

The “Wall Street Walk” and Shareholder Activism: Exit as a Form of Voice

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We examine whether a large shareholder can alleviate conflicts of interest between managers and shareholders through the credible threat of exit on the basis of private information. In our model, the threat of exit often reduces agency costs, but additional private information need not enhance the effectiveness of the mechanism. Moreover, the threat of exit can produce quite different effects depending on whether the agency problem involves desirable or undesirable actions from shareholders’ perspective. Our results are consistent with empirical findings on the interaction between managers and minority large shareholders and have further empirical implications. (*JEL* D53, D82, G10, G30, G34)

The role of active large shareholders in improving corporate performance has been discussed extensively in the last two decades. Although large shareholders (including pension funds, mutual funds, hedge funds, and other investors) hold a substantial and increasing fraction of shares in public companies in the United States, most large shareholders play a limited role in overt forms of shareholder activism such as takeovers, proxy fights, strategic voting, shareholders’ proposals, etc. One likely reason for this is that active shareholders only realize a relatively small fraction of the benefits from their monitoring while bearing the full cost, which can be substantial. In other words, we have a classic “free rider” problem. In addition, legal barriers, agency problems affecting the incentives of the large shareholder, and the fact that many large shareholders are committed to being passive and not investing resources to monitor their portfolio firms

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have also worked to limit activism.¹ If a large shareholder is aware that a firm's management does not act in the best interest of shareholders, it may be rational for the shareholder to follow the so-called "Wall Street Rule" or "Wall Street Walk," voting with his feet and selling his shares, rather than attempting to be active.

Exit seems to be an alternative to activism, and as such appears to be inconsistent with it. This has led some (e.g., Bhidé 1993; Coffee 1993) to argue that market liquidity impairs corporate governance. What seems to have not been widely recognized is that the threat of exit itself can be a form of shareholder activism. Palmiter (2002, pp. 1437–38) suggests that large shareholders may be able to affect managerial decisions through the "threat (actual or implied) of selling their holdings and driving down the price of the targeted company." Presumably, if managers' compensation is tied to share prices, and if the exit of a large shareholder has a negative price impact, then the presence of a large shareholder who is potentially able to trade on private information may help discipline management and improve corporate governance. In addition, the threat of exit may be important in making "jawboning" activities and behind-the-scenes negotiation with management effective.

A number of questions arise immediately as one considers the possibility that the threat of exit can alleviate agency problems between managers and shareholders. First, can the threat of exit be credible? Since the key to the notion that the threat of exit has a disciplining effect is that exit drives the stock price of the targeted firm down, it would appear that the large shareholder suffers a loss when a threat to exit is carried out. This would seem to make the threat not credible. Second, even if the threat to exit is shown to be credible, would this threat always help align managerial incentives better with shareholders' preferences, or might it interfere with other forms of managerial discipline? Third, if the threat of exit on the basis of private information has a disciplinary impact, would additional information improve the situation further? In other words, is it always better if the large shareholder has more information? Fourth, will the threat of exit remain effective in disciplining managers if the large shareholder incurs additional costs in exiting (e.g., transactions costs)?

In this paper, we examine all of these issues within a simple model where a manager's incentives are not aligned with shareholders. In our model, a large shareholder has private information about the manager's actions and/or about the consequences of these actions to the value of the firm, and can sell shares based on this information. All agents are rational and prices perfectly reflect all public information, including the large shareholder's trading decisions. Our

¹ Many papers in the law and economics literature discuss the role of large shareholders in corporate governance, and many focus on shareholder activism. With each taking a different perspective on the subject, Black (1990); Grundfest (1993); Romano (1993); Black and Coffee (1994); Roe (1994); Macey (1997); Gillan and Starks (1998); Romano (2001); Palmiter (2002); Bainbridge (2005); and Bebchuk (2005) discuss how shareholder activism has been practiced, describe some of the barriers that have limited its use and effectiveness, and suggest ways in which large shareholders can become more involved in corporate governance.

model combines two common elements present in trading models and in models of executive compensation, namely that (i) large shareholders often collect information and use it for trading and (ii) explicit and implicit managerial compensation contracts often lead managers to be sensitive to market prices of their firms.

We will consider two distinct types of agency problems. In one case, the manager can take an action that is undesirable from the shareholders' perspective, but which produces a private benefit to the manager. In the other case, the action is desirable from the shareholders' perspective, but it is privately costly to the manager.² The manager's decision and its impact, which the manager knows when a decision is made, will be observed publicly at the final date of our model, but in the short run investors have less than complete information about either the manager's decision or the consequences of the action, if taken, or both. The large shareholder observes some information privately before other investors and may be able to sell shares on the basis of this information. For each of the agency problems and for a number of different information structures, we examine whether and to what extent the presence of the privately informed large shareholder reduces the agency costs associated with the action.

We show that the ability of large shareholders to exit on the basis of private information often helps in reducing agency costs and aligning managerial decisions with shareholders' preferences. However, the nature and effectiveness of this mechanism can depend critically on the nature of the agency problem, as well as on the information structure. While the two types of agency problems described above (one with the "bad" action and one with the "good" action from the shareholders' perspective) may seem to be mirror images of each other, we find that they can lead to dramatically different results. For example, if we assume that the agency problem is one of discouraging the manager from taking a "bad" action, then we find that the threat of exit by an informed large shareholder generally disciplines the manager and reduces the agency cost, and in no case makes the agency problem worse. The same is not true when the agency problem is one of motivating the manager to take a "good" action. In this case, it is possible that potential exit by an informed large shareholder does not reduce the agency cost, and it may even exacerbate the agency problem and increase the agency cost relative to a situation where the large shareholder is not present. The differences in results for the "bad" action and "good" action models are due to the fact that the inferences that can be made in equilibrium regarding the value of the firm conditional on exit behave differently in the two types of agency problems.

² We assume for most of the paper that investors are aware of which of these agency problems is present. (In Section 6, we discuss "model uncertainty," where this is not true.) Mature firms with large cash reserves (free cash flow) may be more prone to a "bad action" type of agency problem. A "good action" problem may arise when the manager is reluctant to take on risky projects that are beneficial to shareholders but which entail high cost to the manager and carry the risk of failure and job loss.

We also show that, while the threat of exit on the basis of private information can have a disciplinary impact, more private information does not always lead to a better outcome, and in fact in some situations it may reduce or eliminate the disciplinary impact of the threat to exit. As discussed further below, our model and results are generally consistent with empirical findings on the role and impact of large shareholders in governance. In addition to noting the general empirical support, we suggest some more direct empirical tests of the effectiveness of the threat of exit in resolving agency problems.

There is an extensive theoretical literature on shareholder activism and on the role of large shareholders in corporate governance.³ The models in this literature typically assume that the large shareholder can take a costly action, often called “monitoring,” to affect the value of the firm. Monitoring is associated with the ownership of shares, and inconsistent with exit. While the possibility that the large shareholder trades is considered in a number of these papers, the focus is generally on the incentives of the large shareholder to engage in monitoring and/or on the ownership structures that arise endogenously. In our model, by contrast, the ability of the large shareholder to exit is itself the technology that may affect managerial decisions. While in most of our analysis we take the information structure as given and do not incorporate the cost of acquiring information, our results have several immediate implications for the case where information acquisition by the large shareholder is endogenous. This is discussed in Section 7.1.

The notion that stock prices may play a role in monitoring managerial performance was discussed in Holmstrom and Tirole (1993). Their model and the focus of their analysis differ from ours in several ways. In particular, Holmstrom and Tirole focus on how the ownership structure of the firm affects the value of market monitoring through its effect on liquidity and on the profits speculators realize in trading on information. In our model, by contrast, we focus on the disciplining impact of a large shareholder’s threat of exit and examine how the effectiveness of this threat depends on the nature of the agency problem and the information structure.

Gopalan (2005) and Edmans (2008) each consider the possibility that the ability to exit can have a positive impact on the firm. In Gopalan’s study, exit by an informed large shareholder creates value by encouraging another bidder to acquire information and implement improvements through a takeover mechanism. This mechanism for bringing about improvement is very different from the one at work in our model, which focuses on managerial incentives, and where the impact of large shareholder exit is due to its effect on managerial compensation. The main difference between our model and that of Edmans is

³ A partial list includes Huddart (1993); Admati, Pfleiderer, and Zechner (1994); Burkart, Gromb, and Panunzi (1997); Bolton and Von Thadden (1998); Kahn and Winton (1998); Maug (1998); Katz and Owen (2001); Tirole (2001); Noe (2002); Aghion, Bolton, and Tirole (2004); Faure-Grimaud and Gromb (2004); Hartzell and Starks (2004); Mello and Repullo (2004); Yung (2005); and Attari, Banerjee, and Noe (2006).

that our model addresses a fundamental agency problem that is most extreme if the manager’s compensation is not sensitive to prices, while Edmans suggests that there is no fundamental agency problem—the manager would always make the optimal decision from the shareholders’ perspective if his compensation were a fixed salary. The agency problem in Edmans arises because of the combined assumptions that the manager’s compensation depends on short-term prices (as in our model), and that the manager’s actions affect the price in a particular way, namely the more productive the action, the more *unfavorable* the public signal that is generated in the short term.

Several empirical studies of the role and impact of large shareholders present evidence that is consistent with our model.⁴ Carleton, Nelson, and Weisbach (1998) suggest that large shareholders can affect firms’ values through private negotiations. This is consistent with our model, because discipline through exit requires that the manager knows that the large shareholder is informed, and these private negotiations may be an effective means of communicating this. Parrino, Sias, and Starks (2003) provide evidence to support both the notion that large shareholders are better informed than other investors, as our model assumes, and the fact that they sometimes use their private information to “vote with their feet” prior to CEO turnover. They suggest that the price impact of these trades may affect corporate decisions. Sias, Starks, and Titman (2001) also suggest that large shareholder trading has a price impact that is likely due to superior information, consistent with our model. More recently, and consistent with our model, Massa and Simonov (2006) and Qiu (2006) show that noncontrolling large shareholders can have meaningful impact on managerial decisions, particularly in preventing managers from taking value-reducing actions such as bad acquisitions.

A number of recent papers have focused attention on hedge fund activism, and their findings are also consistent with our model. Using 13D and other filings over various periods of time, Klein and Zur (2009) and Brav et al. (2006) suggest that hedge funds help reduce agency costs and that their activism increases firm value. Klein and Zur (2009) argue that hedge funds are able to affect managerial decisions through the perceived threat of a proxy fight. However, they find that the results of hedge fund activism do not seem to depend on whether a proxy fight was explicitly mentioned in the 13D filing or whether a proxy fight actually took place. Clifford (2008) also examines hedge fund activism, comparing situations where hedge funds define themselves as activists to those where the same funds define themselves as passive.⁵ The results of all these papers are consistent with the notion that the (perceived) threat of exit helps explain why certain large investors are able to affect managerial decisions.

⁴ For a survey of the empirical literature, see Gillan and Starks (2007).

⁵ The possibility of exit is explicitly mentioned in the example given by Clifford (2008, Appendix B), where Steel Partners II states that among the possible actions it might take would be “selling some or all of its Shares.” Kahan and Rock (2007) and Bratton (2007) discuss in detail various aspects of hedge fund activism.

Indeed, our model assumes that the manager is aware of the fact that the large shareholder is informed. The SEC filings made by the large shareholder, which are studied empirically in these studies, may be one source of this awareness.

In a recent paper, Brenner (2007) presents empirical evidence that is supportive of our model and results. Brenner finds, using a global data set, that liquidity and the share of CEO equity-related pay to total pay are complementary. Moreover, he uses variables related to the legal and governance environments in different countries to identify situations where particular types of agency problems (namely those with “bad action” versus those with “good action”) are likely to be severe, and to show that the threat of exit seems to be differentially effective across the different agency problems. In Section 8, we discuss some unique features of our model that can be exploited in future empirical studies to examine whether the threat of exit plays a role in corporate governance.

The paper is organized as follows. We introduce our basic model and the two agency problems in Section 1. Section 2 analyzes the case where the large shareholder’s private information includes only the manager’s action and no investor observes the effect of the action on the value of the firm until the final period. In Section 3, we examine what happens when the large shareholder privately observes both the manager’s decision and its impact on the firm’s value. Section 4 considers the case where the manager’s action is observed by all investors and the large shareholder’s private information includes only the action’s implications. For completeness, we analyze in Section 5 the case in which the impact of the action on the firm value is publicly known, and the private information of the large shareholder only concerns whether the action is taken or not. In Section 6, we consider various extensions and variations on the model, such as the case where information acquisition is endogenous, the case where the large shareholder’s trade is not completely observable but masked by the trading of other liquidity traders, the case where exit by the large shareholder is costly to the large shareholder and possibly to all shareholders, and situations where investors have uncertainty about the manager’s private cost or benefit or about the type of agency problem. Section 7 discusses the empirical predictions of our analysis. Section 8 offers concluding remarks.

1. The General Model

There are three periods in our model. In Period 0, the manager, whom we denote by M , decides whether or not to take a particular action. An agency problem arises because M and the shareholders of the firm have conflicting preferences with respect to this action. We will analyze two distinct models using the same notation. In one model, which we refer to as *model B*, the action available to M is “bad” in the sense that it is undesirable from the shareholders’ perspective, but the action produces a private benefit to M . In another model we analyze,

model G , the action is “good” for shareholders in that it increases the value of the firm, but it requires M to incur a private cost. We denote the value of the firm if M does not take the action by v . If M takes the action in model B , then the value of the firm decreases by $\tilde{\delta} \geq 0$ and becomes $v - \tilde{\delta}$, while M obtains a private benefit of $\beta > 0$. If the action is taken in model G , then the value of the firm increases by $\tilde{\delta} \geq 0$ and becomes $v + \tilde{\delta}$, while M incurs a private cost of $\beta > 0$. These two models may seem like mirror images of each other but, as we will see, in our setting they can produce dramatically different results.

Our basic assumptions regarding uncertainty and the information structure are as follows. The status quo value of the firm v is fixed and common knowledge.⁶ In Period 0, investors assess that $\tilde{\delta}$ has a continuous distribution $f(\cdot)$ with support on $[0, \bar{\delta}]$, where $\bar{\delta}$ is positive and possibly infinite. M observes the realization of $\tilde{\delta}$ before making the decision whether to take the action or not. We further assume that the private cost or benefit β is fixed and known to all investors.⁷

Since M makes a decision regarding the action after observing $\tilde{\delta}$, the strategy can be described by a function $a(\tilde{\delta})$, where $a(\tilde{\delta}) = 1$ denotes the event in which M takes the action and $a(\tilde{\delta}) = 0$ denotes the event in which he does not take it. In most of our analysis, investors will make inferences regarding the expected change in the firm value, the magnitude of which is given by $a(\tilde{\delta})\tilde{\delta}$. To simplify the notation, we will use the shorthand \tilde{a} to represent M 's action instead of $a(\tilde{\delta})$. We assume that in the final period, investors do observe the realizations of both \tilde{a} and $\tilde{\delta}$. The value of the firm is therefore $v - \tilde{a}\tilde{\delta}$ in model B and $v + \tilde{a}\tilde{\delta}$ in model G .

We assume that the firm is owned by many small and passive investors, as well as by a large shareholder, whom we denote by L . For expositional clarity, we will from now on use female pronouns to refer to L . The exact ownership structure will not matter to our results, since valuation will be done under risk neutrality. We assume that L observes some private information regarding \tilde{a} and/or $\tilde{\delta}$ in Period 1, and that she may be in a position to sell her shares on the basis of this information. Because it generally reflects her private information, L 's trading decision will have an impact on the firm's price in Period 1. This in turn has the potential to affect M 's decision if M cares about the market price of the firm in Period 1.

The manager's compensation is assumed to be linear in the realized market price of the firm in Periods 1 and 2, P_1 and P_2 . Specifically, we assume that M 's compensation is equal to $\omega_1 P_1 + \omega_2 P_2$, where ω_1 and ω_2 are positive coefficients representing the dependence of the compensation on the

⁶ We can assume more generally that v is random but that no agent has private information about it. In fact, the value of v will not play any significant role in our analysis.

⁷ As discussed in Section 6.3, our results cover the case where β is perfectly correlated with $\tilde{\delta}$. If β is privately known only to the manager, then inferences based on L 's information and based on her trade become more complicated to analyze. Such a model is beyond the scope of this paper.

firm's short-term ("Period 1") and long-term ("Period 2") price performance, respectively.⁸ The potential impact of L on M 's decision comes about through the impact of her trading decisions on P_1 . We assume that the prices, P_1 and P_2 , are set by risk-neutral, competitive market makers and therefore reflect all of the information publicly available. This means that P_2 equals $v - \tilde{a}\tilde{\delta}$ in model B and equals $v + \tilde{a}\tilde{\delta}$ in model G. In Period 1, P_1 reflects the information contained in L 's trading decision, as is described in more detail below.

If M does not take the action, then his utility is simply his compensation, $\omega_1 P_1 + \omega_2 P_2$. If he takes the action in model B, M 's utility is equal to the sum of his compensation and the private benefit β . Similarly, if M takes the action in model G, then his utility is equal to the compensation minus the private cost β . M chooses whether to take the action or not to maximize his expected utility for every realization of $\tilde{\delta}$.

We assume that L may be subject to a liquidity shock in Period 1. Specifically, there is a probability $0 < \theta < 1$ that, independent of her private information, L will need to sell her entire stake in Period 1. While the value of θ is common knowledge, only L knows her actual motives for trading when she trades. We generally assume that $\theta > 0$, but our model is also well defined in the limit case where $\theta = 0$ (i.e., when L is never subject to a liquidity shock). As will become clear, most of our results will apply to this case as well, and we will often use it for illustration. The main complication for the $\theta = 0$ case is that additional equilibria can arise that are not the limit of any equilibrium for the case $\theta > 0$ as θ vanishes.⁹ The equilibria we analyze when $\theta > 0$ always have a well-defined limit as θ goes to zero, and these equilibria obtained in the limit as θ vanishes are indeed equilibria of the model in which $\theta = 0$. If she is not subject to a liquidity shock, L chooses to sell her shares if the expected value of the firm given all her information is smaller than P_1 , the price at which she would exit, where P_1 incorporates the information communicated by the sale.

We will analyze the Bayesian-Nash equilibria of models B and G under various assumptions concerning what L and other investors observe in Period 1. In such equilibria M , using his information, makes the optimal decision regarding his action, taking L 's trading strategy as given. Similarly, L , based on her information, determines whether to sell her shares in the event that she is not

⁸ We take the form of M 's compensation as exogenous here. Presumably, M 's compensation balances risk sharing and various agency considerations. If the agency problem considered in this paper were the only relevant problem in the contracting environment between M and shareholders, then it would be reasonable to endogenize the dependence of the compensation on prices. However, we believe that in reality M 's compensation is designed to solve a more complex problem. We therefore limit ourselves to asking what disciplinary impact L can have given any particular compensation function within our assumed structure. Note that if $\omega_1 = 0$, then L will not affect M 's decision through her trade. The case $\omega_2 = 0$ is significantly more complicated to analyze and, in some cases, it admits a large number of equilibria. For this special case, we have characterized the set of equilibria and derived their properties for some versions of our model. Details are available upon request.

⁹ For example, there may be equilibria in which L never sells and therefore never has an effect on M 's decisions through her trading, or equilibria where L sells only some of her shares. Eliminating these equilibria would require restrictions on out-of-equilibrium beliefs. This is not necessary when $\theta > 0$ since in this case exit always occurs with positive probability.

subject to a liquidity shock.¹⁰ Both M and L take as given the fact that P_1 will reflect the conditional expectation of $\tilde{a}\tilde{\delta}$ based on the information available to investors, including L 's trading decision, in Period 1.

For most of our analysis we will make the following tie-breaking assumptions: (i) if M is indifferent between taking the action and not taking the action, then he takes the action; (ii) if L is indifferent between selling her shares and not selling, she sells her shares. When we use these assumptions, they will not change the set of equilibria, because $\tilde{\delta}$ has a continuous distribution and indifference will hold for at most one realization of $\tilde{\delta}$.¹¹

Given a particular realization of $\tilde{\delta}$, M must decide whether to take the action. It is easy to see that in the benchmark case in which L is not present and \tilde{a} is not observed by investors until Period 2, M will take the action if and only if $\tilde{\delta} \leq \beta/\omega_2$ in model B and if and only if $\tilde{\delta} \geq \beta/\omega_2$ in model G. We assume that $\beta/\omega_2 < \bar{\delta}$, i.e., that there is a positive probability that, even without L present, M acts in the interests of the shareholders (refraining from taking the action in model B and taking the action in model G).¹² For a strategy of M that specifies whether he takes the action or not as a function of $\tilde{\delta}$, the *ex ante* expected value of the firm in model B is $v - E(\tilde{\delta}\tilde{a})$. Similarly, in model G, the *ex ante* value of the firm given M 's strategy is $v + E(\tilde{\delta}\tilde{a})$.

Note that the best outcome from the shareholders' perspective in model B is that M never takes the action, which means that the highest value of the firm in this case is v . Since the firm value is reduced by $\tilde{\delta}$ whenever $\tilde{a} = 1$ relative to this best case, the *ex ante* expected agency cost associated with the action in model B is $E(\tilde{\delta}\tilde{a})$. Analogously, the first best from the shareholders' perspective in model G is that M always takes the action, which increases the value of the firm from v to $v + \tilde{\delta}$. Since in this case the increase of $\tilde{\delta}$ is not realized whenever $\tilde{a} = 0$, the *ex ante* expected agency cost in model G is equal to $E(\tilde{\delta}(1 - \tilde{a})) = E(\tilde{\delta}) - E(\tilde{\delta}\tilde{a})$. Thus, in model B the *ex ante* expected agency cost is reduced if $E(\tilde{\delta}\tilde{a})$ is made lower, while the opposite is true in model G. We are interested in the impact that L 's presence has on the *ex ante* expected agency cost in the two models, which from now on we will simply refer to as agency cost. This impact is measured by the difference between the agency cost in the equilibrium where L is not present and the agency cost in the equilibrium where L is present. We use the following terms:

¹⁰ We do not need to consider trades by L that cannot arise from a liquidity shock, since such trades will generally lead to zero expected profits under reasonable assumptions about investors' beliefs. However, when investors cannot be sure whether L 's trade is based on private information or liquidity, L makes positive profits when she trades on her information. See the discussion in Section 6.1 on the case where L trades anonymously.

¹¹ In a few cases the equilibrium will involve mixed strategies, and in those cases agents' decisions, when indifferent, will be determined by the equilibrium (rather than by an assumption). This occurs, for example, in the case where $\tilde{\delta}$ is publicly observable in Period 1, which is discussed in Section 5.

¹² This assumption, which holds trivially when $\bar{\delta}$ is infinite, rules out extreme cases where the agency problem is so severe that L cannot have any impact.

Definition. Consider the impact that L 's presence has on the agency cost associated with the action.

- (i) An equilibrium is *disciplining* if L 's presence has a positive impact (i.e., the agency cost is lower when L is present than when she is not present).
- (ii) An equilibrium is *nondisciplining* if L 's presence has no impact on the agency cost.
- (iii) An equilibrium is *dysfunctional* if L 's presence has a negative impact (i.e., the agency cost is higher when L is present than when she is not present).

It is easy to see that in order for the equilibrium to be disciplining, L must have some information about \tilde{a} in Period 1, and that some of her information at that point must be private. We will examine L 's impact under various information structures that satisfy this condition. We will at times also compare, for the same model specifications, L 's effectiveness in model B versus model G. To distinguish the different information structures, we will use superscripts to denote the information observed by L in Period 1, and subscripts to denote the information (if any) that is publicly observed by all investors in Period 1. For example, model B^a is model B where L observes \tilde{a} in Period 1 and investors do not observe either \tilde{a} or $\tilde{\delta}$ directly until Period 2; model $G_a^{a,\delta}$ is model G where \tilde{a} is observed publicly in Period 1, and, in addition, L observes $\tilde{\delta}$ privately in Period 1. Note that when there is no subscript, investors do not observe either \tilde{a} or $\tilde{\delta}$ in Period 1. When there is no superscript, the model is the base or benchmark model where L is not present.

2. Action-only Monitoring

We start our analysis by assuming that L observes privately whether M has taken the action (i.e., the realization of \tilde{a}). However, neither L nor other investors are assumed to observe the realization of $\tilde{\delta}$ until Period 2. The models in this section, therefore, are denoted by the superscript a (and no subscript).

Consider first model B^a . It is easy to see that, since the action reduces the value of the firm, in every equilibrium of this model L sells her shares whenever she observes that M has taken the action.¹³ Let E_s be the expected value of $\tilde{a}\tilde{\delta}$ conditional on L selling her shares and E_{ns} be the expected value of $\tilde{a}\tilde{\delta}$ conditional on L not selling her shares. Then the price of the firm in Period 1, P_1 , can take on two possible values: $v - E_s$ if L sells her shares, and $v - E_{ns}$ if she does not. Note that, when $\theta > 0$, L might be forced to sell for liquidity reasons even if M does not take the action, and this, together with the strategies of L and M , will need to be incorporated into the determination of E_s and E_{ns} .

¹³ It is immediate that L must *weakly* prefer to sell if the action is taken, and we can invoke the tie-breaking assumption that she sells when she is indifferent. As we will see, in the unique equilibrium of our model, L in fact strictly prefers to sell her shares when the action is taken.

If M takes the action for a particular δ , P_2 is equal to $v - \delta$. Since L exits with probability 1 when M takes the action, P_1 is equal to $v - E_s$. Thus, M 's expected utility is

$$\beta + \omega_1(v - E_s) + \omega_2(v - \delta). \quad (1)$$

If M does not take the action, then $P_2 = v$, and P_1 is equal to $v - E_s$ with probability θ and $v - E_{ns}$ with probability $1 - \theta$, because L sells if and only if she is subject to a liquidity shock. Thus, M 's expected utility if he does not take the action is

$$\omega_1(v - \theta E_s - (1 - \theta)E_{ns}) + \omega_2 v. \quad (2)$$

Comparing Equations (1) and (2), we conclude that M will take the action if and only if

$$\beta - (1 - \theta)\omega_1(E_s - E_{ns}) - \omega_2\delta \geq 0. \quad (3)$$

The potential impact of L 's presence comes about through the second term in the equation above, $(1 - \theta)\omega_1(E_s - E_{ns})$. This term depends on the difference between the first-period price given a sale by L and the first-period price given that L retains her shares. To the extent that exit reflects negative information, this is negative. The absolute value of this difference measures the extent to which L exerts “punishment” on M by selling her shares and driving the price down when M takes the action.

Note that, since $\omega_2 > 0$, the left-hand side of Equation (3) is decreasing in δ . This implies that if M prefers to take the action for a given δ , then he must strictly prefer to take it for all smaller values. An equilibrium of model B^a will therefore be characterized by a cutoff point x such that the action is taken if and only if $\tilde{\delta} \leq x$. Given such a strategy for M , and since L sells her shares if M takes the action or if she is subject to a liquidity shock, we have

$$E_s(x) = \frac{\Pr(\tilde{\delta} \leq x)E(\tilde{\delta} \mid \tilde{\delta} \leq x)}{\theta + (1 - \theta)\Pr(\tilde{\delta} \leq x)}; \quad E_{ns}(x) = 0. \quad (4)$$

Note that we use the notation $E_s(x)$ to signify the dependence of E_s on the cutoff point x . Since investors can infer that $\tilde{a} = 0$ (the action was not taken) if L does not sell her shares, $E_{ns}(x) = 0$ independent of x . The calculation of $E_s(x)$ takes into account that with probability θ , a sale by L is due to a liquidity shock and, therefore, is uninformative about $\tilde{a}\tilde{\delta}$, while with probability $1 - \theta$, a sale implies that $\tilde{a} = 1$ and therefore, given M 's strategy, that $\tilde{\delta} \leq x$. Note that for a given x , $E_s(x)$ is decreasing in θ , and in the limit case where $\theta = 1$, $E_s(x) = \Pr(\tilde{\delta} \leq x)E(\tilde{\delta} \mid \tilde{\delta} \leq x)$. Conversely, when θ vanishes, E_s approaches $E(\tilde{\delta} \mid \tilde{\delta} \leq x)$, since in this case a sale conveys perfectly that $\tilde{a} = 1$.

Now consider M 's decision whether or not to take the action. Since $\tilde{\delta}$ has a continuous distribution, it is easy to see that in any disciplining equilibrium, M

must be indifferent between taking and not taking the action at the equilibrium cutoff $\tilde{\delta} = x_B$.¹⁴ Thus, x_B must satisfy

$$\beta - (1 - \theta)\omega_1(E_s(x_B) - E_{ns}(x_B)) - \omega_2 x_B = 0. \quad (5)$$

Let us now turn to model G^a . Since the action increases the value of the firm, in every equilibrium L sells her shares if the action is *not* taken (or if she is subject to a liquidity shock), and retains her shares if the action is taken. Let E_s and E_{ns} be the conditional expectations of $\tilde{a}\tilde{\delta}$ given sale and no sale by L , respectively. If M takes the action for $\tilde{\delta} = \delta$, then $P_2 = v + \delta$, and, since L sells if and only if she is subject to a liquidity shock, P_1 is equal to $v + E_s$ with probability θ and $v + E_{ns}$ with probability $1 - \theta$. Thus, M 's expected utility if he takes the action is

$$-\beta + \omega_1(\theta(v + E_s) + (1 - \theta)(v + E_{ns})) + \omega_2(v + \delta). \quad (6)$$

If M does not take the action, then $P_1 = v + E_s$, since L sells with probability 1, and $P_2 = v$. Thus, M 's expected utility if he does not take the action is

$$\omega_1(v + E_s) + \omega_2 v. \quad (7)$$

It follows that M prefers to take the action if and only if

$$-\beta + (1 - \theta)\omega_1(E_{ns} - E_s) + \omega_2 \delta \geq 0. \quad (8)$$

The left-hand side of Equation (8) is increasing in δ , so an equilibrium for this model involves a cutoff point x such that M takes the action if and only if $\tilde{\delta} \geq x$. Since L sells her shares if she is subject to a liquidity shock or if M does not take the action, we have for model G^a , again using the notation $E_s(x)$ and $E_{ns}(x)$ to signify the dependence of prices on M 's cutoff point,

$$E_s(x) = \frac{\theta \Pr(\tilde{\delta} \geq x) E(\tilde{\delta} | \tilde{\delta} \geq x)}{\theta + (1 - \theta) \Pr(\tilde{\delta} < x)}; \quad E_{ns}(x) = E(\tilde{\delta} | \tilde{\delta} \geq x). \quad (9)$$

In model G^a , no sale by L communicates to investors that the action was definitely taken ($\tilde{a} = 1$), and thus that $\tilde{\delta} \geq x$. A sale by L communicates that either the action was not taken (and therefore $\tilde{a} = 0$ and $\tilde{\delta} < x$), or that L was subject to a liquidity shock, which is uninformative about \tilde{a} and $\tilde{\delta}$. Fixing x , $E_s(x)$ is increasing in θ . In the limit when $\theta = 1$, a sale is uninformative about $\tilde{a}\tilde{\delta}$ and thus $E_s(x) = \Pr(\tilde{\delta} \geq x) E(\tilde{\delta} | \tilde{\delta} \geq x)$. As θ vanishes, however, a sale implies that the action was definitely not taken, and thus in the limit $E_s(x) = 0$.

An equilibrium for model G^a will be characterized by a cutoff x_G such that M is indifferent between taking and not taking the action when $\tilde{\delta} = x_G$, and

¹⁴ Our tie-breaking assumption is that M takes the action for $\tilde{\delta} = x_B$, but of course with a continuous distribution this does not matter to the calculation of $E_s(x_B)$ and $E_{ns}(x_B)$ and therefore does not affect the equilibrium.

thus x_G satisfies

$$-\beta + (1 - \theta)\omega_1(E_{ns}(x_G) - E_s(x_G)) + \omega_2x_G = 0. \quad (10)$$

As already observed, if L is not present, then the equilibrium cutoff point in both models is equal to β/ω_2 . That is, in this benchmark case the action is taken for $\tilde{\delta} \leq x_B = \beta/\omega_2$ in model B and for $\tilde{\delta} \geq x_G = \beta/\omega_2$ in model G. Note also that in both models, shareholders are better off the lower the equilibrium cutoff point, because when $\tilde{\delta}$ is below the cutoff point in both models, M is not acting in their best interests. The discipline L is able to exert on M 's actions is thus measured in both models by how low the equilibrium cutoff is. The following result characterizes the equilibrium for both models and compares model B^a with model G^a in terms of L 's effectiveness in disciplining M . The proofs of this and other results are found in the Appendix.

Proposition 1. *In both model B^a and model G^a, there exists a unique equilibrium, and the equilibrium is always disciplining.*

- (i) *In model B^a, equilibrium is characterized by a cutoff $x_B < \beta/\omega_2$ such that the manager takes the action if and only if $\tilde{\delta} \leq x_B$ and the large shareholder exits if the manager takes the action. The cutoff x_B solves Equation (5), where $E_s(\cdot)$ and $E_{ns}(\cdot)$ satisfy Equation (6).*
- (ii) *In model G^a, equilibrium is characterized by a cutoff $x_G < \beta/\omega_2$ such that the manager takes the action if and only if $\tilde{\delta} \geq x_G$ and the large shareholder exits if the manager does not take the action. The cutoff x_G solves Equation (10), and $E_s(\cdot)$ and $E_{ns}(\cdot)$ satisfy Equation (9).*
- (iii) *Fixing β , ω_1 , ω_2 , and the distribution of $\tilde{\delta}$, both x_B and x_G are increasing in θ .*
- (iv) *Fixing β , θ , ω_1 , ω_2 , and the distribution of $\tilde{\delta}$, $x_G < x_B$. That is, all else equal, the large shareholder is more effective in disciplining the manager in model G^a than in model B^a.*

This proposition states that when L observes \tilde{a} privately and no investor observes $\tilde{\delta}$ until Period 2, the credible threat that L will exit if M does not act in shareholders' interests is an effective disciplining tool and reduces the agency cost. L 's impact is decreasing in θ , the probability that she is subject to a liquidity shock, because a higher value of θ makes her trades less informative and reduces her ability to “punish” M for not acting in shareholders' interests.

Perhaps surprisingly, since the two models appear as mirror images of each other, part (iv) of Proposition 1 states that, fixing all the model's parameters, L is more effective in model G^a than she is in model B^a. To understand this result, consider how inferences differ across the two models for a fixed cutoff value x . In model B^a, the difference between the expected value of the firm when the manager takes the action and when he does not is $E(\tilde{\delta} \mid \tilde{\delta} \leq x)$, while in model G^a this difference is $E(\tilde{\delta} \mid \tilde{\delta} \geq x)$. Clearly, for every

x , $E(\tilde{\delta} \mid \tilde{\delta} \leq x) < E(\tilde{\delta} \mid \tilde{\delta} \geq x)$. Since L observes whether the action is taken, the absolute difference between the prices when L exits and when she does not will be larger in model G^a than in model B^a . This is easy to see when $\theta = 0$, since in this case L 's trade reveals perfectly whether the action was taken or not. In this case $|E_{ns}(x) - E_s(x)| = E(\tilde{\delta} \mid \tilde{\delta} \geq x)$ in model G and $|E_{ns}(x) - E_s(x)| = E(\tilde{\delta} \mid \tilde{\delta} \leq x)$, which is smaller, in model B^a . The price difference across L 's trading decision is in fact larger in model G^a than in model B^a for any cutoff level x , and also when $\theta < 1$. Since L has a larger impact on M 's compensation in model G^a than she has in model B^a for any potential cutoff level, it follows that the equilibrium cutoff levels satisfy $x_G < x_B$.

A related observation is that L 's disciplining tool, equal to the net price impact of exit $|E_s(x) - E_{ns}(x)|$, behaves differently in the two models as the cutoff x goes to zero (i.e., as we approach the best situation (in both models) from the shareholders' perspective). In model B^a , $|E_s(x) - E_{ns}(x)|$ goes to zero as x vanishes. Thus, as M 's preferences get better aligned with those of shareholders, the tool that L can use to discipline M vanishes in model B^a . This is not true in model G^a , where $|E_s(x) - E_{ns}(x)|$ always has a positive lower bound even as x vanishes.¹⁵ Thus, L is better able to exert discipline in model G^a than in model B^a .

The reader may wonder whether the different results we obtain for models B^a and G^a are driven by our assumption that L can only sell or hold her shares, but is (in our model) precluded from buying shares. We have analyzed the model under various assumptions about the types of trade L can make, including the assumption that L can buy shares, and we have found that our qualitative results do *not* change under different specifications of the possible trading actions available to L : L is always more effective in model G^a than in model B^a . Whatever is assumed about L 's "action space" (i.e., the possible trades she can make), there will be a trade (e.g., buy if this is possible, or hold) that is taken if the manager "does the right thing" from the shareholders' perspective and a different trading decision (e.g., hold or sell) if the manager does the "wrong thing." What drives the difference between the models is the fact that as discipline improves and the manager does less of the "wrong thing," L 's disciplining tool, captured by the difference in P_1 across these two trades, vanishes in model B^a but not in model G^a .¹⁶

3. Is L More Effective with More Private Information?

We now assume that L is able to observe privately not only whether M has taken the action, i.e., the realization of \tilde{a} , but also the realization of $\tilde{\delta}$. We

¹⁵ If $\theta = 0$, $E_{ns}(x) - E_s(x) = E(\tilde{\delta} \mid \tilde{\delta} \geq x) > E(\tilde{\delta}) > 0$. More generally, $E_{ns}(x) - E_s(x)$ has a positive lower bound that depends on θ .

¹⁶ Details of the analysis of a variation of the model that allows L to potentially buy shares are available upon request.

continue to assume that neither \tilde{a} nor $\tilde{\delta}$ is observed by other investors until Period 2. As will become clear, the resulting models, denoted by $B^{a,\delta}$ and $G^{a,\delta}$, produce results dramatically different from each other with this information structure, and we will therefore discuss them separately.

Consider model $B^{a,\delta}$ first. Note that, since $\omega_2 > 0$, any equilibrium must still involve M taking the action only if $\tilde{\delta}$ falls below a cutoff point. Again, it is easy to see that in any equilibrium, L prefers not to sell her shares if M does not take the action. However, when L observes $\tilde{\delta}$, it is no longer the case that she always prefers to sell when the action is taken. If $\tilde{\delta} < E_s$, where E_s is the market’s conditional expectation of $\tilde{a}\tilde{\delta}$ given that L sells, then even if M takes the action, the price response to the sale, measured by E_s , is more severe than the loss to the value of the firm that L will incur if she retains her shares, which is equal to $\tilde{\delta}$. Thus, L will not want to sell if $\tilde{\delta} < E_s$.

The above implies that if M takes the action for $\tilde{\delta} \leq x$, then we must have

$$E_s(x) = \frac{\theta \Pr(\tilde{\delta} \leq x) E(\tilde{\delta} | \tilde{\delta} \geq e) + (1 - \theta) \Pr(\tilde{\delta} \in [E_s(x), x]) E(\tilde{\delta} | \tilde{\delta} \in [E_s(x), x])}{\theta + (1 - \theta) \Pr(\tilde{\delta} \in [E_s(x), x])}, \quad (11)$$

and

$$E_{ns}(x) = \frac{\Pr(\tilde{\delta} < E_s(x)) E(\tilde{\delta} | \tilde{\delta} < E_s(x))}{1 - \Pr(\tilde{\delta} \in [E_s(x), x])}. \quad (12)$$

This implicitly assumes that $E_s(x)$ must be smaller than x , which can be seen by noticing that $E_s(x)$ is a weighted average of $\Pr(\tilde{\delta} \leq x) E(\tilde{\delta} | \tilde{\delta} \leq x)$ and $E(\tilde{\delta} | \tilde{\delta} \in [E_s(x), x])$, both of which are smaller than x . (As discussed below, this property does not hold in model $G^{a,\delta}$.) A sale by L communicates that either the action was taken and L chose to sell, i.e., $\tilde{a} = 1$ and $\tilde{\delta} \in [E_s(x), x]$, or L was subject to a liquidity shock. No sale by L communicates that either the action was not taken, or that it was taken and $\tilde{\delta} < E_s(x)$. In equilibrium, the cutoff point x_B will satisfy the indifference condition for M given again by

$$\beta - (1 - \theta)\omega_1(E_s(x_B) - E_{ns}(x_B)) - \omega_2 x_B = 0. \quad (13)$$

The following result states that an equilibrium for model $B^{a,\delta}$ with the characterization described above exists, and that L always has a disciplinary impact in equilibrium.¹⁷

Proposition 2. *There exists at least one equilibrium in model $B^{a,\delta}$, and every equilibrium is disciplining. For every equilibrium, there is a cutoff $x_B < \beta/\omega_2$ such that the manager takes the action if and only if $\tilde{\delta} \leq x_B$, and the large*

¹⁷ The equilibrium in this model is not always unique. However, it is unique when $\tilde{\delta}$ has a uniform distribution, as in the example we use below.

shareholder sells shares if the action is taken and $\tilde{\delta} \geq E_s(x_B)$, where $E_s(\cdot)$ and $E_{ns}(\cdot)$ are given by Equations (11) and (12) and x_B solves Equation (13). The probability that the large shareholder sells shares in equilibrium is positive when $\theta > 0$ and vanishes as θ goes to zero.

Note that L has a disciplinary impact in this model even though in equilibrium an actual exit may be observed quite rarely. This is unlike model B^a , where L sells her shares in equilibrium whenever $\tilde{\delta} \leq x_B$. In fact, when the probability of a liquidity shock θ is very small, L is extremely unlikely to exit in the equilibrium of model $B^{a,\delta}$. Nevertheless, L can have a significant disciplinary impact despite this low probability of exit. When L exits, the market concludes that, except for the possibility of a liquidity shock, $\tilde{\delta} \in [E_s(x_B), x_B]$ and, therefore, that not only was the action likely to have been taken, but that, if the action was taken, then $\tilde{\delta}$ is in the relatively more “harmful” range of values. In the limit when θ vanishes, L only exits when $\tilde{\delta} = x_B$, i.e., with probability zero. A sale in this case communicates that the action was taken and that $\tilde{\delta}$ is equal to the *worst* value for which the action is taken in equilibrium, namely x_B .¹⁸ Note, however, that while the price impact of a sale is more pronounced, the information content of L not selling is diminished. In particular, in the limit case when $\theta = 0$, since L sells with probability zero, no information about $\tilde{\delta}$ is communicated if L does not exit, and thus $E_{ns}(x_B)$ is equal to the unconditional expectation of $\tilde{\delta}$ given M 's strategy of taking the action for $\tilde{\delta} \leq x_B$, namely $\Pr(\tilde{\delta} \leq x_B)E(\tilde{\delta} | \tilde{\delta} \leq x_B)$.

Since L has strictly more information in model $B^{a,\delta}$ than in model B^a , is it the case that her impact is accordingly greater in model $B^{a,\delta}$ than in model B^a ? It turns out that more information does not necessarily make L more effective. We will consider first the limit case where $\theta = 0$, and then discuss the general case $\theta > 0$. Let x be a candidate cutoff point for M 's strategy. If M takes the action when $\tilde{\delta} \leq x$, then in model B^a , $E_s(x) = E(\tilde{\delta} | \tilde{\delta} \leq x)$ and $E_{ns}(x) = 0$. As noted above, in model $B^{a,\delta}$, we have $E_s(x) = x$, and $E_{ns}(x) = \Pr(\tilde{\delta} \leq x)E(\tilde{\delta} | \tilde{\delta} \leq x)$. This is summarized in the table below:

	$E_s(x)$	$E_{ns}(x)$
Model B^a with $\theta = 0$	$E(\tilde{\delta} \tilde{\delta} \leq x)$	0
Model $B^{a,\delta}$ with $\theta = 0$	x	$\Pr(\tilde{\delta} \leq x)E(\tilde{\delta} \tilde{\delta} \leq x)$

M 's decision of whether to take the action depends on $E_s(x) - E_{ns}(x)$. Note that for any x , both $E_s(x)$ and $E_{ns}(x)$ are larger in model $B^{a,\delta}$ than they are in

¹⁸ To understand this intuitively, note that when $\theta = 0$, since L knows both \tilde{a} and $\tilde{\delta}$ and has no liquidity motivation for trade, it is not possible that, in equilibrium, L sells for more than one realization of $\tilde{\delta}$ since $E_s(x_B)$ would have then had to be above one of the possible realizations of $\tilde{\delta}$ for which L sells. This is a contradiction because it entails L selling for some realizations below $E_s(x_B)$, which is suboptimal. When $\theta > 0$, then it is possible that $E_s(x_B) < x_B$ and so there is an interval of realizations of $\tilde{\delta}$ between $E_s(x_B)$ and x_B for which L sells in equilibrium.

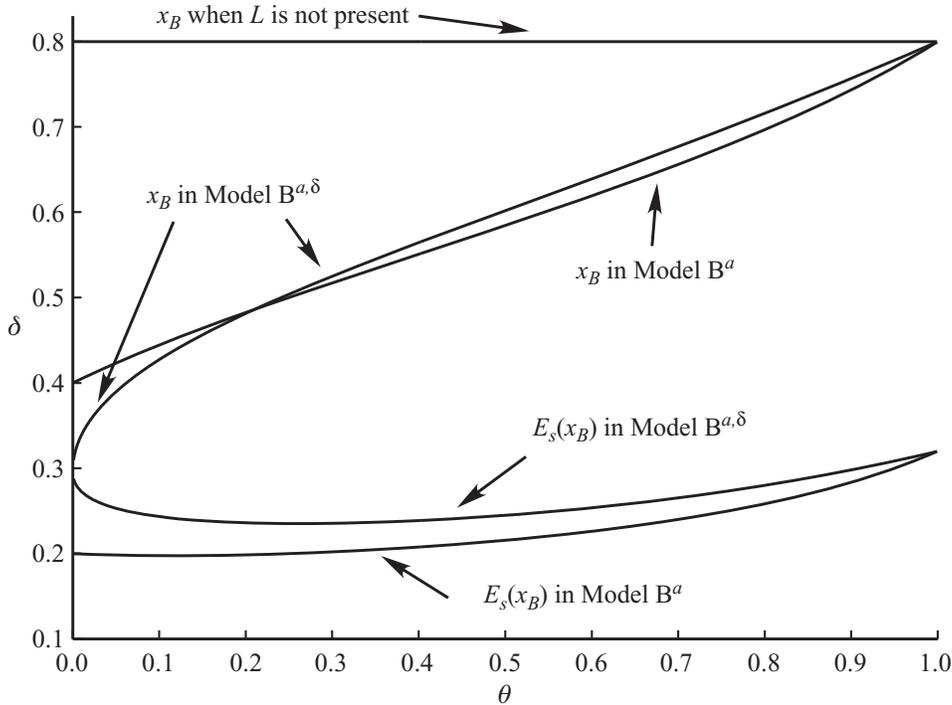


Figure 1
Is more information better?

An example of the equilibrium in models B^a and $B^{a,\delta}$, assuming $\tilde{\delta}$ (the loss to the firm due to the action being taken) has uniform distribution and for all possible values of θ (the probability of liquidity shock). In each equilibrium, the action is taken when $\tilde{\delta} \leq x_B$ for the appropriate cutoff x_B , and $E_s(\cdot)$ measures the price impact of a sale by the large shareholder.

model B^a . When L exits, the action is likely to be in a relatively more harmful range in model $B^{a,\delta}$ than in model B^a , but when L does not exit, the action may have still been taken in model $B^{a,\delta}$ but not in model B^a . Thus, it is not clear which of the models produces a larger difference $E_s(x) - E_{ns}(x)$ at the equilibrium cutoff point. In fact, it can be shown that this difference depends on the distribution of $\tilde{\delta}$, and that it is entirely possible that more information produces a worse outcome. That is, the equilibrium cutoff point might be higher in model $B^{a,\delta}$ than it is in model B^a .

Whether more information is better also depends on θ , the probability that L is subject to a liquidity shock. As an example, consider the case where $\tilde{\delta}$ is distributed uniformly over $[0, 1]$, $\beta = 0.4$, $\omega_1 = 1$, and $\omega_2 = 0.5$. If L is not present, then, for this example, M takes the action if and only if $\tilde{\delta} \leq \beta/\omega_2 = 0.8$. Figure 1 shows the equilibrium cutoffs x_B , as well as the price impact of exit, measured by $E_s(x_B)$ in the equilibrium of both models for all values of θ . When $\theta = 0$, more information is clearly better. This is seen by noting that the cutoff x_B is lower in model $B^{a,\delta}$ than it is in model B^a . We see that in both models x_B is increasing in θ , which is intuitive. When θ is small, L is more effective in model $B^{a,\delta}$ than she is in model B^a . However, for values of θ above 0.25, the reverse is true (i.e., L is less effective when she has private information

about $\tilde{\delta}$ in addition to \tilde{a} (the cutoff point is higher in model $B^{a,\delta}$ than in model B^a). The following proposition shows that for *every* distribution of $\tilde{\delta}$, fixing the model's other parameters, model B^a always produces better discipline than model $B^{a,\delta}$ as θ grows toward 1. In other words, for large enough values of θ , more information is not better but actually makes things worse.

Proposition 3. *For any given distribution of $\tilde{\delta}$ and parameters β , ω_1 , and ω_2 , there exists $\hat{\theta}$ such that if $\theta > \hat{\theta}$, then the large shareholder is more effective in disciplining the manager, and thus the agency costs are lower, in the equilibrium of model B^a than in any equilibrium of model $B^{a,\delta}$.*

To understand this result, it is useful to note that in both models as $\theta \rightarrow 1$, $E_s(x)$ converges to $E(\tilde{\delta}\tilde{a}) = \Pr(\tilde{\delta} \leq x)E(\tilde{\delta} \mid \tilde{\delta} \leq x)$. This is because as the probability that L is subject to a liquidity shock grows to 1, a sale becomes less informative about $\tilde{a}\tilde{\delta}$. However, in model $B^{a,\delta}$, even as θ grows, $E_{ns}(x)$ remains strictly positive, while in model B^a , $E_{ns}(x)$ is always equal to zero. Intuitively, as θ becomes large, exit carries the same (diminishing) information in both models, but the event in which L does not sell has very different information content in the two models. In model B^a , it guarantees that the action was not taken by M , while in model $B^{a,\delta}$ it is also consistent with the action being taken but $\tilde{\delta} < E_s(x)$. This means that for θ sufficiently large, $E_s(x) - E_{ns}(x)$ is larger in model B^a than it is in model $B^{a,\delta}$ for all positive values of x , which implies that L is more effective in model B^a , where she does *not* have the private information about $\tilde{\delta}$.

We now turn to the model $G^{a,\delta}$. In contrast to the comparison between model $B^{a,\delta}$ and model B^a , we will show that L is *never* more effective in model $G^{a,\delta}$ than in model G^a and that, moreover, it is possible that the only equilibrium in model $G^{a,\delta}$ is *nondisciplining*. (Recall that the equilibrium in model G^a is always disciplining.) Thus, no additional disciplinary impact arises from the additional information about $\tilde{\delta}$, and the additional information may in fact make L less effective or completely ineffective in disciplining M . The following result characterizes the equilibrium; it is discussed and illustrated further below.¹⁹

Proposition 4. *Model $G^{a,\delta}$ has a unique equilibrium. Equilibrium is characterized by a cutoff point x_G such that M takes the action if and only if $\tilde{\delta} \geq x_G$ and which satisfies exactly one of the following conditions:*

- (i) *It is identical to the equilibrium cutoff in model G^a ;*
- (ii) *It is strictly higher than the equilibrium cutoff in model G^a but smaller than β/ω_2 ; or*
- (iii) *It is equal to β/ω_2 .*

¹⁹ We are grateful to Andy Skrzypacz for helping us identify the appropriate equilibrium conditions for this model.

In cases (i) and (ii), the equilibrium is disciplining, while in case (iii) the equilibrium is nondisciplining.

The above results show that there is a major distinction between models $B^{a,\delta}$ and $G^{a,\delta}$. In model $B^{a,\delta}$, L always has a disciplinary impact, while this is not true in model $G^{a,\delta}$. The key difference between the models lies in the possible relations between E_s , the market expectation of $\tilde{a}\tilde{\delta}$ given a sale, and x , the cutoff in the manager’s strategy. For L to have a disciplinary impact at the cutoff x , it is necessary in either model that when $\tilde{\delta} = x$, L sells when the manager makes the undesirable choice and holds otherwise. In both models, L will be willing to do this at $\tilde{\delta} = x$ if and only if E_s is less than or equal to the cutoff x . In model $B^{a,\delta}$, it turns out that E_s will always be strictly less than x (as long as $\theta > 0$), so L always has a disciplinary impact. In model $G^{a,\delta}$, however, E_s can be strictly above x , and in these cases L will not have any disciplinary impact.

To understand how the three possible types of equilibria described in Proposition 4 arise, first consider those cases where the equilibrium in model G^a would be one where $E_s(x_G) \leq x_G$. Recall that in the equilibrium of model G^a , where L only observes the manager’s action but not $\tilde{\delta}$, she prefers to sell if the action is not taken and to hold otherwise. If, in addition to observing \tilde{a} , L also observes the realization of $\tilde{\delta}$, would she want to change her strategy? If $E_s(x_G) \leq x_G$ in model G^a , then the answer is no: for any realization of $\tilde{\delta}$, L prefers to hold when the action is taken and sell when it is not taken. This is because for any $\tilde{\delta}$ for which the action is taken, L ’s shares, whose value increases by $\tilde{\delta}$, are worth at least as much as the selling price, since $\tilde{\delta} \geq x_G \geq E_s(x_G)$. L , therefore, has no desire to change her trading decision based on learning about the realization of $\tilde{\delta}$. It follows that when $E_s(x_G) < x_G$ in the equilibrium of model G^a , then this is also the unique equilibrium in model $G^{a,\delta}$. This explains case (i) in Proposition 4.

Now consider those cases where in the equilibrium of model G^a , $E_s(x_G) > x_G$. Assume again that L observes $\tilde{\delta}$ in addition to the manager’s action choice. With this additional information, will L still be content to follow her equilibrium trading strategy in model G^a (i.e., to hold if the manager takes the action and sell otherwise)? To see that she will not, suppose that $\tilde{\delta} = x_G$, where x_G is the equilibrium cutoff in model G^a . If the manager takes the action and L observes this, and also that $\tilde{\delta} = x_G < E_s(x_G)$, then clearly L will prefer to sell even though M has taken the action, because the price at which she will sell exceeds the value of the firm whenever $\tilde{\delta} < E_s(x)$. This means that if $E_s(x_G) > x_G$ in the equilibrium of model G^a , then x_G cannot be an equilibrium cutoff for model $G^{a,\delta}$. We show in the Appendix that in those cases where $E_s(x_G) > x_G$ in the equilibrium of model G^a , the equilibrium in model $G^{a,\delta}$ involves a *higher* cutoff level and thus less discipline by L . In some situations (corresponding to case (ii) in Proposition 4), the equilibrium is still disciplining, but less so than the equilibrium of model G^a (the cutoff is higher), and $E_s(x_G) = x_G$ in equilibrium.

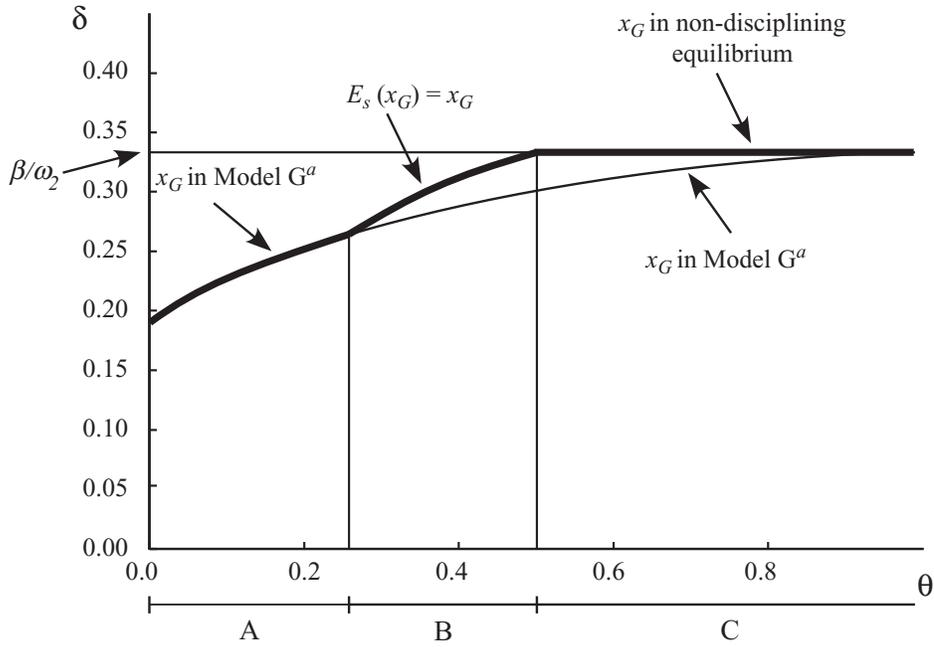


Figure 2
Equilibrium in model $G^{a,\delta}$

This figure presents the equilibrium of model $G^{a,\delta}$ for all possible values of θ (the probability of liquidity shock) in an example where $\tilde{\delta}$ has a uniform distribution. In each equilibrium, the manager takes the action for $\tilde{\delta} > x_G$. For values of θ in intervals A, B, and C, the equilibrium is of type (i), (ii), and (iii) of Proposition 4, respectively.

In other cases (corresponding to case (iii) in Proposition 4), $E_s(x_G) > x_G$, and the equilibrium is not disciplining (i.e., $x_G = \beta/\omega_2$).²⁰

We illustrate Proposition 4 with the following example. Suppose $\tilde{\delta}$ is uniformly distributed on $[0, 1]$, $\beta = 0.33$, $\omega_1 = 0.25$, and $\omega_2 = 1$. The bold line in Figure 2 shows the equilibrium cutoffs for different values of θ . Note that for small θ (interval A), $E_s(x_G) < x_G$ in model G^a , and the equilibrium of model $G^{a,\delta}$ is the same as that in model G^a . For an intermediate range of values of θ (interval B), the equilibrium cutoff in this example satisfies $E_s(x_G) = x_G$. This equilibrium is no longer the same as the equilibrium of model G^a , and it involves less discipline (i.e., a higher cutoff). In this intermediate range, L is indifferent between selling and not selling at the cutoff x_G , but M strictly prefers to take the action at the cutoff. This equilibrium exists for model $G^{a,\delta}$ as long as the solution to $E_s(x) = x$ is smaller than β/ω_2 . If this solution is larger than β/ω_2 , then the unique equilibrium becomes nondisciplining, which occurs for relatively large values of θ (interval C) in this example.²¹

²⁰ Note that in this equilibrium L will typically use her private information about $\tilde{\delta}$ to sell her shares when $\tilde{\delta} \in [\beta/\omega_2, E_s]$ even though M takes the action.

²¹ It should be noted that, while the equilibrium cutoff is always increasing in θ (indeed, strictly increasing as long as the equilibrium is disciplining), the two types of disciplining equilibrium (those in parts (i) and (ii) of Proposition 4 and intervals A and B in Figure 2) do not always appear in the same order as in this example. It is possible that for relatively small values of θ , the equilibrium of model $G^{a,\delta}$ is of type (ii) in Proposition 4 (interval B of Figure 2), while for higher values of θ , it is of type (i) (interval A). It is also possible that the equilibrium is of type (i) both for very small and very large values of θ while it is of type (ii) for a range of intermediate values of θ . Which type of equilibrium prevails depends on all the parameters, namely θ , β , ω_1 , and ω_2 , as well as on the distribution of $\tilde{\delta}$.

In sum, we have seen that if, in addition to observing whether the action is taken, L has private information about the consequences of the action, her disciplinary impact may be weakened. In contrast to model $B^{a,\delta}$, where L always has a disciplinary impact and the additional $\tilde{\delta}$ information can make L more effective in disciplining the manager, in model $G^{a,\delta}$ the additional $\tilde{\delta}$ information never makes L more effective and can in fact make her completely ineffective.

4. Can L 's Presence Exacerbate the Agency Problem?

In the models we have analyzed to this point, we have shown that L 's presence generally has a disciplinary impact on M and the worst equilibrium in terms of the agency cost is one where L has no impact at all. We have not encountered a dysfunctional equilibrium, one in which L 's impact is negative. In this section, we will show that L 's presence can actually make things worse. We will consider an information structure where \tilde{a} is public in Period 1 (i.e., all investors observe whether M takes the action), and L 's private information consists of the realization of $\tilde{\delta}$. Again, and quite dramatically, our two agency models will produce very different results. We first show that the equilibrium of model $B_a^{a,\delta}$ is disciplining; in fact, the agency cost in this model is lower than that in either model B^a or model $B^{a,\delta}$. By contrast, we show that in model $G_a^{a,\delta}$ the equilibrium is dysfunctional, and L 's presence *increases* the agency cost relative to the case where she is not present.

In the models analyzed so far, where \tilde{a} is not observed by investors until Period 2, if L is not present then discipline is only provided by the impact of the action on P_2 , and so the equilibrium of model B is that M takes the action when $\tilde{\delta} \leq \beta/\omega_2$. Now consider model B_a , where L is not present and \tilde{a} is public. Since $\omega_2 > 0$, equilibrium must again involve a cutoff x such that M takes the action if and only if $\tilde{\delta} \leq x$. If M is observed taking the action, investors conclude that $\tilde{\delta} \leq x$. Without any additional information, the expected value of $\tilde{a}\tilde{\delta}$ is $E(\tilde{\delta} \mid \tilde{\delta} \leq x)$, and thus $P_1 = v - E(\tilde{\delta} \mid \tilde{\delta} \leq x)$. Since $P_1 = v$ if M does not take the action, the equilibrium cutoff x_B is determined by

$$\beta - \omega_1 E(\tilde{\delta} \mid \tilde{\delta} \leq x_B) - \omega_2 x_B = 0. \quad (14)$$

Note that this is the same as the equilibrium cutoff in model B^a in the special case of $\theta = 0$, i.e., where L observes \tilde{a} privately and she is never subject to a liquidity shock (see Proposition 1). If $\theta = 0$ in model B^a , then L exits if and only if the action was taken, so in equilibrium investors know with certainty whether or not the action was taken. This is the same situation as model B_a , where \tilde{a} is publicly observed and L is not present.

Now consider model $B_a^{a,\delta}$, where \tilde{a} is public and L observes $\tilde{\delta}$ privately. If the action is not taken, then the price in Period 1 is v independent of L 's trade, and L sells only when she is subject to the liquidity shock. If the action is taken, then, as in model $B^{a,\delta}$, L sells whenever $\tilde{\delta} \geq E_s(x)$, where x is the cutoff value

of $\tilde{\delta}$ below which the action is taken. This means that when the action is taken, we must have²²

$$E_s(x) = \frac{\theta \Pr(\tilde{\delta} \leq x) E(\tilde{\delta} | \tilde{\delta} \geq x) + (1 - \theta) \Pr(\tilde{\delta} \in [E_s(x), x]) E(\tilde{\delta} | \tilde{\delta} \in [E_s(x), x])}{\theta \Pr(\tilde{\delta} \leq x) + (1 - \theta) \Pr(\tilde{\delta} \in [E_s(x), x])}, \quad (15)$$

and

$$E_{ns}(x) = E(\tilde{\delta} | \tilde{\delta} < E_s(x)). \quad (16)$$

In equilibrium, M must again be indifferent between taking and not taking the action at the cutoff $\tilde{\delta} = x_B$. This means that any equilibrium cutoff x_B in model $B_a^{a,\delta}$ must satisfy

$$\beta - \omega_1 E_s(x_B) - \omega_2 x_B = 0. \quad (17)$$

Note that $E_{ns}(x_B)$, which measures the price impact of no sale, does not affect the determination of x_B in this model, because if M takes the action when $\tilde{\delta} = x_B$, then L sells her shares for sure, while if M does not take the action, $P_1 = v$ independent of L 's trading. In other words, since M can be sure that $P_1 = v$ if he does not take the action, and since L always exits when $\tilde{\delta} = x_B$, the inference investors would make if L retains her shares is irrelevant to M 's decision when $\tilde{\delta} = x_B$.

The next result confirms that there exists a unique equilibrium to model $B_a^{a,\delta}$ and compares the agency cost associated with the action in this model to the agency costs in the equilibria of models B^a and $B^{a,\delta}$ analyzed in previous sections.

Proposition 5. *There exists a unique equilibrium in model $B_a^{a,\delta}$ and the equilibrium is disciplining. In equilibrium*

- (i) *The manager takes the action if and only if $\tilde{\delta} \leq x_B$, where x_B is determined by Equation (17);*
- (ii) *The large shareholder sells her shares if the action is taken and $\tilde{\delta} \geq E_s(x_B)$, where $E_s(\cdot)$ is determined by Equation (15); and*
- (iii) *The agency cost is lower than the agency cost in the unique equilibrium of model B^a and is also lower than the agency cost in any equilibrium of model $B^{a,\delta}$.*

The key to understanding how L 's presence affects M 's behavior is to examine M 's incentives when $\tilde{\delta} = x$ and x is assumed to be the manager's cutoff. These incentives depend on the difference between the (expected) first-period price P_1 when M takes the action and when he does not. While the short-term

²² Note that these apply only if the action is taken. While our notation does not signify this fact, no confusion should arise.

compensation difference between taking and not taking the action is only a function of L 's trading decisions in models B^a and $B^{a,\delta}$, this is no longer true when M 's action is publicly observable in Period 1. The following table shows the first-period price in the three models when M does and does not take the action. All prices are given as a function of the assumed cutoff point x and are based on the assumption that $\theta = 0$.

Model	P_1 if M does not take action	P_1 if M takes action	Difference
B^a with $\theta = 0$	v	$v - E(\tilde{\delta} \mid \tilde{\delta} \leq x)$	$E(\tilde{\delta} \mid \tilde{\delta} \leq x)$
$B^{a,\delta}$ with $\theta = 0$	$v - \Pr(\tilde{\delta} \leq x)E(\tilde{\delta} \mid \tilde{\delta} \leq x)$	$v - x$	$x - \Pr(\tilde{\delta} \leq x)E(\tilde{\delta} \mid \tilde{\delta} \leq x)$
$B_a^{a,\delta}$ with $\theta = 0$	v	$v - x$	x

First consider the comparison between model $B^{a,\delta}$ and model $B_a^{a,\delta}$. When $\theta = 0$ and $\tilde{\delta}$ is at the cutoff x , if M takes the action, L exits and this reveals perfectly that $\tilde{a}\tilde{\delta} = x$ in both models, since this is the only realization of $\tilde{\delta}$ for which L exits. If M does not take the action, however, then in model $B_a^{a,\delta}$, $P_1 = v$ since this will be observable to investors, but in model $B^{a,\delta}$ investors only observe that L is not selling, which provides no information about $\tilde{a}\tilde{\delta}$ and the resulting first-period price is $v - E(\tilde{\delta}\tilde{a}) = v - \Pr(\tilde{\delta} \leq x)E(\tilde{\delta} \mid \tilde{\delta} \leq x)$. In other words, in both of these models M will suffer the “maximal hit” to his compensation when he takes the action at the cutoff point, but the consequences of not taking the action are quite different. In model $B^{a,\delta}$ investors do not learn anything from L not exiting, since they do not observe \tilde{a} and since L only exits when $\tilde{\delta} = x$. However, since \tilde{a} is public in model $B_a^{a,\delta}$, the first-period price will reflect the fact that the action was not taken. This means that the consequences of taking the action are greater in model $B_a^{a,\delta}$ and thus the agency cost in the equilibrium of model $B_a^{a,\delta}$ is lower than that in any equilibrium of model $B^{a,\delta}$.

We now compare model B^a , where L observes \tilde{a} privately and no investor observes $\tilde{\delta}$, and model $B_a^{a,\delta}$, where \tilde{a} is public and L observes $\tilde{\delta}$ privately. In both of these models, although for different reasons, $P_1 = v$ if M does not take the action. In model B^a this is because L retains her shares only if the action is not taken, while in model $B_a^{a,\delta}$ this is because it is publicly observed that the action was not taken. The difference in discipline comes about because if M takes the action at the cutoff $\tilde{\delta} = x$, then in model B^a L sells her shares and investors only know that $\tilde{\delta} \leq x$, and thus $P_1 = v - E(\tilde{\delta} \mid \tilde{\delta} \leq x)$, while in model $B_a^{a,\delta}$, investors know from the fact that L exits that $\tilde{\delta} = x$. It follows that at any possible cutoff point x , the difference between P_1 when M does not take the action and when he does is again greater in model $B_a^{a,\delta}$ than it is in B^a . This implies the equilibrium cutoff point in model $B_a^{a,\delta}$ is always lower than that in model B^a , and thus again that the agency cost is smaller.

The above discussion, with appropriate modifications, applies to the model with $\theta > 0$. Model $B_a^{a,\delta}$ produces the best outcome from the shareholders' perspective among the models considered so far, because, as in model B^a , M is able to obtain the highest compensation when he does not take the action and at

the same time, as in model $B^{a,\delta}$, he suffers the most severe consequences when he does take the action at the cutoff point. Note, however, that this does *not* imply that L has a larger disciplinary impact in model $B_a^{a,\delta}$ than she does in the other models, because the benchmark situation where L is not present is different when \tilde{a} is public information than when \tilde{a} is not public information in Period 1. In fact, it can be shown that L 's impact can be higher or lower in model $B_a^{a,\delta}$ relative to models B^a and $B^{a,\delta}$.

Let us now turn to model $G_a^{a,\delta}$, and again we start with model G_a , where L is not present and \tilde{a} is public. If M is observed taking the action and L is not present, the expected value of $\tilde{\delta}$ will be $E(\tilde{\delta} \mid \tilde{\delta} \geq x)$, and thus the price in Period 1 will be $v + E(\tilde{\delta} \mid \tilde{\delta} \geq x)$, where x is the cutoff such that M takes the action if and only if $\tilde{\delta} \geq x$. Since the price if M does not take the action is v , the equilibrium cutoff x_G is determined by

$$-\beta + \omega_1 E(\tilde{\delta} \mid \tilde{\delta} \geq x_G) + \omega_2 x_G = 0. \tag{18}$$

Note that again this is the same as the equilibrium cutoff point in model G^a when $\theta = 0$ (i.e., where L observes \tilde{a} privately and is never subject to a liquidity shock). This is because, when $\theta = 0$, L 's trading in model G^a communicates perfectly whether the action was taken. Now consider model $G_a^{a,\delta}$. Since \tilde{a} is publicly observed, $P_1 = v$ if the action was not taken, and this is independent of whether L sells or not. If the action is taken for $\tilde{\delta} \geq x$, then L exits when $\tilde{\delta} \leq E_s(x)$. Note that we must have $x \leq E_s(x)$ because if $\tilde{a} = 1$ then it is publicly known that $\tilde{a}\tilde{\delta} \geq x$. This means that when the action is taken,

$$E_s(x) = \frac{\theta \Pr(\tilde{\delta} \geq x) E(\tilde{\delta} \mid \tilde{\delta} \geq x) + (1 - \theta) \Pr(\tilde{\delta} \in [x, E_s(x)]) E(\tilde{\delta} \mid \tilde{\delta} \in [x, E_s(x)])}{\theta \Pr(\tilde{\delta} \geq x) + (1 - \theta) \Pr(\tilde{\delta} \in [x, E_s(x)])}. \tag{19}$$

The equilibrium cutoff x_G in model $G_a^{a,\delta}$ must solve

$$-\beta + \omega_1 E_s(x_G) + \omega_2 x_G = 0. \tag{20}$$

Analogous to model $B_a^{a,\delta}$, if the action is taken for $\tilde{\delta} \geq x$, then $E_{ns}(x) = E(\tilde{\delta} \mid \tilde{\delta} > E_s(x))$, but $E_{ns}(\cdot)$ does not affect the determination of the equilibrium cutoff x_G .

The next result states the existence of a unique equilibrium for model $G_a^{a,\delta}$. Most interestingly, it shows that when \tilde{a} is public information in Period 1, having L privately observe $\tilde{\delta}$ and potentially trade on this information actually *reduces* the discipline placed on M . In other words, the agency cost in model $G_a^{a,\delta}$ is higher than that in model G_a , where L is not present, which means that the equilibrium of model $G_a^{a,\delta}$ is *dysfunctional*.

Proposition 6. *There exists a unique equilibrium in model $G_a^{a,\delta}$ and the equilibrium is dysfunctional. In equilibrium:*

- (i) *The manager takes the action if and only if $\tilde{\delta} \geq x_G$, where x_G is determined by Equation (20);*
- (ii) *The large shareholder sells her shares if the action is taken and $\tilde{\delta} \leq E_s(x_G)$, where E_s is determined by Equation (19); and*
- (iii) *The agency cost is higher than that in model G_a (i.e., the large shareholder’s impact on the agency costs is negative).*

To understand why L ’s presence is harmful in this model, consider again M ’s incentives at a candidate cutoff point x . When L is not present, if M takes the action, he is rewarded by an increase in his first-period compensation equal to $\omega_1 E(\tilde{\delta} \mid \tilde{\delta} \geq x)$, because investors have no information about $\tilde{\delta}$ other than what is revealed by the fact that M has chosen to take the action, which implies that $\tilde{\delta} \geq x$. In model $G_a^{a,\delta}$, L exits when $\tilde{\delta} = x$, since the selling price, $v + E_s(x)$, is larger than the actual value of the firm given that M takes the action, which is $v + x$ when $\tilde{\delta} = x$. Exit by L communicates that the realization is relatively low among the values of $\tilde{\delta}$ for which the action is taken, since L only chooses to sell when $\tilde{\delta} \in [x, E_s(x)]$. (In the extreme case in which $\theta = 0$, L only sells when $\tilde{\delta} = x$, and thus $E_s(x) = x$.) Thus, when $\tilde{\delta} = x$, L ’s trading causes the market to revise *downward* its expectation of $\tilde{\delta}$ relative to the expectation based only on M ’s willingness to take the action. For any potential cutoff x , this lowers the difference between the compensation for M in model $G_a^{a,\delta}$ when he takes the action and when he does not relative to the difference in model G_a . It follows that L ’s presence reduces M ’s incentives to take the value-enhancing action and shareholders would be better off if L were not present.

Note that this implies that for $\theta = 0$, the agency cost in model $G_a^{a,\delta}$ is strictly higher than that in model G^a , because in this case model G^a is identical to model G_a . (In both of these models investors know perfectly when the action is taken but nothing more about $\tilde{\delta}$.) Since we already observed that model $G_a^{a,\delta}$ produces the same or a worse outcome than model G^a , it follows that, for $\theta = 0$, model G^a (equivalently model G_a) produces a strictly lower agency cost than either model $G^{a,\delta}$ or model $G_a^{a,\delta}$. When $\theta > 0$, the comparison between the agency cost in models $G_a^{a,\delta}$ and G^a turns out to be ambiguous, since \tilde{a} is publicly observed in model $G_a^{a,\delta}$, while this information is only communicated with some noise in model G^a . The lowest agency cost for model G is obtained in model G_a where \tilde{a} is publicly observed and L is not present. Note the difference between this result and Part (iii) of Proposition 4. The lowest agency cost for model B is obtained in model $B_a^{a,\delta}$.

5. The Model with Action-only Uncertainty

For completeness, we now discuss an information structure in which all investors observe $\tilde{\delta}$ in Period 1, while L observes, in addition, whether M has

taken the action. In other words, there is no uncertainty about $\tilde{\delta}$, but only L observes \tilde{a} in Period 1. As we will show, this turns out to be the only information structure that we examine where model B and model G behave like mirror images of each other and, for the same parameters, produce the same type of results in terms of L 's impact.

When investors know the realization of $\tilde{\delta}$, equilibrium will depend on the realized value of $\tilde{\delta}$. The prior distribution of $\tilde{\delta}$ will not play any role in determining the equilibrium. However, to the extent that $\tilde{\delta}$ is drawn from a particular distribution, one can still discuss the *ex ante* expected agency costs by integrating over the possible values of $\tilde{\delta}$ that investors observe in Period 1. The next result characterizes the equilibrium and the agency cost in models $B_\delta^{a,\delta}$ and $G_\delta^{a,\delta}$. Note that equilibrium involves a mixed strategy for M for a range of values of δ .

Proposition 7. *In each of model $B_\delta^{a,\delta}$ and model $G_\delta^{a,\delta}$, there exists a unique equilibrium, which is always disciplining.*

- (i) *In model $B_\delta^{a,\delta}$, equilibrium is characterized by a function $m_B(\delta)$, such that for a given δ , the manager takes the action with probability $m_B(\delta)$ and the large shareholder sells her shares if the manager takes the action. The mixing probability is given by*

$$m_B(\delta) = \begin{cases} 1, & \text{if } \delta < \frac{\beta}{(1-\theta)\omega_1 + \omega_2} \\ \left(\frac{\theta}{1-\theta}\right) \left(\frac{\beta - \omega_2\delta}{(\omega_1 + \omega_2)\delta - \beta}\right), & \text{if } \frac{\beta}{(1-\theta)\omega_1 + \omega_2} \leq \delta \leq \frac{\beta}{\omega_2} \\ 0, & \text{otherwise.} \end{cases} \quad (21)$$

- (ii) *In model $G_\delta^{a,\delta}$, equilibrium is characterized by a function $m_G(\delta)$, such that for a given δ , the manager takes the action with probability $m_G(\delta)$ and the large shareholder sells her shares if the manager does not take the action. Furthermore, $m_G(\delta) = 1 - m_B(\delta)$ where $m_B(\delta)$ is given in Equation (21).*
- (iii) *Holding fixed $\theta, \beta, \omega_1, \omega_2$, and the distribution of $\tilde{\delta}$, the impact of the large shareholder's presence on the agency cost is equal in model $B_\delta^{a,\delta}$ and model $G_\delta^{a,\delta}$.*

The information structure analyzed in this section can be thought of as the limit of the model with “action-only monitoring,” analyzed in Section 2, as the distribution of $\tilde{\delta}$ becomes degenerate. Proposition 7 shows that with no uncertainty about $\tilde{\delta}$, there is complete symmetry between model B and model G. It is therefore clear that the differing results for the two models in previous sections were driven by the inference investors must make in Period 1 about $\tilde{\delta}$ based on L 's trading behavior.

6. Extensions and Variations of the Model

6.1 Endogenous information acquisition and anonymous trading

Our model has assumed that L is endowed with her private information, and that L 's trade is observable (i.e., that she does not trade anonymously). It follows that L 's *ex ante* expected trading profits in our model are zero. That is, before L observes her private information and before it is known whether she is subject to a liquidity shock, the expected trading profits L obtains when she trades on private information are just offset by the expected losses she suffers when she is subject to a liquidity shock. Thus, the value of any private information acquired by L is only due to the increase in the value of her initial share holdings brought about by her disciplinary impact (i.e., to any decrease in the agency costs). This implies that if L can choose whether or not to become informed, a nondisciplining or a dysfunctional equilibria would not arise.²³ In particular, if the agency problem is of the “good action” type, our results imply that the large shareholder will not acquire information about the consequences of the action ($\tilde{\delta}$), since this will not lower the agency costs, and it may in fact lead to an increase in those costs.

Recall that our results imply that the lowest agency costs across all information structures for “bad action” agency problems are obtained in $B_a^{a,\delta}$ (where investors observe the action and the large shareholder observes $\tilde{\delta}$ privately), while the lowest agency cost for “good action” agency problems is obtained in G_a .²⁴ This is suggestive of the type of information large shareholders are likely to collect in the various settings. In model B, information about $\tilde{\delta}$ is always valuable if \tilde{a} is publicly observed in Period 1. If \tilde{a} is not publicly observable, then L will collect information about \tilde{a} , and sometimes she will also collect information about $\tilde{\delta}$. In model G, by contrast, L should *never* collect private information about $\tilde{\delta}$. If \tilde{a} is publicly observable in Period 1, then improving discipline through the threat of exit is not possible. If \tilde{a} is not publicly observable in period 1, then the threat of exit will have a disciplinary impact if L collects information about \tilde{a} and exits when the action is not taken. However, collecting additional information about $\tilde{\delta}$ will never reduce agency costs, and it might eliminate L 's disciplinary impact.

The result that L 's *ex ante* expected trading profits are zero is sensitive to our assumptions that L does not trade anonymously. If instead L trades anonymously in a market that includes other liquidity traders, then two seemingly conflicting effects emerge. First, the direct impact of L 's trade on the price would tend to be lower than when the price is based on L 's trade alone. Other things equal, this would seem to reduce L 's ability to discipline M , since her

²³ An implicit assumption here is that if L acquires information, other investors, including the market maker, become aware of the fact that L has become informed (i.e., they know that L has acquired information but do not know its content). Disclosure requirements such as 13D filings may help bring this about.

²⁴ This statement holds under the assumption that investors have some uncertainty about $\tilde{\delta}$ in Period 1. Thus, we are not considering models $B_{\tilde{\delta}}^{a,\delta}$ and $G_{\tilde{\delta}}^{a,\delta}$.

trade would have less direct impact on the manager's compensation. At the same time, in the presence of other liquidity traders, L 's *ex ante* expected trading profits would be positive. This might increase L 's willingness to gather information, especially when it is costly to do so, and this in turn may lead to an increase in her disciplinary impact.

There are actually situations where L 's disciplinary impact would not necessarily be reduced even if her trade has a lower price impact due to the presence of other liquidity traders. For example, suppose M 's compensation is sensitive to prices set after L makes her trading decision but before all of L 's information becomes public. Further, suppose that L 's trade, and possibly the motive for her trade, becomes public subsequent to the trade, due perhaps to trade disclosure requirements. Then there will be further price impact at the time when information about L 's trade becomes public, which would potentially affect M 's compensation and this would generally have a disciplining impact. Combining this with the fact that L would have stronger incentives to acquire costly information when she trades in a more liquid market, we would expect her overall disciplinary impact to be larger in this situation.

As an example, suppose that M 's short-term compensation is based on the price prevailing at the end of the calendar year. If L exits anonymously in October, and then in November it becomes known or is disclosed that she has exited, then the price in December would fully reflect the fact that L has exited and this would affect M 's compensation. At the same time, L is able to benefit from her information advantage by trading anonymously in October, potentially allowing her to recover the cost of information or any other costs exit entails.²⁵

6.2 Costly exit

Our model assumed that the large shareholder does not incur any costs in exiting other than the price impact of her trade due to her private information. However, if exit is costly in additional ways, then L 's decision whether to exit might be affected, and this can change the potential impact of the threat of exit on the manager. Two types of exit costs can be considered.²⁶ The first is a simple transaction cost that L would incur whenever she trades. Clearly, exit can have a disciplining impact in the presence of such costs only if L 's trading profits, when she chooses to trade, cover the transactions costs. Since L knows whether her trade is due to a liquidity shock or is based on payoff-relevant information, she has an informational advantage over other investors, and this makes for positive expected trading profits when she is able to trade on the basis of her information.

²⁵ Of course, when L trades anonymously, she generally imposes a trading cost on other investors who may be subject to a liquidity shock. The additional cost on other investors should also be taken into account in a full analysis of this case.

²⁶ A detailed analysis of model B^a with the two types of exit costs is available upon request.

It can be shown that when the transactions costs are not too high, disciplining equilibria still exist, but these may involve L mixing between exit and no exit. Not surprisingly, the presence of transactions costs generally weakens the disciplinary impact of the threat of exit. This implies that the disciplinary impact of the large shareholder will be lower when the market for the firm’s stock is less liquid to the extent that less liquid markets can be interpreted as those having higher transactions costs.

Consider now the possibility that L ’s exit per se may lower the value of the firm, for example, by eliminating the benefit of L ’s future presence as an active shareholder. This would cause the price impact of exit to be larger. When L exits, the price drop would reflect the information about $\tilde{\alpha}\tilde{\delta}$ that is revealed by her decision to sell (i.e., the effect we have analyzed), and also the loss in value brought about by the fact that L will no longer produce benefits for the firm in the future. Obviously, this increases the costs to L of selling and makes sale less desirable. However, unlike a simple transaction cost, which is borne only by L , a loss in the value of the firm due to L ’s departure impacts M ’s compensation directly. It is not intuitively clear whether L is more or less effective in the presence of such exit costs. On the one hand, to the extent that the exit “punishment” will be used less frequently (because it is more costly for L to exit), this would generally tend to reduce L ’s disciplinary impact. However, when L does choose to exit, the negative effect on M ’s compensation is larger in the presence of the loss in firm value, which would generally tend to increase L ’s disciplinary impact. It can be shown that it is possible for the agency costs to be lower in the presence of exit costs that lower the value of the firm upon exit. In other words, these exit costs can have positive value in that in their presence the agency costs we consider are reduced by more than the loss in value associated with the exit.

6.3 Additional uncertainty

While our model assumed that there is no uncertainty regarding the cost or benefit of the action to the manager, our analysis actually covers a special case where the private cost/benefit is random. This is the case when the private cost/benefit is perfectly correlated with the consequences of the action, i.e., when $\tilde{\beta} = \gamma_0 + \gamma_1\tilde{\delta}$ with $\gamma_0 > 0$. This is a natural model when the bad action involves perks and compensation or the good action’s consequences are increasing with the manager’s costly effort. To see how this maps into our model consider, for example, model B^a, and recall that when $\tilde{\delta} = \delta$, M takes the action when $\beta - (1 - \theta)\omega_1(E_s - E_{ns}) - \omega_2\delta \geq 0$. If $\beta = \gamma_0 + \gamma_1\delta$, a manipulation of the equilibrium conditions shows that they are the same as those in Section 2 for the case of fixed β , with γ_0 playing the role of the “fixed” value of β of Section 2, and $\omega_2 - \gamma_1$ playing the role of the coefficient ω_2 in Section 2. Since our analysis in Section 2, as well as in the rest of the paper, relied on the

assumption that $\omega_2 > 0$, the analysis applies fully to the model with $\tilde{\beta} = \gamma_0 + \gamma_1 \tilde{\delta}$ if $\gamma_1 < \omega_2$.²⁷

Another interesting extension of the model is to relax the assumption that the nature of the agency problem is common knowledge. If investors are uncertain about whether model B or model G is appropriate then, under the maintained assumption that L can only exit or retain her shares, it can be shown that L can only provide discipline for one of the two types of agency problems, but not both.²⁸ Interestingly, “model uncertainty” can enhance the disciplinary impact of L in the sense that for the agency problem that L alleviates, the possibility that the agency problem is of the other type can increase $E_s - E_{ns}$ relative to the case where it is common knowledge what the agency problem is.

7. Empirical Predictions

In this section, we discuss some of the empirical implications of our model. It should be noted that several implications of our models are consistent with models that involve other mechanisms, typically referred to as “monitoring” or “shareholder activism,” through which shareholders might exert control over managers. For example, since the presence of the informed large shareholder reduces the agency costs whenever the equilibrium is disciplining, our model implies that in these cases there will be a favorable stock market reaction to the (not fully anticipated) acquisition of a large block by a shareholder. This implication is shared by any model that incorporates some mechanism for a large shareholder to resolve agency problems. Our analysis also predicts that the effectiveness of the threat to exit as a disciplinary device generally increases when the large shareholder is less likely to be subject to a liquidity shock (i.e., θ is lower). Again, many models would have a similar prediction.

To detect empirically whether the threat of exit plays a meaningful role in governance and to distinguish it from other forms of shareholder activism, we must focus on the particular way the mechanism works, which crucially depends on the interaction between the large shareholder’s information and managerial compensation. To see how this can be done, recall that, in much of our analysis, the cutoff value of $\tilde{\delta}$ for which the manager is indifferent between taking and not taking the action is equal to the x that solves

$$(1 - \theta)\omega_1|E_s(x) - E_{ns}(x)| + \omega_2x = \beta. \quad (22)$$

²⁷ If $\gamma_1 > \omega_2$, then some of our results would be “switched,” because in model B the manager will now take the action for all realizations of $\tilde{\delta}$ *above* a cutoff, and in model G he will take the action for realizations *below* a cutoff value. The general observations, however (e.g., that additional information may lead to lower disciplinary impact and that L ’s presence may exacerbate the agency problem), will not change.

²⁸ If L had a third possible trade (e.g., to increase her stake by buying more shares), then it would in principle be possible for her to provide discipline in both model B and model G. A full examination of this is beyond the scope of this paper.

The disciplinary effect of potential exit on the manager’s decision is felt through the first term on the left-hand side of Equation (22). In general, the larger this term, the lower the cutoff level and thus the lower the agency cost. As shown in Equation (22), the magnitude of this term depends on (i) the probability that the large shareholder is not subject to a short-term liquidity shock, $1 - \theta$, which we define as the “longevity” of the large shareholder; (ii) the difference between the first-period price if the large shareholder exits and the price if she does not, $|E_s - E_{ns}|$; and (iii) the importance to the manager of short-term compensation, ω_1 . While other models may also predict that the longevity of the large shareholder would enhance her effectiveness in reducing agency costs, Equation (22) suggests that when the threat of exit is effective in disciplining the manager, there is a significant interaction between the large shareholder’s longevity and the importance of short-term compensation, ω_1 . Specifically, if we hold everything else constant, the degree to which the large shareholder’s longevity enhances her discipline on the manager is increasing in the importance of the manager’s short-term compensation, ω_1 . Loosely speaking, longevity and short-term compensation are complements. Since such an interaction is not directly predicted by other models, if it is found empirically to hold, it would provide evidence that discipline through the threat of exit is likely at play.

To see how this can be used in an empirical test, let R_{block} be the abnormal return experienced when a large shareholder acquires a large block. Consider regressing R_{block} on (i) some measure of the longevity of the large shareholder, (ii) some measure of the importance of short-term compensation,²⁹ and (iii) the product of (i) and (ii). The critical coefficient in identifying the importance of the threat of exit in disciplining managers is the one on the interaction term. Other models of shareholder activism of which we are aware do not predict any relation between R_{block} and this interaction term, while our analysis predicts a positive relation. A significant positive interaction effect would be an indication that the “Wall Street Walk,” i.e., the threat of exit, plays a meaningful role in corporate governance.

A similar test of our model can be constructed using measures of market liquidity. We have shown that transactions costs generally reduce the effectiveness of the large shareholder’s threat to exit (see again the discussion in 7.2). This means that the large shareholder’s threat of exit is less effective in illiquid markets, which are characterized by higher transactions costs. As was true for longevity and ω_1 , market liquidity and ω_1 will be complements. Consider again a regression with R_{block} as the dependent variable and introduce as one of the regressors the product of ω_1 with a measure of market liquidity. Once again a

²⁹ Short-term stock-based compensation can include both unrestricted stock and options that have vested or will vest within a short time horizon. A measure of the significance of this type of compensation can take the weight of this component relative to total compensation.

test of our model would be based on finding a significant positive coefficient on this interaction term.

We have shown that the effectiveness of the threat of exit as a disciplining device may be quite different depending on the nature of the agency problem and the type of private information that motivates the large shareholder's trades. To the extent that it is possible to make empirically identifiable distinctions across firms and/or settings with respect to the type of agency problem and information structure that are likely to be present, our results will lead to predictions regarding the effectiveness of the threat of exit by a large shareholder. For example, mature, cash-rich firms prone to "free cash flow" agency problems, whose managers might be inclined to initiate value-reducing mergers, are probably those likely to be affected by a "bad action" type of agency problem. In addition, in such situations it is more likely that the information structure is one where the action is publicly observable but the large shareholder has private information about the consequences of the action. In this case, our model predicts that the threat of exit can be very effective in disciplining the manager. In contrast, in a situation in which the shareholder would want to motivate the manager to take a value-enhancing but privately costly action (such as a risky investment that might fail and lead to job loss for the manager), the presence of a large shareholder with private information about the consequences of the action does not alleviate the agency costs. This implies, for example, that the interaction effects discussed above would be smaller for firms more likely to fall in the second category than in the first.³⁰

8. Summary and Conclusion

This paper has identified a simple mechanism, namely the ability to exit on the basis of private information, by which large shareholders may be able to impact managerial decisions. This mechanism is based on the interaction between managers who care about their firm's stock prices and the trading decisions of a large shareholder who is able to affect the price through the exit decision. In our model, the large shareholder does not engage in costly monitoring or "shareholder activism" in the usual sense, but simply trades optimally on the basis of her information. However, the threat of exit as a form of activism does not necessarily rule out other forms of activism; indeed, it may enhance their effectiveness.

Our model assumed that there are potentially two sources of uncertainty for investors in the short run: (i) whether the manager has taken a particular action, and (ii) the long-run consequences of the action (if taken) on the future value of the firm. For the trading of the large shareholder to have any impact on managerial decisions, it is necessary that the large shareholder has information

³⁰ Brenner (2007) identifies settings, based on legal systems in different countries, in which different types of agency problems are likely to be relatively more severe.

in the short run about whether the action is taken; otherwise the manager will receive the same compensation whether he takes the action or not. It is also necessary that the large shareholder is better informed than other investors, so that her trading decision has a price impact (and thus an impact on managerial compensation) that would not obtain otherwise. Our analysis shows that the threat of exit is credible and that for the threat of exit to be effective, it is not necessary that exit actually occurs frequently.

We have found that the effectiveness of the “Wall Street Walk” in disciplining management depends on the type of the agency problem creating a conflict between management and shareholders. The two types of agency problems we analyze (one that we termed B, where the manager might take a value-reducing action that produces private benefits, and one that we termed G, where the manager might take a value-enhancing action that entails a private costs) produce quite different results. Some of these results are summarized in the table below.³¹

Model B

- (i) Threat of exit by the large shareholder generally has a disciplining impact. The presence of the large shareholder never makes the agency problem worse.
- (ii) Having private information about the consequences of the action, in addition to having private information about whether the action was taken or not, does not necessarily make the large shareholder more effective and can make her less effective.
- (iii) If all investors observe whether the action was taken, then the large shareholder always reduces the agency costs by trading on private information regarding the consequences of the action.
- (iv) If the large shareholder observes whether the action is taken and its potential consequences, then the agency cost can be further reduced if other investors also observe whether the action is taken.

Model G

- (i) The presence of the large shareholder and the threat of exit can actually make the agency problem worse.
- (ii) Having private information about the consequences of the action never makes the large shareholder more effective and can make her completely ineffective in disciplining the manager.
- (iii) If all investors observe whether the action was taken, then a large shareholder who can trade on private information regarding the consequences of the action always increases the agency costs.
- (iv) If the large shareholder observes whether the action is taken and its potential consequences, then the agency costs would increase if other investors also observe whether the action is taken.

When the agency problem is one of discouraging a “bad” action (model B), the lowest agency costs among the models we considered occurs when investors observe publicly whether the action is taken and the large shareholder has private information about the consequences of the action. This would correspond empirically to such actions as value-reducing mergers or to other situations involving the abuse of “free cash flows.” As discussed in the introduction, there is empirical support to the notion that large shareholders reduce the agency costs in these situations. In contrast, when the problem is one of motivating a “good” action (model G), the table above shows that having private information about the consequences of the action in no case makes the large shareholder more effective and in fact can lead to the large shareholder becoming dysfunctional.

³¹ The discussion that follows assumes that for investors other than the large shareholder there is a residual uncertainty about the consequences of an action (i.e., we do not consider models $B_8^{a,\delta}$ and $G_8^{a,\delta}$).

Our results generally support the notion that liquidity need not interfere with, and in fact may enhance, corporate governance. Much of what is known about the interaction between large shareholders and managers is consistent with our model and results. In particular, our model is consistent with the “targeting” of firms and with behind-the-scene negotiations with managers, often referred to as “jawboning.” These activities have been shown to be successful in affecting managerial decisions, and the implicit or explicit threat of exit may be part of the explanation for why minority shareholders are able to have this impact.

Appendix

Proof of Proposition 1. Let $A(x) = \int_x^{\bar{\delta}} \delta dF(\delta)$, $B(x) = \int_0^x \delta dF(\delta)$, and $C(x) = \int_x^{\bar{\delta}} dF(\delta)$. Consider first model B. If $x_B < \bar{\delta}$ is an equilibrium cutoff, then $\beta - (1 - \theta)\omega_1 (E_s^B(x_B) - E_{ns}^B(x_B)) - \omega_2 x_B = 0$, where

$$E_s^B(x) = \frac{B(x)}{\theta + (1 - \theta)(1 - C(x))}, \quad E_{ns}^B(x) = 0. \quad (A1)$$

The equilibrium will be unique if $E_s^B(x) - E_{ns}^B(x)$ is nondecreasing in x . We have

$$E_s^B(x) - E_{ns}^B(x) = \frac{B(x)}{1 - C(x)} \left(\frac{1 - C(x)}{1 - (1 - \theta)C(x)} \right). \quad (A2)$$

The first part of the product on the right-hand side of Equation (A2), namely $B(x)/(1 - C(x))$, is equal to $E(\bar{\delta} \mid \delta \leq x)$, which is nondecreasing in x . The second part is nondecreasing in x since $C'(x) \leq 0$ and $0 < \theta < 1$. It is easy to see that $x_B < \beta/\omega_2$, which means that the equilibrium must be disciplining.

Now consider model G^a. If $x_G < \bar{\delta}$ is an equilibrium cutoff, then

$$-\beta + (1 - \theta)\omega_1 (E_{ns}^G(x_G) - E_s^G(x_G)) + \omega_2 x_G = 0, \quad (A3)$$

where

$$E_s^G(x) = \frac{\theta A(x)}{\theta + (1 - \theta)(1 - C(x))}, \quad E_{ns}^G(x) = \frac{A(x)}{C(x)}. \quad (A4)$$

In this case, the equilibrium will be unique if $E_{ns}^G(x) - E_s^G(x)$ is nondecreasing in x . We have

$$E_{ns}^G(x) - E_s^G(x) = \frac{A(x)}{C(x)} \left(\frac{1 - C(x)}{1 - (1 - \theta)C(x)} \right). \quad (A5)$$

The first part of the product on the right-hand side of Equation (A5), namely $A(x)/C(x)$, is equal to $E(\bar{\delta} \mid \bar{\delta} \geq x)$, which is nondecreasing in x . The second part is the same as the second part in Equation (A2) and is nondecreasing in x . To show that $x_G < x_B$ whenever $x_B < \bar{\delta}$, it is sufficient to show that for all x in the support of $\bar{\delta}$, $E_{ns}^G(x) - E_s^G(x) > E_s^B(x_B) - E_{ns}^B(x_B)$, or

$$\frac{A(x)}{C(x)} \left(\frac{1 - C(x)}{1 - (1 - \theta)C(x)} \right) > \frac{B(x)}{1 - C(x)} \left(\frac{1 - C(x)}{1 - (1 - \theta)C(x)} \right). \quad (A6)$$

This follows immediately since $A(x)/C(x) = E(\bar{\delta} \mid \bar{\delta} \geq x)$, which is clearly greater than $B(x)/(1 - C(x)) = E(\bar{\delta} \mid \bar{\delta} \leq x)$.

Proof of Proposition 2. Let $g(x) = \beta - (1 - \theta)\omega_1(E_s(x) - E_{ns}(x)) - \omega_2x$, where $E_s(x)$ and $E_{ns}(x)$ are defined by Equations (11) and (12). Since we assume that $\tilde{\delta}$ is continuously distributed, it follows that $E_s(x)$ and $E_{ns}(x)$ are continuous functions of x . Moreover, for all $x > 0$, $E_s(x) - E_{ns}(x) > 0$. Since $g(0) > 0$ and $g(\beta/\omega_2) < 0$, there must be at least one $x_B \in (0, \beta/\omega_2)$ such that $g(x_B) = 0$, and this is an equilibrium cutoff for model $B^{a,\delta}$. For any given value of x , $E_s(x)$ solves

$$\theta \int_0^x \delta dF(\delta) - \theta E_s(x) + (1 - \theta) \int_{E_s(x)}^x (\delta - E_s(x)) dF(\delta) = 0. \quad (A7)$$

As $\theta \rightarrow 0$, it is clear that $E_s(x) \rightarrow x$. Since L sells on the interval $[E_s(x), x]$, the probability of L selling vanishes as $\theta \rightarrow 0$.

Proof of Proposition 3. Let $x^* = \beta/w_2 < \tilde{\delta}$, $x_1(\theta)$ be the highest-type manager that takes the action in model B^a for a given θ , and $x_2(\theta)$ be the same for model $B^{a,\delta}$. We want to show that for θ sufficiently close to 1, the gain produced by L in model B^a is greater than that produced in model $B^{a,\delta}$. The gain is related to the size of the interval of $\tilde{\delta}$ realizations that refrain from taking the action due to L 's presence. For model B^a this is

$$x^* - x_1(\theta) = \frac{\beta}{w_2} - \frac{\beta - (1 - \theta)w_1 Q(x_1(\theta), \theta)}{w_2} = \frac{(1 - \theta)w_1 Q(x_1(\theta), \theta)}{w_2}, \quad (A8)$$

where

$$Q(x_1(\theta), \theta) = \frac{\int_0^{x_1(\theta)} \delta dF(\delta)}{\theta + (1 - \theta) \int_0^{x_1(\theta)} dF(\delta)}. \quad (A9)$$

Note that

$$\lim_{\theta \rightarrow 1} Q(x_1(\theta), \theta) = \int_0^{x^*} \delta dF(\delta). \quad (A10)$$

For model $B^{a,\delta}$ this is

$$x^* - x_2(\theta) = \frac{\beta}{w_2} - \frac{\beta - (1 - \theta)w_1 R(x_2(\theta), \theta)}{w_2} = \frac{(1 - \theta)w_1 R(x_2(\theta), \theta)}{w_2}, \quad (A11)$$

where

$$R(x_2(\theta), \theta) = \frac{\theta \int_0^{x_2(\theta)} \delta dF(\delta) + (1 - \theta) \int_{y(\theta)}^{x_2(\theta)} \delta dF(\delta)}{\theta + (1 - \theta) \int_{y(\theta)}^{x_2(\theta)} dF(\delta)} - \frac{\int_0^{y(\theta)} \delta dF(\delta)}{1 - \int_{y(\theta)}^{x_2(\theta)} dF(\delta)}, \quad (A12)$$

and where $y(\theta)$ solves

$$y(\theta) = \frac{\theta \int_0^{x_2(\theta)} \delta dF(\delta) + (1 - \theta) \int_{y(\theta)}^{x_2(\theta)} \delta dF(\delta)}{\theta + (1 - \theta) \int_{y(\theta)}^{x_2(\theta)} dF(\delta)}. \quad (A13)$$

Note that

$$\lim_{\theta \rightarrow 1} R(x_2(\theta), \theta) = \int_0^{x^*} \delta dF(\delta) - \frac{\int_0^{y^*} \delta dF(\delta)}{1 - \int_{y^*}^{x^*} dF(\delta)}, \quad (A14)$$

where $y^* = \int_0^{x^*} \delta dF(\delta)$. We now take the limit of $(x^* - x_1(\theta))/(x^* - x_2(\theta))$ as $\theta \rightarrow 1$. This is

$$\lim_{\theta \rightarrow 1} \frac{x^* - x_1(\theta)}{x^* - x_2(\theta)} = \lim_{\theta \rightarrow 1} \frac{Q(x_1(\theta), \theta)}{R(x_2(\theta), \theta)} = \frac{\int_0^{x^*} \delta dF(\delta)}{\int_0^{x^*} \delta dF(\delta) - \frac{\int_0^{y^*} \delta dF(\delta)}{1 - \int_0^{y^*} dF(\delta)}}, \quad (\text{A15})$$

which is strictly greater than 1 since $y^* > 0$. This means that for θ sufficiently close to 1, the cutoff below which the action is taken in model B^a is strictly smaller than that in model $B^{a,\delta}$.

Proof of Proposition 4. Define

$$E_s(x) = \frac{\theta \int_x^{\bar{\delta}} \delta dF(\delta)}{\theta + (1 - \theta) \int_x^{\bar{\delta}} dF(\delta)}. \quad (\text{A16})$$

Let x_G be the cutoff in model G^a and let z be the cutoff when there is no discipline, i.e., $z = \beta/\omega_2$. Finally, define x° to be the solution to $E_s(x) = x$. It is easy to show that such a solution always exists and is unique since for all $\theta > 0$, $E_s(0) = E(\bar{\delta}) > 0$ and $E_s(x)$ is continuous and strictly decreasing in x . Consider the following three cases:

- (1) $x_G \leq E_s(x_G)$,
- (2) $x_G > E_s(x_G)$ and $x^\circ < z$, and
- (3) $x_G > E_s(x_G)$ and $x^\circ \geq z$.

Note that these cases are mutually exclusive and exhaustive. If Case 1 holds, then the equilibrium of model G^a is an equilibrium of model $G^{a,\delta}$. If Case 2 holds, it is an equilibrium for M to take the action if and only if $\delta > x^\circ$ and (absent a liquidity shock) for L to sell either if $\delta < x^\circ$ or the action is not taken and otherwise holds. Finally, if Case 3 holds, there is a nondisciplining equilibrium, where M takes the action only if $\delta > z$ and L (absent a liquidity shock) sells if $\delta < y$ or the action is not taken, where y solves:

$$y = \frac{\theta \int_z^{\bar{\delta}} \delta dF(\delta) + (1 - \theta) \int_z^y \delta dF(\delta)}{\theta + (1 - \theta) \int_0^y dF(\delta)}. \quad (\text{A17})$$

Now we must show that the equilibrium is unique. The only possibility for more than one equilibrium to exist is for there to exist a disciplining equilibrium (with a cutoff $x < z$) and a nondisciplining equilibrium with a cutoff equal to z . Let θ_m be the minimum value of θ that is consistent with a nondisciplining equilibrium. At this value $y = z$ and we have

$$z = \frac{\theta_m \int_z^{\bar{\delta}} \delta dF(\delta)}{\theta_m + (1 - \theta_m) \int_0^z dF(\delta)}. \quad (\text{A18})$$

This means that for a nondisciplining equilibrium to exist, θ must be such that

$$\theta \geq \theta_m = \frac{z \int_0^z dF(\delta)}{\int_z^{\bar{\delta}} \delta dF(\delta) + z \int_0^z dF(\delta) - z}. \quad (\text{A19})$$

Now, since $z > x$, it follows that

$$\frac{\theta \int_z^{\bar{\delta}} \delta dF(\delta)}{\theta + (1 - \theta) \int_0^z dF(\delta)} < \frac{\theta \int_x^{\bar{\delta}} \delta dF(\delta)}{\theta + (1 - \theta) \int_0^x dF(\delta)} = E_s(x) \leq x < z. \quad (\text{A20})$$

This implies that

$$\theta < \frac{z \int_0^z dF(\delta)}{\int_z^{\bar{\delta}} \delta dF(\delta) + z \int_0^z dF(\delta) - z} = \theta_m, \quad (\text{A21})$$

which contradicts Equation (A19), which is necessary for the existence of a nondisciplining equilibrium. Thus we cannot have both types of equilibria.

Proof of Proposition 5. Let

$$\begin{aligned} Q^a(x) &= \frac{\theta \int_0^x \delta dF(\delta) + (1 - \theta) \int_{Q^a(x)}^x \delta dF(\delta)}{\theta \int_0^x dF(\delta) + (1 - \theta) \int_{Q^a(x)}^x dF(\delta)}; \\ Q^b(x) &= \frac{\int_0^x \delta dF(\delta)}{\theta + (1 - \theta) \int_0^x dF(\delta)}; \text{ and} \\ Q^c(x) &= \frac{\theta \int_0^x \delta dF(\delta) + (1 - \theta) \int_{Q^c(x)}^x \delta dF(\delta)}{\theta + (1 - \theta) \int_{Q^c(x)}^x dF(\delta)}. \end{aligned} \quad (\text{A22})$$

To show that model $B_a^{a,\delta}$ produces the highest *ex ante* value for the firm, it is sufficient to show that for all x in the support of the distribution of δ , $Q^a(x)$ is at least as large as $Q^b(x)$ and $Q^c(x)$. To see why this is sufficient, first note that any equilibrium cutoff x for model $B_a^{a,\delta}$ must solve

$$\beta - w_2 x = w_1 Q^a(x), \quad (\text{A23})$$

while equilibrium cutoffs for model B^a and model $B^{a,\delta}$ solve respectively

$$\beta - w_2 x = (1 - \theta) w_1 Q^b(x), \quad (\text{A24})$$

and

$$\beta - w_2 x = (1 - \theta)(w_1 Q^c(x) - E_{ns}(x)). \quad (\text{A25})$$

If $Q^a(x)$ is at least as large as $Q^b(x)$ and $Q^c(x)$, then there is an equilibrium cutoff solving Equation (A23) that is no greater than any solving Equations (A24) and (A25). Moreover, if $Q^a(x)$ is strictly larger than $Q^b(x)$ and $Q^c(x)$ (which will generally be the case), then there is an equilibrium cutoff solving Equation (A23) that is strictly less than any solving Equations (A24) and (A25).

We will first show that $Q^a(x) \geq Q^b(x)$ for all x . Define $\Pi_a^b = \int_a^b dF(\delta)$ and $\Delta_a^b = \int_a^b \delta dF(\delta)$, and let Q^a be shorthand for $Q^a(x)$. It is straightforward to show that the sign of $Q^a(x) - Q^b(x)$ is the same as the sign of

$$\theta^2 (1 - \Pi_0^x) \Delta_0^x + \theta(1 - \theta) (\Delta_{Q^a}^x - \Pi_{Q^a}^x \Delta_0^x) - (1 - \theta)^2 (\Pi_0^x \Delta_{Q^a}^x - \Pi_{Q^a}^x \Delta_0^x). \quad (\text{A26})$$

The first term in Equation (A26) is clearly nonnegative. Consider now the last term. Observe that

$$\begin{aligned} \Pi_0^x \Delta_{Q^a}^x - \Pi_{Q^a}^x \Delta_0^x &= \left(\Pi_{Q^a}^x \Delta_{Q^a}^x + \Pi_0^{Q^a} \Delta_{Q^a}^x \right) - \left(\Pi_{Q^a}^x \Delta_{Q^a}^x + \Pi_{Q^a}^x \Delta_0^{Q^a} \right) \\ &= \Pi_0^{Q^a} \Delta_{Q^a}^x - \Pi_{Q^a}^x \Delta_0^{Q^a}. \end{aligned} \quad (\text{A27})$$

Now, since $x \geq Q^a \geq 0$, we have

$$\begin{aligned} \Pi_0^{Q^a} \Delta_{Q^a}^x &\geq Q^a \Pi_0^{Q^a} \Pi_{Q^a}^x \\ \Pi_{Q^a}^x \Delta_0^{Q^a} &\leq Q^a \Pi_0^{Q^a} \Pi_{Q^a}^x. \end{aligned} \quad (\text{A28})$$

This means that the last expression in Equation (A26) is nonnegative (and strictly positive if $x > Q^a > 0$). It is easy to see that the nonnegativity of the last expression in Equation (A26) implies that the second expression in Equation (A26) is also nonnegative. This is because $\Delta_{Q^a}^x \geq \Pi_0^x \Delta_{Q^a}^x$. Now consider $Q^c(x)$. First note that if $\theta = \theta \int_0^x dF(\delta)$, $Q^a(x) = Q^c(x)$. We need only consider the cases where $\theta > \theta \int_0^x dF(\delta)$, i.e., $\theta > 0$ and $\int_0^x dF(\delta) < 1$. From the definition of $Q^c(x)$, we know that $Q^c(x)$ is equal to y such that y solves

$$y - \frac{\theta \int_0^x \delta dF(\delta) + (1 - \theta) \int_y^x \delta dF(\delta)}{\theta + (1 - \theta) \int_y^x dF(\delta)} = 0. \tag{A29}$$

Using the definition of $Q^a(x)$, one can easily see that

$$Q^a(x) - \frac{\theta \int_0^x \delta dF(\delta) + (1 - \theta) \int_{Q^a(x)}^x \delta dF(\delta)}{\theta + (1 - \theta) \int_{Q^a(x)}^x dF(\delta)} > 0, \tag{A30}$$

when $\theta > \theta \int_0^x dF(\delta)$. To show that $Q^a(x) \geq Q^c(x)$, it is sufficient to show that there is a unique solution to Equation (A29) and that the left-hand side of Equation (A29) is increasing in y at the solution. Let $S(y)$ be the left-hand side of Equation (A29). It is straightforward to show that

$$S'(y) = 1 + \frac{(1 - \theta)f(y)}{\theta + (1 - \theta) \int_y^x dF(\delta)} S(y). \tag{A31}$$

One can see from Equation (A31) that $S(y)$ is increasing at all values of y that solve Equation (A29). Since $S(y)$ is continuous, this means that there is a unique y that solves Equation (A29). From this and Equation (A30), it follows that $Q^a(x) \geq Q^c(x)$.

Proof of Proposition 6. First we prove that an equilibrium exists and is unique. To do this, we first show that for all x in the support of the distribution of $\bar{\delta}$, there is a unique $E_s(x)$ that solves the defining equation given by Equation (19) in Section 4, and that $E_s(x)$ is increasing in x . From Equation (19), we see that $E_s(x)$ is any value of y that solves

$$y = \frac{\theta \int_x^{\bar{\delta}} \delta dF(\delta) + (1 - \theta) \int_x^y \delta dF(\delta)}{\int_x^{\bar{\delta}} dF(\delta) + \int_x^y dF(\delta)} \tag{A32}$$

or, equivalently, that solves

$$S(y) = \theta \int_x^{\bar{\delta}} (y - \delta) dF(\delta) + (1 - \theta) \int_x^y (y - \delta) dF(\delta) = 0. \tag{A33}$$

It is easy to see that $S(x) < 0$, $S(\bar{\delta}) > 0$, and $S'(y) > 0$ for all $y \in (x, \bar{\delta})$. This means that there is a unique $y > x$ that solves Equation (A33).³² Using the fact that Equation (A33) implicitly defines y as a function of x , it is easy to show that

$$y'(x) = \frac{(y(x) - x)f(x)}{\theta \int_x^{\bar{\delta}} dF(\delta) + (1 - \theta) \int_x^y dF(\delta)} > 0. \tag{A34}$$

Thus $E_s(x)$ is an increasing function of x . Now, for an interior equilibrium in model $G_\delta^{a,\delta}$ (i.e., one for which $0 < x_G < \bar{\delta}$), we must have $-\beta + \omega_1 E_s(x_G) + \omega_2 x_G = 0$. Since we have shown that

³² Note that we are assuming that $\theta > 0$. In the limit case where $\theta = 0$, we have $y = x$ as a solution to Equation (A33).

$E_s(x)$ is monotone increasing in x , it follows that if there is an interior equilibrium, it is unique. (Otherwise, the equilibrium is not interior and either $x_G = 0$ if $-\beta + \omega_1 E_s(0) > 0$ or $x_G = \bar{\delta}$ if $-\beta + \omega_1 E_s(\bar{\delta}) + \omega_2 \bar{\delta} < 0$.)

Define $E_a(x) = E(\bar{\delta} \mid \bar{\delta} \geq x)$. As discussed in Section 4, when L is not present, the equilibrium cutoff x is determined by $-\beta + \omega_1 E_a(x) + \omega_2 x = 0$, while if L is present, the equilibrium cutoff point is determined by $-\beta + \omega_1 E_s(x) + \omega_2 x = 0$. To show that there is less discipline when L is present, it is sufficient to show that $E_a(x) > E_s(x)$ for all $x < \bar{\delta}$. We have

$$\begin{aligned} E_a(x) - E_s(x) &= \frac{\int_x^{\bar{\delta}} \delta dF(\delta)}{\int_x^{\bar{\delta}} dF(\delta)} - \frac{\theta \int_x^{\bar{\delta}} \delta dF(\delta) + (1 - \theta) \int_x^{E_s(x)} \delta dF(\delta)}{\int_x^{\bar{\delta}} dF(\delta) + \int_x^{E_s(x)} dF(\delta)} \\ &= \frac{(1 - \theta) \int_x^{E_s(x)} dF(\delta)}{\int_x^{\bar{\delta}} dF(\delta) + \int_x^{E_s(x)} dF(\delta)} \left(\frac{\int_x^{\bar{\delta}} \delta dF(\delta)}{\int_x^{\bar{\delta}} dF(\delta)} - \frac{\int_x^{E_s(x)} \delta dF(\delta)}{\int_x^{E_s(x)} dF(\delta)} \right) > 0. \end{aligned} \quad (\text{A35})$$

The inequality in Equation (A35) follows since $E_s(x) < \bar{\delta}$ if $x < \bar{\delta}$ and

$$\left(\frac{\int_x^{\bar{\delta}} \delta dF(\delta)}{\int_x^{\bar{\delta}} dF(\delta)} - \frac{\int_x^{E_s(x)} \delta dF(\delta)}{\int_x^{E_s(x)} dF(\delta)} \right) = E(\bar{\delta} \mid x \leq \bar{\delta}) - E(\bar{\delta} \mid x \leq \bar{\delta} \leq E_s(x)) > 0. \quad (\text{A36})$$

Proof of Proposition 7. Consider first model $B_\delta^{a,\delta}$. It is clear that in any equilibrium, L exits whenever M takes the action and retains them whenever M does not take the action (unless subjected to a liquidity shock). Let $m_B(\delta)$ be the probability that M takes the action in model $B_\delta^{a,\delta}$ when the realization of $\bar{\delta}$ is δ . This means that

$$E_s(\delta) = \frac{m_B(\delta)\delta}{\theta + (1 - \theta)m_B(\delta)}; \quad E_{ns}(\delta) = 0. \quad (\text{A37})$$

M is indifferent between taking the action and not taking it if and only if

$$\beta - \omega_1 E_s(\delta) - \omega_2 \delta = -\omega_1(\theta E_s(\delta) + (1 - \theta)E_{ns}(\delta)) \quad (\text{A38})$$

or

$$\beta - (1 - \theta)\omega_1 \left(\frac{m_B(\delta)\delta}{\theta + (1 - \theta)m_B(\delta)} \right) - \omega_2 \delta = 0. \quad (\text{A39})$$

Now consider model $G^{a,\delta}$, and let $m_G(\delta)$ be the probability that M takes the action for a given δ . In this case, in any equilibrium, L will retain her shares when M takes the action (unless she is subject to a liquidity shock) and sell if M does not take the action. This means that when $\bar{\delta} = \delta$, we have

$$E_s(\delta) = \frac{\theta m_G(\delta)\delta}{\theta + (1 - \theta)(1 - m_G(\delta))}, \quad E_{ns}(\delta) = \delta. \quad (\text{A40})$$

It follows that in model $G_\delta^{a,\delta}$, M is indifferent between taking the action and not taking it if and only if

$$-\beta + \omega_1(\theta E_s(\delta) + (1 - \theta)E_{ns}(\delta)) + \omega_2 \delta = \omega_1 E_s(\delta) \quad (\text{A41})$$

or

$$-\beta + (1 - \theta)\omega_1 \left(\frac{(1 - m_G(\delta))\delta}{\theta + (1 - \theta)(1 - m_G(\delta))} \right) + \omega_2\delta = 0. \quad (\text{A42})$$

Note that Equation (A39) defines the function $m_B(\delta)$ over the range of δ for which $m_B(\delta) \in (0, 1)$ and Equation (A42) does the same for $m_G(\delta)$.

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