^c)}.
\]

This implies the following average prices following repurchase and no-repurchase:

\[
\overline{P} = \alpha P^H + (1-\alpha)\left[\theta P^H + (1-\theta)P^L\right] = (\alpha + (1-\alpha)\theta)P^H + (1-\alpha)(1-\theta)P^L = (\alpha + (1-\alpha)\theta)E(x | x > x^c) + (1-\alpha)(1-\theta)E(x | x < x^c).
\]

and

\[
P = \alpha \left[\theta P^H + (1-\theta)P^L\right] + (1-\alpha)P^L = \alpha \theta P^H + (1-\alpha)P^L = \alpha \theta E(x | x > x^c) + (1-\alpha)E(x | x < x^c).
\]

From the manager’s best response function, the cutoff must satisfy

\[
x^c = P^\beta \frac{(1-h)}{h(1-\beta)} + \overline{P} \frac{(h-\beta)}{h(1-\beta)}.
\]  

(27)

A solution to the above equation exists due to the Intermediate Value Theorem. In particular, notice that for \( x^c = 0 \) we obtain that \( \theta = \frac{(1-\alpha)\Pr(x > x^c)}{(1-\alpha)\Pr(x > x^c) + \alpha \Pr(x < x^c)} = 1 \) and \( \langle P, \overline{P} \rangle = \langle \alpha E(x), E(x) \rangle \), i.e., \( x^c < P^\beta \frac{(1-h)}{h(1-\beta)} + \overline{P} \frac{(h-\beta)}{h(1-\beta)} \) but for \( x^c = x_{\text{max}} \) we obtain that \( \theta = \frac{(1-\alpha)\Pr(x > x^c)}{(1-\alpha)\Pr(x > x^c) + \alpha \Pr(x < x^c)} = 0 \),
and \( \langle P, \mathcal{P} \rangle = \langle E(x), \alpha x_{\text{max}} + (1 - \alpha)E(x) \rangle \), i.e., \( x^c < \frac{P_{H(1-h)}}{h(1-\beta)} + \mathcal{P} \frac{(h-\beta)}{h(1-\beta)} \). Thus, there exists an intermediate value for which the condition (27) holds.

The difference between the prices shall be sufficiently small for this equilibrium to hold: \( \bar{P} \leq \Delta P \). Thus, we require that (for \( \eta = \alpha + \theta - 2a\theta \))

\[
\Delta \geq \frac{(\alpha + (1 - \alpha)\theta) E(x|x > x^c) + (1 - \alpha)(1 - \theta)E(x|x < x^c)}{\alpha \theta E(x|x > x^c) + (1 - \alpha \theta)E(x|x < x^c)}.
\]

Since \( x^c \) does not depend on the cost of disclosure in this case, we establish that the above equilibrium condition holds for sufficiently high cost of disclosure \( c \).

In an equilibrium with two cutoffs we have:

\[
\mathbb{E} \left[ 1 + \frac{c(1-h)}{h-\beta} \right] = (\alpha + (1 - \alpha)\theta) E(x|x > \bar{x}) + (1 - \alpha)(1 - \theta)E(x|x < \bar{x}),
\]

and

\[
\mathbb{E} \left[ 1 - \frac{c}{\beta} \right] = \alpha \theta E(x|x > \bar{x}) + (1 - \alpha \theta)E(x|x < \bar{x}).
\]

Since a solution exists for \( c = 0 \) and all functions are continuous we conclude that a solution exists for sufficiently small \( c \). Q.E.D.

**Derivation of closed form solution for Uniform Distribution case** \( \beta \in (0, h) \) and disclosure cost \( c \): First, note that:

\[
\mathbb{E} \tau_1 = \alpha P_H + (1 - \alpha)P_M \Leftrightarrow P_M = \frac{\mathbb{E} \tau_1 - \alpha P_H}{1 - \alpha} = \frac{\mathbb{E} (2\tau_1 - \alpha) - \alpha}{2(1 - \alpha)}
\]

and,

\[
\mathbb{E} \tau_2 = \alpha P_M + (1 - \alpha) P_L = \alpha \left( \frac{\mathbb{E} (2\tau_1 - \alpha) - \alpha}{2(1 - \alpha)} \right) + (1 - \alpha) \frac{\mathbb{E} \tau_2}{2} \Leftrightarrow \mathbb{E} (2\tau_2 - 1 + \alpha) = \alpha \left( \frac{\mathbb{E} (2\tau_1 - \alpha) - \alpha}{1 - \alpha} \right) \Leftrightarrow \mathbb{E} = \frac{\alpha}{1 - \alpha} \left( \frac{\mathbb{E} (2\tau_1 - \alpha) - \alpha}{2\tau_2 - 1 + \alpha} \right).
\]

Now, the best response of the market maker \( P_M \) is given by,
\[ P^M = \frac{\bar{x}(2\tau_1 - \alpha) - \alpha}{2(1 - \alpha)} \]
\[ = \frac{(1 - \alpha) \Pr(x > \bar{x})E(x|x > \bar{x}) + \alpha \Pr(x < \bar{x})E(x|x < \bar{x})}{(1 - \alpha) \Pr(x > \bar{x}) + \alpha \Pr(x < \bar{x})} \]
\[ = \frac{1}{2} \left( \frac{(1 - \alpha)(1 - \bar{x}^2) + \alpha \bar{x}^2}{(1 - \alpha)(1 - \bar{x}) + \alpha \bar{x}} \right). \]

This implies that,
\[ \frac{\bar{x}(2\tau_1 - \alpha) - \alpha}{2(1 - \alpha)} = \frac{1}{2} \left( \frac{(1 - \alpha)(1 - \bar{x}^2) + \alpha \bar{x}^2}{(1 - \alpha)(1 - \bar{x}) + \alpha \bar{x}} \right). \]

If simplified we have,
\[ \left[ \bar{x}(2\tau_1 - \alpha) - \alpha \right] ((1 - \alpha)(1 - \bar{x}) + \alpha \bar{x}) = (1 - \alpha) \left[ (1 - \alpha)(1 - \bar{x}^2) + \alpha \bar{x}^2 \right]. \]

The left-hand-side equals
\[ LHS = \left[ \bar{x}(2\tau_1 - \alpha) - \alpha \right] ((1 - \alpha)(1 - \bar{x}) + \alpha \bar{x}) \]
\[ = \bar{x}2\tau_1(1 - \alpha) - \alpha(1 - \alpha) - \bar{x}^2(2\tau_1 - \alpha)(1 - \alpha) + \alpha \bar{x}(2\tau_1 - \alpha) - \alpha^2 \bar{x}. \]

The right-hand-side equals
\[ RHS = (1 - \alpha) \left[ 1 - \alpha - (1 - \alpha)\bar{x}^2 + \alpha \bar{x}^2 \right]. \]

Equating the two and dividing by \((1 - \alpha)\) implies
\[ RHS = 1 - \alpha - (1 - \alpha)\bar{x}^2 + \alpha \bar{x}^2 \]
\[ LHS = \bar{x}2\tau_1 - \bar{x}^2(2\tau_1 - \alpha) - \alpha - \frac{\alpha^2 \bar{x}}{1 - \alpha} + \frac{\alpha \bar{x}(2\tau_1 - \alpha)}{1 - \alpha}. \]

Thus,
\[ (2\tau_1 - 1)\bar{x}^2 - 2\bar{x}\tau_1 + 1 = -\frac{\alpha^2 \bar{x}}{1 - \alpha} + \frac{\alpha \bar{x}(2\tau_1 - \alpha)}{1 - \alpha} - \alpha \bar{x}^2. \]
Now, noticing that \( x = \frac{\alpha}{1-\alpha} \left( \frac{(2\tau_1-\alpha)-\alpha}{2\tau_2-1+\alpha} \right) \) we obtain the right-hand-side,

\[
\begin{align*}
LHS &= (2\tau_1 - 1)x^2 - 2\tau_1 + 1 \\
RHS &= \frac{\alpha x}{1-\alpha} \left( \frac{(2\tau_1 - \alpha) - \alpha}{2\tau_2 - 1 + \alpha} \right) - \alpha x^2 \\
&= x^2 (2\tau_2 - 1) = [2\tau_2 - 1] \left[ \frac{\alpha}{1-\alpha} \left( \frac{(2\tau_1 - \alpha) - \alpha}{2\tau_2 - 1 + \alpha} \right) \right]^2
\end{align*}
\]

Thus, using \( z = \frac{\alpha^2}{[1-\alpha]^2 \tau_2 - 1 + \alpha} \), we obtain,

\[
(2\tau_1 - 1)x^2 - 2\tau_1 + 1 = z (\tau_1 - \alpha)^2.
\]

This yields the quadratic equation,

\[
(2\tau_1 - 1 - z(2\tau_1 - \alpha)^2)x^2 + x(-2\tau_1 + 2z(2\tau_1 - \alpha)\alpha) + 1 - z\alpha^2 = 0.
\]

Now, consider the equilibrium with no disclosure. The conditions for prices in equilibrium when there is no disclosure simplifies to:

\[
P_H = \frac{1+x^c}{2}, \quad P_L = \frac{x^c}{2}, \quad \text{and} \quad P_M = \theta P_H + (1-\theta)P_L \tag{28}
\]

where \( \theta = \frac{(1-\alpha)(1-x^c)}{(1-\alpha)(1-x^c) + \alpha x^c} \).

From the manager’s best response function, the cutoff must satisfy (where \( \gamma = \frac{(h-\beta)}{h(1-\beta)} \))

\[
x^c = P(1-\gamma) + P\gamma \iff \langle ND, R \rangle = \langle ND, NR \rangle \tag{29}
\]

This implies the following average prices following repurchase and no-repurchase:

\[
\mathcal{P} = \alpha \left( \frac{1+x^c}{2} \right) + (1-\alpha)P^M \quad \text{and} \quad \mathcal{P} = \alpha P^M + (1-\alpha)\frac{x^c}{2} \tag{30}
\]

and therefore,

\[
\mathcal{P} = \alpha \left[ \theta P_H + (1-\theta)P_L \right] + (1-\alpha)P_L = \frac{x^c}{2} + \alpha \theta \frac{1}{2} \tag{31}
\]
This implies that,

\[ x^c = \left[ \alpha P^M + (1 - \alpha) \frac{x^c}{2} \right] (1 - \gamma) + \left[ \alpha \left( \frac{1 + x^c}{2} \right) + (1 - \alpha) P^M \right] \gamma \]  

(32)

\[ = \frac{x^c}{2} ((1 - \alpha) (1 - \gamma) + \alpha \gamma) + \alpha \gamma + P^M [\gamma (1 - \alpha) + (1 - \gamma) \alpha]. \]  

(33)

Now, since \( \theta = \frac{(1 - \alpha) (1 - x^c)}{(1 - \alpha) (1 - x^c) + \alpha x^c} \), we have,

\[ P^M = \theta P^H + (1 - \theta) P^L = \theta \left[ \frac{1 + x^c}{2} - \frac{x^c}{2} \right] + \frac{x^c}{2} \]  

(34)

\[ = \frac{(1 - \alpha) (1 - x^c)}{2 [(1 - \alpha) (1 - x^c) + \alpha x^c]} + \frac{x^c}{2}. \]  

(35)

This leads to the equality,

\[ [x^c - \alpha \gamma] [1 - \alpha - x^c + 2 \alpha x^c] = (1 - \alpha) (1 - x^c) [\gamma + \alpha - 2 \gamma \alpha]. \]  

(36)

Therefore, the cutoff is given by the solution to the quadratic equation with the following constants,

\[ A = -1 + 2 \alpha, \]

\[ B = 1 + \gamma - 2 \gamma \alpha - \alpha^2, \]

\[ C = (1 - \alpha) (\gamma \alpha - \gamma - \alpha). \]
References


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Figure 1

Disclosure and Repurchase Strategy

The figure depicts the manager’s payoffs from disclosure and repurchase when the expected prices following repurchase and non-repurchase are given by 0.8 and 0.3 the level of myopia is $\beta = 0.2$, the likelihood of no liquidity shock is $\alpha = 0.7$, and the size of the liquidity shock is $h = 0.4$. 
Figure 2

Disclosure and Repurchase Equilibrium

The figure depicts the disclosure and repurchase regions as a function of the likelihood of the liquidity shock $\alpha$ when the level of myopia is $\beta=0.1$, the size of the liquidity shock is $h=0.4$. 
The figure depicts the manager’s payoffs from disclosure and repurchase for the case of high managerial myopia when the expected prices following repurchase and non-repurchase are given by 0.8 and 0.5 the level of myopia is $\beta=0.5$, the likelihood of no liquidity shock is $\alpha = 0.7$, and the size of the liquidity shock is $h= 0.3$. 
Figure 4A

Disclosure and Repurchase Equilibrium
(Costly Disclosure)

The figure depicts the disclosure and repurchase regions as a function of the likelihood of the liquidity shock $\alpha$ when the level of myopia is $\beta = 0.1$, the size of the liquidity shock is $h = 0.4$, the cost of disclosure is $c = 0.035$. 
Figure 4B

Disclosure and Repurchase Equilibrium
(Costly Disclosure)

The figure depicts the disclosure and repurchase regions as a function of the cost of disclosure when the likelihood of the liquidity shock is $\alpha = 0.45$, the level of myopia is $\beta = 0.1$, and the size of the liquidity shock is $h = 0.3$. 
The figure depicts the disclosure and repurchase regions as a function of the size of the liquidity shock $h$ when the cost of disclosure is $c = 0.03$ when the likelihood of the liquidity shock is $\alpha = 0.45$, and the level of myopia is $\beta = 0.1$. 