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Ownership Structure, Speculation, and Shareholder Intervention

CHARLES KAHN and ANDREW WINTON*

ABSTRACT

An institution holding shares in a firm can use information about the firm both for trading ("speculation") and for deciding whether to intervene to improve firm performance. Intervention increases the value of the institution's existing shareholdings, but intervention only increases the institution's trading profits if it enhances the precision of the institution's information relative to that of uninformed traders. Thus, the ability to speculate can increase or decrease institutional intervention. We examine key factors that affect the intervention decision, the usefulness of "short-swing" provisions and restricted shares in encouraging institutional intervention, and implications for ownership structure across different firms.

INSTITUTIONAL INVESTORS HOLD an ever-greater fraction of Corporate America's equity. Traditionally, these institutions were "stock pickers" who tried to beat the market through trading; if a firm whose stock they held seemed headed for trouble, these investors headed for the door ("the Wall Street rule"). More recently, some of these institutions have been using the ownership rights attached to their shares to pressure firms to act in the shareholders' interest. Some have even argued that there is a synergy between gathering information for use in trading shares ("speculation") and intelligently pressuring firms to improve performance ("intervention"). We argue that these motives can also conflict. Analyzing these motives allows us to predict which firms are most likely to attract institutional intervention, which in turn has cross-sectional implications for firm ownership structure.

Recent examples suggest that institutional investors with large stakes sometimes intervene and sometimes follow the Wall Street rule, so that there is indeed a choice to be studied. In the early 1990s, there was a wave of activism by a variety of large institutional investors, among them CalPERS, the California public employees pension fund, Putnam Management, a mutual fund manager, and J.P. Morgan, a bank holding company.[1] These institu-

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[1] See "Shareholders call the plays," *Economist*, April 24, 1993.

tions lobbied for the removal of CEOs at several large, poorly performing firms, including Kodak, IBM, Westinghouse, Borden, American Express, and GM. In the mid 1990s, Fidelity Investment's Magellan mutual fund began to accumulate large positions in a number of high-technology stocks, many of them smaller firms: by the end of March 1995, 49 percent of Magellan's holdings were stakes of 5 percent or more in the target firms' shares. It would seem that Fidelity was well-placed to exert influence in these firms if matters started to deteriorate. Yet in late 1995, Magellan reduced its technology holdings from 45 percent to 8.5 percent just in advance of a downturn in those stocks.[2]

More generally, suppose that an institution learns that a firm whose shares it holds is doing poorly and might benefit from a change in direction. If the institution's position (possibly in coalition with other institutions) is large enough, it might be able to effect such a change, albeit at some cost in time and effort. Knowing that the market price doesn't yet reflect this information, the institution could buy additional shares, profiting from the impact its subsequent intervention will have on the additional shares it has bought as well as on its existing holdings. On the other hand, the institution could sell its stake (and perhaps go short shares), saving the cost of intervention and profiting from advance knowledge that the firm will do badly. Thus, the ability to speculate may lead to "cut-and-run" behavior—the Wall Street rule—and this possibility continues to concern many commentators, such as Bhide (1993) and Roe (1994).

The institution's decision will of course depend on its payoffs: it will intervene if that is more profitable than pure speculation. In part, the institution must examine the expected impact of intervention on its existing stake in the firm, less the costs of such intervention. Since an increase in the institution's existing stake in the firm increases its share of any improvement in firm performance, this "direct impact" of intervention should also increase with the institution's stake.

However, the institution must also consider how intervention affects its profits from trading on private information. By increasing the odds that the firm will do well, intervention increases the probability that the institution buys ahead of good outcomes and decreases the probability that it sells ahead of bad ones. Whether expected trading profits increase or decrease depends on whether intervention increases or decreases the value of the institution's information relative to that of uninformed traders. For example, if the market believes that the firm is likely to do badly, intervening pushes the firm's return in the unexpected direction, which tends to increase the institution's trading profits. But if the market believes the firm is likely to do well, intervention only reaffirms these beliefs, while not intervening and letting the firm do badly leads to the less expected outcome. In this case, intervention

[2] See Floyd Norris (May 21, 1995), and David J. Morrow (February 10, 1996). In at least one case (Micron Technology), there were accusations that Jeffrey Vinik, Magellan's fund manager, had given positive interviews about the firm's prospects that were published while he was selling off his position—see Robert McGough (December 15, 1995).

tends to decrease trading profits, and an institution whose stake in the firm seems more than large enough to influence management may instead choose to sell out if it gets advance notice of a problem.

Thus, if we are to predict which firms an institution is most likely to intervene in, we must look at not only the size of the institution's stake, but also firm-specific factors that influence the magnitude and sign of intervention's impact on the institution's trading profits (henceforth, "trading impact"). For example, although the institution's stake may give it better access to management and a better sense of the firm's overall direction, it is unlikely to be the only investor ("speculator") looking to gather information about the firm and trade on it. Because other speculators will acquire information as long as they expect to at least break even, their marginal cost of gathering information limits the size of the institution's trading profits. In firms where information is difficult to gather—smaller, younger, or other less well-known firms—the effective barrier to entry is high, and trading profits may loom large in the institution's decision. By contrast, for large, well-established "blue-chip" firms, public coverage may make the cost of information low, reducing the importance of trading profits in the institution's decision.

Similarly, "intervention" can vary both in its expected impact on the firm and in the speed with which its success or failure becomes apparent. For example, spinning off a money-losing, unrelated division to an acquirer with the right managerial expertise is quite likely to improve matters, in contrast to replacing a somewhat below-average CEO. Thus, the spin-off will have a greater effect on the value of the institution's existing stake (a higher "direct impact"), and it will have a greater impact on the institution's trading profits—for good or ill. The results of a policy change may take more time to resolve in a young, rapidly evolving industry than in a mature, stable one; if so, intervention's effect on trading profits will be more negative in the younger industry, because the institution exchanges relatively precise information (the firm *is* doing badly) for less precise information (the firm *may* do well).

These results are broadly consistent with the two examples given at the start of this paper. In the cases of shareholder activism in the early 1990s, the targets were large, well-established firms that had performed badly for years, with relatively clear inefficiencies and mistakes. Thus, the trading impact of intervention would probably be positive, and might in any case be of secondary importance for such well-followed firms. By contrast, in 1995, the Magellan Fund's stakes were concentrated in younger, high-tech firms at a time when (partly because of Magellan's positions) technology stocks reached record highs. With high market expectations and a young industry where the impact of outside intervention might be less clear, the trading impact of intervention was likely to be negative and relatively large in size.[3]

[3] More support for this view comes from a 1993 interview with Robert Pozen, Fidelity's general counsel: "The times when we become most activist are when we are drawn into it, either because people propose things that we think are not in the interests of shareholders, *or because companies have such a low level of management that we almost feel we have gone beyond the pale with our investment.*" [Emphasis added.] (Myron Magnet, March 8, 1993, p. 60)

Our model also has implications for ownership structure. Diversification, liquidity, or regulatory concerns may impose costs on large institutional holdings. Thus, the greatest gains from a large institutional position should be found in firms where the threshold for intervention is lowest: for example, those where the odds of success without outside intervention are viewed as low and the gains to potential monitoring or intervention are most clear-cut, such as firms in mature industries with generally well-understood operations. These results are particularly relevant for an initial owner who wishes to maximize proceeds from selling off its ownership stake: for an example, an entrepreneur or venture capitalist seeking to cash out its stake, or a government seeking to privatize a state-owned firm.

Furthermore, firms may wish to privately place *restricted* shares with institutions: because such shares are harder to sell, cut-and-run behavior is reduced, and intervention becomes more attractive. Our analysis suggests that the incentives to do this will be highest in those firms for which trading profits loom largest—i.e., those where other speculators face high costs of gathering information. By contrast, "short-swing" rules requiring that large shareholders forfeit short-run trading profits are less likely to be useful in enhancing intervention: such rules make any trading less attractive, whether it is linked to cut-and-run behavior or to buying more shares so as to take advantage of intervention.

Several earlier papers have focused on the positive externality that a large shareholder's monitoring creates. Shleifer and Vishny (1986) show how an active and anonymous stock market may make it difficult to assemble a large position because of holdout problems, and Huddart (1993) and Admati, Pfleiderer, and Zechner (1994) show how such a market may induce an already large shareholder to sell rather than incur the cost of monitoring. Stoughton and Zechner (1996) show how the holdout problem can be partially overcome at the time of an IPO by underpricing shares and allocating a large block to a large shareholder. In these papers, liquidity traders and other informed traders are absent, and the only private information that the large shareholder has is its decision on whether to monitor.[4]

Most closely related to our work is that of Maug (1998), who also analyzes an institutional investor's intervention decision when the institution's private knowledge of its decision may allow it to earn trading profits at the expense of liquidity traders. Although the two papers begin with the same problem, the modeling assumptions are somewhat different, reflecting a difference in focus.

Maug's primary goal is to see how increased liquidity trading affects an institution's incentives to intervene when the institution acquires its initial

[4] Other recent work on ownership structure includes Bolton and von Thadden (1998) and Pagano and Röell (1996) who examine the relative pros and cons of concentrated versus dispersed ownership shares, and Burkart, Gromb, and Panunzi (1997), who examine the possible *disincentives* that concentrated ownership can have for managerial performance. Other related work includes the extensive literature on the pros and cons of insider trading, such as Ausubel (1990), Leland (1992), Fishman and Hagerty (1992), and Bernhardt, Hollifield, and Hughson (1995).

stake on the open market. He shows that increased liquidity trading may actually increase the institution's desire to acquire a large initial stake and intervene. Intuitively, with no liquidity trading, the holdout problem of Grossman and Hart (1980) applies: small shareholders' reservation price reflects any benefits of intervention, so the institution cannot recoup its costs of intervention. Fear of trading at a loss to meet future liquidity needs reduces small shareholders' reservation price, making it more attractive for the institution to acquire shares.

By contrast, we focus on how differing firm characteristics affect the institution's intervention decision, and the implications that this has for firm ownership structure. This complementary focus leads us to adopt a somewhat richer structure than Maug. For example, we incorporate additional large traders, and find that trading effects are of little concern for firms where costs of gathering information are relatively low and competition among informed traders is high. We also make firm outcomes partly independent of intervention, and find that firms that are generally thought to be doing well are less likely to receive intervention when they do need it, because market expectations make it more profitable for the institution to cut and run rather than intervene.

Our complementary focus also leads us to a broader analysis of ownership structure choice. To illustrate his main point, Maug focuses on the case where the holdout problem is most severe—the case where the institution acquires its stake on the open market at a price that reflects the small shareholders' marginal valuation. Because private placements of shares can alleviate the holdout problem, we analyze ownership structure choice under both private placements and open market purchases. We also analyze the impact of issuing restricted shares to mitigate cut-and-run behavior.

The rest of the paper is structured as follows. After describing our model and assumptions in Section I, Section II examines the intervention and information gathering decisions of the institution and other speculators, given a preexisting ownership structure. Section III examines how ownership structure is determined, and Section IV considers the use of short-swing rules and restricted shares. Section V discusses our model's empirical implications and some supporting evidence, and Section VI concludes.

I. Basic Assumptions

Our model focuses on a firm whose stock is traded in a market with three types of participants: small investors, large institutional investors, and competitive market makers. For simplicity, all agents are risk neutral. The model takes place over times 0, 1, and 2. The firm allocates its shares (normalized to one for simplicity) among different investors at time 0, shares are traded on the open market at time 1, and the firm is liquidated at time 2.

At time 2, the firm returns either 0 or X units of the consumption good, which is then divided among shareholders on a pro rata basis. Absent outside intervention (see below), the chance of a return of X is assumed to be $q \in (0,1)$.

At time 0, a large institutional investor (henceforth "the institution") obtains ν of the firm's shares; the remaining $1 - \nu$ go to a continuum of infinitesimal small investors. For the moment, this allocation is exogenous; the choice of ownership structure is addressed in Section III.

Before time 1 trading, the institution learns whether or not the firm is "distressed."[5] If the firm is not distressed, its time 2 realization will be X. If it is distressed, then its time 2 return will be zero unless the institution "intervenes" at a positive cost m. Intervention changes the firm's return from zero to X with probability δ. Thus, if the institution is certain to intervene when the firm is distressed, the firm's ex ante chance of success increases to $q_{\max} \equiv q + \delta(1 - q)$. Intervention involves determining a beneficial change in the firm's policy and then trying to get that change carried out. In practice, getting management to make the change might involve threatening (and possibly carrying out) a takeover or proxy fight, but we abstract from these details. (An alternative would be to structure managerial compensation so as to motivate management to make these changes, but such schemes are limited by managerial risk aversion and wealth constraints. Thus, intervention can play a useful role even in the presence of compensation schemes.)[6]

It seems reasonable that other large institutional investors might attempt to gather information about the firm for use in trading at time 1. We assume a large number of such potential "speculators." By paying an amount g, speculators learn the firm's situation before time 1 trading, including whether or not the institution has intervened. For simplicity, we assume that both the institution and the speculators immediately find out whether the intervention has been successful. The assumption that informed speculators have the same information as the institution is extremely strong. Nonetheless, weakening this assumption would not change our qualitative results—as will be seen, our assumptions already give the institution a trading advantage over the speculators. The effects of weakening the assumption that informed traders immediately learn whether intervention has been successful is discussed at the end of Section II.

As noted before, the time 1 stock market has three types of participants: competitive market makers, small shareholders, and large informed investors (the institution and speculators). Small shareholders will not intervene or speculate because the fixed costs involved outweigh their (infinitesimal)

[5] In earlier versions of this paper, we assumed that the institution has to pay a cost for acquiring this information. As long as the institution can acquire information more cheaply than can other investors—perhaps by virtue of its stake in the firm—our basic results are unchanged.

[6] Although in principle one could have multiple large shareholders, we assume that there is only one (the institution) so as to simplify the analysis of intervention. Having one large shareholder intervene (or "monitor") avoids duplication of effort and free rider problems. However, multiple monitors may be useful if monitoring quality is sufficiently convex in effort (see Winton (1993)), or if the signals received by different monitors are imperfectly correlated. Also, if the effectiveness of monitoring depends on the number of shares controlled, multiple large shareholders might gain from forming coalitions.

Table I
Sequence of Events

Time 0:	• Initial ownership structure is chosen. • Speculators decide whether to gather information.
Time 1:	• Competitive stock market opens. • Institution and active speculators learn the firm's base time 2 return. • If the institution finds that the base return is bad, it decides whether to intervene. Intervention's outcome is realized and observed by informed investors. • Small investors may experience liquidity shocks. • Trading takes place.
Time 2:	• Firm return is realized and divided among shareholders.

gains from these activities. Market makers have no private information of their own. Following Admati and Pfleiderer (1989) and Easley and O'Hara (1992), we assume that market makers quote bid and ask prices P_B and P_A independent of the supply or demand for shares at time 1; i.e., these prices are independent of realized order flow. Bertrand competition among the market makers leads to zero profits in equilibrium, so that P_B equals the expected value of a share conditional on a sale, and P_A equals the expected value conditional on a buy.

At time 1, small investors may suffer "liquidity shocks" that cause them to buy or sell a number of shares equal to the amount they hold, independent of the market price. Buying could be the result of a portfolio shock that leads them to desire exposure to the firm; selling could represent a sudden need for funds. For simplicity, we assume that small investors have a chance μ of each type of shock. Thus, if small investors hold $1 - \nu$ of the firm's shares, the total expected volume Λ of liquidity buys or sells is $\mu(1 - \nu)$.

For simplicity, large investors with private information about the firm (the institution and the speculators) do not face liquidity shocks. Each large investor's trading is limited to buying or selling w shares. This limit can be thought of as a simplified version of a wealth restriction on buying on margin or selling short. Any short selling or borrowing must be repaid at time 2. (In a more complex model with risk aversion, w might also reflect diversification concerns.)

The sequence of events in the model is summarized in Table I.

II. Market Equilibrium Given an Initial Ownership Structure

A. Market Equilibrium at Time 1

We solve our model starting from the situation at time 1 and working backwards. Suppose that the institution holds ν shares. Before time 1, if the firm is distressed, it may choose to intervene. Although the institution and any informed ("active") speculators know what the institution has chosen to do and whether any intervention has been successful, the market makers only know the ex ante equilibrium probabilities that these events have oc-

curred. Accordingly, let α be the equilibrium probability that an informed institution intervenes upon finding that the firm is performing badly. Let S be the equilibrium expected number of active speculators.

It follows that the ex ante probability q' that the firm will eventually do well (whether through intervention or not) equals $q + \alpha\delta(1 - q)$; similarly, the ex ante value of the firm's cash flows is $q'X$. In the absence of informed trading, the competitive market makers would quote $q'X$ as both the bid and the ask price. However, fully informed investors know that the firm is either worth 0 or X: if the firm is worth 0, they will sell as many shares as they can at any bid price P_B above 0; if the firm is worth X, they will buy as many shares as they can at any ask price P_A below X. Because the expected probability that the firm eventually succeeds is q', and the maximum trading volume of informed traders Σ equals $(S + 1)w$, it easily follows that expected informed selling volume is $(1 - q')\cdot\Sigma$, while expected informed buying volume is $q'\cdot\Sigma$.

These considerations lead to the following results.

LEMMA 1 (Equilibrium Prices and Returns):

(i) The equilibrium bid and ask prices are

$$P_B = \frac{\Lambda\cdot q'X}{\Lambda + (1 - q')\Sigma} \quad \text{and} \quad P_A = \frac{(\Lambda + \Sigma)\cdot q'X}{\Lambda + q'\Sigma}. \tag{1}$$

(ii) Denoting the institution's possible actions as D (don't intervene at all) and I (intervene when possible), the net returns R_D and R_I to each of these actions are

$$R_D = \nu\cdot qX + w\cdot[q(X - P_A) + (1 - q)\cdot P_B] \quad \text{and}$$

$$R_I = \nu\cdot q_{\max}X + w\cdot[q_{\max}(X - P_A) + (1 - q_{\max})\cdot P_B] - \delta(1 - q)\cdot m. \tag{2}$$

(iii) The net expected return R_S to each active speculator is

$$R_S = w\cdot[q'(X - P_A) + (1 - q')\cdot P_B] - g. \tag{3}$$

Proofs of this and all subsequent results are given in the Appendix.

In each case, the institution's return consists of the value of its initial shareholding ν, plus speculative profits from using its total wealth w to trade on its private information, less any cost of intervening. These returns are only affected by the institution's intervention decision α and the expected number of speculators S through the effects of these variables on the equilibrium prices P_A and P_B and the ex ante probability q' that the firm succeeds.

Note that an increase in the expected volume of liquidity trading Λ increases the bid price and decreases the ask price; as is usual in microstruc-

ture models, increases in liquidity trading reduce adverse selection problems for market makers, narrowing the bid–ask spread. Increases in the volume of strategic (informed) trading Σ have the opposite effect on prices— adverse selection problems for market makers increase. An increase in the likelihood of intervention α increases both bid and ask prices, both by raising the ex ante value of the firm $q'X$ and by weighting informed trading more toward buying than selling (the firm is more likely to do well).

B. Large Investors' Choices of Actions Before Trading

We now consider the various large investors' equilibrium choices of actions prior to trading. The speculators must decide whether to gather information, and if the firm is distressed the institution must decide whether to intervene. Furthermore, these choices and the resulting equilibrium prices must be consistent. The following proposition shows that an equilibrium always exists and gives the conditions that determine equilibrium action choices.

PROPOSITION 2 (Equilibrium Action Choices): *Take any candidate equilibrium choices for the institution's probability of intervening α and the expected number of active speculators S. Let P_A, P_B, R_D, R_I, and R_S be as defined in Lemma 1. Then, in equilibrium, the following conditions hold:*

(i) If R_I is less than, equal to, or greater than R_D, then α equals zero, is between zero and one, or equals one, respectively.
(ii) If R_S is less than zero, no investors become speculators (S equals zero); if there are speculators (S greater than zero), R_S equals zero.

Given the institution's ownership stake ν and the other parameters of the model, an equilibrium set of action choices always exists.

Condition (i) is straightforward: if the institution is to intervene once it learns that the firm is distressed, its expected return R_I must at least weakly exceed the return to just trading on information R_D. Condition (ii) follows from free entry by speculators: if the expected equilibrium profit of a speculator R_S exceeded zero, it would pay for at least one more speculator to gather information with some probability, so either R_S is negative and there are no speculators, or R_S equals zero. Finally, existence of equilibrium follows standard fixed point arguments, as discussed in the Appendix.

We are interested in situations where the institution is not the only informed trader (i.e., S exceeds zero), as this seems to apply most broadly to publicly traded firms. Proposition A.1 of the Appendix establishes sufficient conditions that guarantee that speculators become active. Essentially, speculators must be able to recoup their costs of gathering information by trading on it. This requires a sufficiently high level of liquidity trading, so the institution's maximum stake w cannot be too large, nor the chance of liquidity shocks μ too small. Also, the cost of gathering information g cannot be too large relative to trading profits, which are directly related to the number of shares w each speculator can trade and to the variance of the firm's returns

(without uncertainty, profitable trading is impossible).[7] Proposition A.2 of the Appendix then shows that, subject to these conditions, the equilibrium is unique.

When speculators are active ($S > 0$), Proposition 2 implies that the equilibrium values of α and S are determined by the condition that R_S equals zero and by the relationship between the return to intervening, R_I, and the return to not intervening, R_D. Notice that R_I and R_D only differ when the institution learns that the firm is distressed: it can either cut and run, selling its shares, or intervene and try to improve matters. Of course, intervention isn't guaranteed success, and with probability $1 - \delta$ the institution ends up selling its shares anyway. Defining $F \equiv (R_I - R_D)/(1 - q)$ as the normalized difference between the two returns, we have

$$F = \delta\nu X - m + \delta w(X - P_A - P_B). \tag{4}$$

F is the (normalized) net benefit of intervention. From Proposition 2(i), the equilibrium probability of intervention α is zero, between zero and one, or one as F is negative, equal to zero, or positive.

The net benefit of intervention has two components. The first is the expected increase in the value of the institution's initial stake, $\delta\nu X$, less the cost of intervention m; this can be thought of as the direct impact of intervention. The second component, $\delta \cdot w(X - P_A - P_B)$, is the impact of intervention on the institution's expected trading profits: with chance δ, the intervention succeeds, causing the institution to buy w shares (and earn $X - P_A$ on each) rather than sell w shares (and earn P_B on each).

This trading impact needn't be positive. Making use of the expressions for the bid and ask prices from Lemma 1, we have

$$X - P_A - P_B = (1 - 2q')X \cdot \left[1 - \frac{\Sigma_A \Sigma_B}{(\Lambda + \Sigma_A) \cdot (\Lambda + \Sigma_B)} \right]. \tag{5}$$

The trading impact of intervention has the same sign as $1 - 2q'$. Intuitively, intervention only increases the institution's trading profits if it increases the value of the institution's information about the firm's future returns. Because the value of this information is directly related to its precision relative to that of the uninformed market makers, and the institution learns the firm's return with certainty, it follows that the value of the institution's information is directly related to the ex ante variance of the firm's return, $q'(1 - q')X^2$. Because intervention increases the ex ante probability q' of good returns, its impact on trading profits has the same sign as the derivative of the variance with respect to q'. This derivative is $(1 - 2q')X^2$, so an

[7] The specific conditions derived in Proposition A.1 are that w be no greater than half of the firm's shares, and wX/g must weakly exceed μ^{-2}, $[q(1 - q)]^{-1}$, and $[q_{\max}(1 - q_{\max})]^{-1}$.

increase in the probability of good returns improves trading profits if and only if q' is less than $\frac{1}{2}$.

Although this leads to a simple rule in our binomial model where the institution is perfectly informed (intervention increases trading profits if and only if q' is less than $\frac{1}{2}$), the more general point is that intervention and speculation are complements only when intervention increases the institution's information advantage over other traders—in this case, the market makers. When intervention's impact is more of a surprise (here, when q' is less than $\frac{1}{2}$), intervention increases trading profits, but if the firm is already expected to do well, or intervention's impact is diffused, *not* intervening may be more surprising, and so more lucrative. As we shall see, this has a number of implications for institutional behavior and for optimal ownership structure.

C. The Impact of Changes in Ownership Concentration

Next, we examine how equilibrium behavior is affected by changes in ownership structure, as measured by the institution's share ν in the firm. Let $\nu_M \equiv \delta X/m$ be the ownership stake at which the institution's direct impact of intervention $\delta \nu X - m$ equals zero. This is strictly increasing in ν, so if ν_M exists, it is unique and greater than zero. Note that ν_M is increasing in the cost of intervention m, decreasing in the probability δ that intervention succeeds, and decreasing in successful intervention's impact X on firm returns.

Absent trading concerns, ν_M would be the ownership level at which an informed institution would start intervening; in fact, since the direct impact of intervention increases with ν, the institution would not intervene if ν was below ν_M, and would intervene with certainty if ν was above ν_M. However, as just shown, the trading impact may be positive or negative, depending on the sign of $1 - 2q'$, and so the point at which intervention becomes attractive may be higher or lower than ν_M. These considerations help lead to the following result.

PROPOSITION 3 (Impact of Ownership Concentration on Intervention):

(i) There is a critical level ν^* such that, if the institution's stake in the firm is less than ν^*, the institution gathers information but never intervenes. As the institution's stake increases beyond ν^*, the probability of intervention increases with the institution's stake.

(ii) The critical level ν^* is greater than ν_M if the firm's base (no intervention) probability of success, q, is greater than $\frac{1}{2}$. It is less than ν_M if the firm's base probability of success is less than $\frac{1}{2}$.

(iii) Suppose that the firm's maximum chance of success (with full intervention) $q_{\max}$ is greater than $\frac{1}{2}$. Then certain intervention can only occur for some ν greater than ν_M, if at all.

The intuition behind part (i) of the proposition is as follows. For low ownership levels, the institution's direct impact from intervening is negative, so unless the trading impact from intervention is very positive, intervention

simply isn't worth the cost. As ownership level increases, the direct impact of intervention increases. Although increasing the institution's stake also reduces expected liquidity trades Λ (there are fewer small shareholders), the number of speculators shrinks to exactly offset the reduced liquidity in the market.[8] This occurs because outside speculators are the marginal informed traders: the institution has lower cost of gathering information, so it is unaffected by the decrease in liquidity as long as some speculators are active. The only factor that affects prices is the probability of intervention, which is zero in this region, so prices and the trading impact of intervention are constant until ν^* is reached, at which point the direct impact offsets any trading impact. Further increases in ν increase the direct impact, making intervention attractive; however, intervention raises prices, reducing the trading impact. The net effect is that the probability of intervention now increases continuously in ν.

The intuition behind part (ii) of the proposition has already been dealt with, but part (iii) requires some explanation. Essentially, when the institution's stake reaches ν_M, its direct impact from intervention is zero, so if the trading impact of intervention is positive, the institution strictly prefers intervention to pure speculation. Because the probability of a good return with certain intervention is $q_{\max}$, it follows that the trading benefit will be positive and consistent with full intervention only if $q_{\max}$ is less than $\frac{1}{2}$.

To summarize, the ability to trade on information alters the institution's behavior as a function of its ownership stake in the firm. Without this ability, the relationship would be clear-cut: no intervention below ν_M, full intervention above this level. The institution's ability to trade has two effects: it typically increases intervention slowly over some range of ownership levels, and this range may begin above or below ν_M, depending on whether intervention increases the institution's information advantage or not. Furthermore, unless the firm is likely to fail even with full intervention ($q_{\max} < \frac{1}{2}$), the ability to trade on information results in slower attainment of full intervention.

D. Comparative Statics on Intervention

We are interested in how changing key parameters affects both the critical ownership level ν^* and the probability of intervention once this level is surpassed. The parameters that we formally analyze are the firm's base chance of success (without intervention) q, the effectiveness of intervention δ, the difference X between good and bad returns, and the cost of gathering information g.

[8] Although we focus on equilibria in which speculators are active, it should be noted that a high enough level of ownership concentration can reduce the volume of liquidity trading to the point at which speculation is unprofitable. Once this occurs, the institution is the only informed trader, and further reductions in the volume of liquidity trading are now internalized by the institution. We return to the relationship between liquidity and the institution's choices in the next subsection.

COROLLARY 4 (Changes in the Base Chance of Success):

(i) An increase in the base chance of success q increases ν^*.
(ii) For ownership stakes above ν^*, an increase in the base chance of success reduces the equilibrium probability of intervention α.

Holding the level of intervention fixed, an increase in the base chance of success q increases the equilibrium probability of success q'—which means that success is more expected than before. This means that intervention's impact on the institution's trading profits is less positive (or more negative) than before, undermining incentives to intervene and reducing the equilibrium level of intervention. It follows that the institution must have a larger stake in the firm to support any intervention, so ν^* increases.

COROLLARY 5 (Changes in the Effectiveness of Intervention):

(i) An increase in the effectiveness of intervention δ reduces ν^*.
(ii) For ownership stakes above ν^*, an increase in intervention's effectiveness increases the equilibrium probability of intervention α when α or δ is sufficiently small.

Intuitively, as intervention becomes more effective, its direct impact increases, making intervention more attractive at lower ownership levels. Nevertheless, because intervention has more effect on the distribution of the firm's returns, such an increase also increases the magnitude of the trading impact of intervention, whether positive or negative. If intervention occurs with zero or low probability, or the effectiveness of intervention δ is itself low, an increase in δ has little effect on the distribution of the firm's returns, and so little effect on the trading impact of intervention; thus, direct effects dominate, making intervention more attractive. Otherwise, the effect can be ambiguous.

COROLLARY 6 (Changes in the Difference Between Good and Bad Returns):

(i) An increase in the difference between good and bad returns X reduces ν^*.
(ii) If the equilibrium probability of good returns q' is less than $\frac{1}{2}$, or the institution's stake ν is close to its overall wealth limit w, then increasing X increases the probability of intervention.

An increase in X increases the direct impact of intervention; it also increases the variance of the firm's returns. The second effect tends to increase the magnitude of intervention's trading impact (it also attracts more speculators into the market, which reduces this magnitude, but the net effect is an increase). If the equilibrium probability of success is below $\frac{1}{2}$, the effects on the direct impact and the trading impact go in the same direction; otherwise, they conflict. The direct effect dominates when the institution's stake is near ν^*; it also dominates when the institution has invested most of its wealth, for in this case the direct impact is close to δw, which exceeds the magnitude of any trading impact.

Thus, increases in both δ and X reduce the threshold at which intervention first occurs, but because they increase intervention's trading impact as well as its direct impact, they can have mixed effects on intervention when the institution is already intervening with significant probability. By contrast, an increase in the cost of gathering information g has no effect on the direct impact of intervention. However, it reduces the profitability of informed trading, so fewer speculators are active, and prices are less revealing. This increases the magnitude of the trading impact of intervention: with less revealing prices, more trading revenues are at stake. Effectively, the departure of marginal speculators means that the institution faces less competition in informed trading. This leads to the following result:

COROLLARY 7 (Changes in the Cost of Gathering Information):

(i) An increase in the speculator's cost of gathering information g does not affect v_M. It decreases v^* if the base probability of good returns q is less than $\frac{1}{2}$, and increases v^* if q is greater than $\frac{1}{2}$.

(ii) If the equilibrium probability of good returns q' is less than $\frac{1}{2}$, then increasing the speculator's cost of gathering information g increases the level of intervention α; otherwise, it decreases intervention.

A further corollary is that, because a decrease in g decreases the overall magnitude of the trading impact, the ambiguous effects of changes in δ and X are lessened—trading effects simply don't matter as much to the institution, because high speculative activity makes prices fairly revealing.

We note that an increase in the probability of liquidity shocks μ has no effect on intervention so long as speculators are active. Again, the reason is that these other speculators are the marginal informed traders, so increases in liquidity trading attract more speculators into the market. In equilibrium, the new speculators exactly offset the additional liquidity trading, leaving the institution's incentives unchanged. However, if speculators' costs of gathering information were not identical, but were drawn from a distribution, higher liquidity volume would attract less efficient speculators, raising equilibrium trading profits. This would tend to increase the magnitude of the trading impact of intervention, which would affect the institution's intervention choice.

E. Discussion

This section has shown that the ability to trade on information alters the institution's incentive to engage in value-enhancing intervention, increasing this incentive if and only if intervention enhances the value of the institution's information. In this simple model, this comes down to whether success or failure is less expected by uninformed market participants, which in turn depends on whether the equilibrium probability of success is below or above $\frac{1}{2}$. From a trading perspective, the institution prefers to enhance the odds of the least expected outcome, so if the expected chance of success is less than

$\frac{1}{2}$, it has incentive to improve matters by intervention, and otherwise it has incentive to cut and run.

The importance of this trading effect increases as intervention becomes more effective, as the firm's innate risk increases, and as the cost of gathering information increases. In the first two cases, the institution's direct impact from intervening also increases. In the last case, the institution faces less competition in informed trading, increasing the importance it places on trading concerns while leaving the direct impact of intervention unaffected.

We conclude this section with a brief discussion of the effects of relaxing some of our model's assumptions.

(1) *Delayed resolution of intervention.* To simplify matters, we have been assuming that intervention's outcome is immediately known to the various informed traders. Suppose instead that this information doesn't become known until time 2. Such delayed resolution of intervention skews the trading impact of intervention toward the negative.[9] Intuitively, by intervening, the institution gives up precise information (the firm *is* doing badly) for less precise information (the firm *may* do well).

This negative impact on intervention is lower as the effectiveness of intervention δ is higher. Furthermore, some types of intervention might be resolved more quickly than others: for example, a spin-off or removal of takeover deterrents resolves more quickly than a shift in R&D emphasis. Similarly, interventions might have more immediate impact in mature industries than in high technology firms.

Of course, in a model with repeated trading periods, the institution might be able to wait until the outcome of the intervention is resolved and then trade, but by that point its intervention may well have become public, reducing the value of the institution's information. Also, institutions must worry about performance evaluation, which might shorten their horizons and increase their desire to sell out for relatively certain gains now rather than intervene and receive uncertain benefits down the road.

(2) *Benefits of control.*[10] Although wealthy individuals and corporations can also be large shareholders, such investors are more likely to obtain benefits of control apart from the increase in share value analyzed here. Such benefits would reduce the large shareholder's willingness to sell shares, encouraging intervention over pure speculation, but now the large shareholder would intervene so as to increase some weighted sum of total shareholder value and private control benefits. Because effective control can be obtained with a fraction of the firm's shares (particularly through the use of different classes of voting rights, or pyramiding schemes), the large shareholder might

[9] Specifically, if the institution intervenes, it now values the firm at δX. If δX is less than the ask price P_A, the institution might intervene, but it cannot profit from buying more shares. Only if δX is greater than P_A can the institution make a profit by trading on its information. Thus, the trading impact becomes $w \cdot [\max \{\delta X - P_A, 0\} - P_B]$, which is less than our previous value of $\delta w \cdot [X - P_A - P_B]$.

[10] We thank the referee and the editor for raising this issue.

inefficiently reduce cash flows available to other shareholders (see Bebchuk and Zingales (1996) and Pagano and Röell (1996)). Thus, although the trade-off between speculation and intervention would loom less large if control benefits were important, the positive relationship between ownership concentration and firm value would also be undermined.

Although control benefits are likely to be less important for most institutional investors, an important exception arises in the case of interlocking shareholdings, which characterize much institutional share ownership in Japan (see Sheard (1994)), and which may effectively limit the activism of corporate pension fund managers in the United States (see Roe (1994)).[11]

III. The Determination of Ownership Structure

We now consider endogenizing the institution's stake in the firm. We find that more concentrated ownership generally increases firm value; however, the benefits to increased concentration are weakest when the institution's stake is less than the critical level ν^* defined in the previous section. In this analysis, we assume that the firm is initially owned by an entrepreneur whose goal is to sell off the firm so as to maximize his or her proceeds. For comparison, we also briefly consider the effects when the firm is initially diffusely held. In this case, there is a tension between the institution's incentives and maximization of shareholder value which stems from the fact that the institution's intervention benefits all shareholders, but its speculation benefits itself and hurts small shareholders. When the institution buys shares anonymously on the open market, these externalities have effects analogous to the holdout problem analyzed in Grossman and Hart's (1980) paper on takeovers.[12]

A. Choosing Initial Ownership Structure to Maximize Shareholder Value

Suppose that an initial owner sells the firm's shares to one large (institutional) and many small investors so as to maximize his or her proceeds. This owner could be an entrepreneur or private equity fund seeking to cash out, or a government seeking to privatize state-owned enterprises. Assume that this initial owner sells shares by competitive auction in two separate lots: one of size ν (as determined by the initial owner) to one of many institutional investors, and one of size $1 - \nu$ to a large number of small investors.[13] Again,

[11] If the institution is also a lender (as in the case of banks in Germany and Japan), there may be a conflict of interest between the institution and other shareholders. On the other hand, some have argued that such combined debt and equity holdings may be useful in maximizing overall firm value. See Berlin, John, and Saunders (1996) for an analysis of some of these issues.

[12] As noted in the introduction, our results when the institution buys shares on the open market are essentially analogous to those of Maug (1998).

[13] Although such price discrimination is generally not part of IPOs in the United States, large institutional investors are sometimes brought in prior to the IPO (see Mikkelson, Partch, and Shah (1995)).

we assume that the maximum number of shares the institution can purchase is w.

It follows that the initial owner's objective is to choose ν less than w so as to maximize

$$(1 - \nu)\cdot[\mu\cdot P_B(\nu) + (1 - \mu)\cdot q'(\nu)\cdot X + \mu\cdot(q'(\nu)\cdot X - P_A(\nu))] + [\alpha(\nu)\cdot R_I(\nu) + (1 - \alpha(\nu))\cdot R_D(\nu)], \tag{6}$$

where we have written the bid price P_B, ask price P_A, monitoring level α, and ex ante probability q' of success as functions of ν to emphasize that, as ν changes, these equilibrium values change as well. The first term in the objective function is the value of the small shareholders' stake: with probability μ, they are forced to sell at the bid price, and with probability μ, they are forced to buy additional shares at the ask price, even though they are uninformed. This can be rearranged as $(1 - \nu)\cdot q'(\nu)\cdot X - (1 - \nu)\mu\cdot(P_A - P_B)$; that is, the small shareholder's share of the firm's expected cash flows, less their expected trading losses $\Lambda(P_A - P_B)$. The second term in the objective function is the value of the institution's stake, which is the weighted average of the returns to pure speculation and intervention.

This objective function can be simplified by noting that, since market makers break even, expected trading losses suffered by liquidity traders must equal expected trading gains to informed investors. These trading gains equal $(S(\nu) + 1)\cdot g$: the $S(\nu)$ speculators each break even, earning g, while the institution's average trading profits are limited to the same amount. Also, it is easy to show that the expected value of the institution's position equals

$$\nu q'(\nu)\cdot X - (1 - q)\cdot\alpha(\nu)\cdot m + g. \tag{7}$$

The institution gets the expected value of its initial stake ν, less expected intervention costs, plus expected trading profits g. Thus, because q' equals $q + \alpha\delta(1 - q)$, the initial owner's objective function equals

$$qX + (1 - q)\alpha(\nu)[\delta X - m] - S(\nu)\cdot g; \tag{8}$$

that is, total shareholder value equals the base value of the firm, qX, plus the net expected benefit of any intervention, less the costs of gathering information.

Although outside speculators break even in their trading, their costs of gathering information are passed through to small shareholders, reducing the amount these shareholders are willing to pay in the first place. Because we do not have a direct positive role for the information that the speculators gather, this cost is a deadweight loss. By contrast, increases in intervention generally increase shareholder value.[14]

[14] Indeed, in this model, institutional intervention only hurts overall shareholder value when the institution's trading volume w is greater than half of the firm's shares: the institution's benefit from intervention is less than $\delta(\nu + w)X - m$, while that to the firm as a whole is $\delta X - m$.

Of course, in a more complex model, speculators' impact on prices might add value; for example, more revealing stock prices can make a manager's shareholdings a better incentive device (Holmström and Tirole (1993)), might give the manager better information about industry conditions (Fishman and Hagerty (1992)), or (in a dynamic model) might allow an institutional investor to learn that the firm is likely to do badly without gathering as much information on its own.[15] These considerations suggest important caveats to any results that depend on increases or decreases in the number of speculators and their total costs of gathering information.

It is easy to show that for ownership levels below ν^* the number of speculators declines with the institution's stake in the firm: liquidity volume is reduced, and the speculators (being the marginal informed traders) are forced out of the market. For levels above ν^*, higher institutional ownership increases intervention and its net benefit to the firm as a whole, $\delta X - m$. The effect on speculation is ambiguous if q' is less than $\frac{1}{2}$, and negative otherwise. (Liquidity volume is always reduced, reducing speculation, but q' less than $\frac{1}{2}$ implies that increased intervention increases the firm's return variance and thus the profit to informed trading, increasing speculation. When q' exceeds $\frac{1}{2}$, return variance is decreased, complementing the liquidity effect.) To the extent the impact of changes in the number of speculators and their expenditures on gathering information are "second order" due to omitted benefits of more informative prices, increasing the institution's stake increases total shareholder value.

Thus, when an initial owner optimally chooses the mix of shareholdings, he or she generally prefers to give the institution as many shares as it can buy. This has the greatest impact when the institution's wealth constraint w exceeds the critical level ν^* at which intervention first occurs; below ν^*, the only impact of increased concentration is to reduce the number of active speculators.

B. Ownership Structure When the Institution Buys Shares on the Open Market

When the institution buys shares on the open market, its incentives to concentrate shares are counter to "social" incentives. Suppose that at time 0 the firm is diffusely held, and assume for the moment that the market makers who sell shares at this point must cover their positions by the end of time 0 by buying shares at competitive prices from small shareholders. We also assume for simplicity that the institution is the only informed trader at time 0. As before, the chance of liquidity trades is μ.

Suppose that the institution buys ν shares with certainty. Then the expected value of the firm's cash flows is $q'X$. Because the ultimate source of shares is small shareholders, the selling price P_0 equals the value of these shares to a small shareholder: $q'X - \mu \cdot (P_A - P_B)$. As already noted, ex-

[15] We thank the referee for this last insight. A good discussion of various pros and cons of informed trading can be found in Fishman and Hagerty (1992).

pected time 1 trading losses $\mu(1 - \nu)\cdot(P_A - P_B)$ equal total expected trading profits $(S + 1)\cdot g$, so

$$P_0 = q'(\nu)\cdot X - \frac{(S(\nu) + 1)\cdot g}{1 - \nu}. \tag{9}$$

The institution benefits from future speculative activity, which depresses the value that the current small shareholders place on their shares. Note that the discount is proportional to $(S + 1)/(\mu(1 - \nu))$, which is the ratio of informed traders to liquidity trading volume.

The institution's net profit from buying ν shares today is $\alpha\cdot R_I + (1 - \alpha)\cdot R_D - \nu\cdot P_0$, which equals

$$\nu\cdot\frac{(S(\nu) + 1)\cdot g}{1 - \nu} + g - (1 - q)\cdot\alpha(\nu)\cdot m. \tag{10}$$

As in Maug (1998), the institution gains no direct benefit from intervention. Instead, the institution benefits from the effect of future speculative activity on the initial price P_0 and from its own expected trading profits, which equal g. Intervention's effect on the firm's cash flows is a positive externality; as in Grossman and Hart (1980), no one small shareholder has incentive to pay for the costs of intervention. By contrast, informed trading creates negative externalities for small shareholders; these depress the share price, enabling the institution to buy shares more cheaply.

For ownership levels below ν^*, there is no intervention. The proof of Proposition 3 shows that the ratio of informed traders to liquidity trades is constant in this region, so the institution's profits increase until ν^* is reached. Thereafter, matters are less clear-cut: although larger stakes increase the institution's share of any discount from future informed trading, expected intervention costs also increase. Also, once the firm's ex ante chance of success q' exceeds $\frac{1}{2}$, increasing the institution's stake decreases the variance of the firm's return, reducing trading profits and thus the ratio of informed traders to liquidity trades. Thus, the institution may limit its stake even though a higher stake and increased intervention might be socially desirable.

We conclude this subsection by considering some modifications of our assumptions.

(1) If market makers don't have to immediately cover their positions, the holdout problem is reinforced. For example, if they can hold positions costlessly until time 2, the time 0 price is $q'X$. It follows that the institution's only gain from buying shares is its expected time 1 trading profit g, and it has no incentive to increase its stake into the range where intervention occurs.

(2) If liquidity traders are present at time 0, the institution can profit by randomizing its decision to buy shares. This is analogous to Kyle and Vila's (1991) analysis of how liquidity trading can mitigate holdout

problems in takeovers. Because liquidity trading masks the institution's share purchases, P_0 is an average of the marginal shareholder's value when the institution is present (and subsequently intervenes) and this value when the institution is not present. Thus, P_0 is lower than in our previous analysis, increasing the institution's profits when it does acquire shares.

(3) If the firm issues stock privately to the institution, the holdout problem is circumvented. This lets management commit to having an institution monitor in the future, which might be useful in a more dynamic model where the firm has to go to the market for funds at some future date. On the other hand, management's desire to do this may be weaker if the firm is already diffusely held than it is at the time of an IPO, particularly if the IPO takes place with a large blockholder already in position.

IV. Short-Swing Rules and Restricted Shares

Concerns about the potential conflict between the ability to speculate and the desire to enhance firm value have led some (e.g., Bhide (1993)) to suggest that trading by institutional investors be somehow restricted. In this section, we discuss two devices that might be used to better align the institution's trading incentives with enhancing firm value: short-swing rules and restricted shares.

Short-swing rules. U.S. insider trading regulations classify institutions with 10% or more of a firm's shares as insiders, so that they forfeit any "short-swing" profits earned by buying or selling shares and then reversing the trade within a six-month period. As we now discuss, this type of rule is unlikely to enhance an institution's incentives to intervene.

Suppose that such a short-swing rule applies to shareholdings of some level $\hat{v}$ or more, and that the interval between time 1 and the unwinding of positions at time 2 is less than the short-swing horizon. Then an institution that holds more than $\hat{v}$ shares cannot profit from any additional purchases or short sales of shares at time 1. However, if the interval between time 1 and the institution's initial purchase of shares at time 0 exceeds the short-swing horizon, and the institution knows the firm will fail, it can profitably sell its initial stake at time 1. Intervention's impact on the institution's existing stake is unchanged, but its impact on trading profits is now negative: intervention reduces the probability that the firm will fail. This effect is most pronounced for firms with a low base chance of success, because these firms have the most positive trading impact of intervention in the absence of short-swing rules.

In addition to favoring pure speculation over intervention, the short-swing rule reduces the institution's expected trading profits. This may lead the institution to hold fewer than $\hat{v}$ shares, so as to retain its ability to trade on any information that it has and earn higher trading profits. Unfortunately,

from the viewpoint of maximizing total shareholder value, this is likely to be inefficient, since a lower stake reduces the probability of intervention.[16]

Restricted shares. The preceding discussion suggests that overall prohibitions on short-term trading by large investors may backfire in promoting intervention. One alternative is to give the institution restricted shares that cannot be sold in the public market.[17] By limiting the institution's ability to sell while leaving its ability to buy additional shares relatively untouched, restricted shares make the trading impact of intervention more positive, encouraging intervention. On the other hand, if the institution has liquidity needs, selling restricted shares involves large losses or delays when the institution needs the money the most; also, regulation may restrict the fraction of an institution's portfolio that can be devoted to such holdings. Such concerns reduce the amount that an institution will be willing to pay for such shares.[18] Because restricted shares are costly, we would expect that they would be most useful in situations where an institutional investor's potential trading profits are high (e.g., other speculators face high costs of gathering useful information), the trading impact of intervention would otherwise be negative (e.g., the resolution of intervention is delayed), and the institution's liquidity needs are limited.

V. Implications

We now discuss the implications of our results for the relationship between outside shareholder monitoring and intervention, ownership structure, and firm characteristics.

Our strongest predictions concern the behavior of institutions that have already acquired large stakes in firms. All else equal, intervention or monitoring should be strongest for firms that are publicly perceived as poor performers, and weakest for firms that are publicly perceived as good performers. To the extent that outside shareholders do play a useful role in disciplining management, this suggests that institutional intervention may exaggerate mean reversion in firm earnings performance—"bad" firms attract intervention, while "good" firms are allowed to slip as informed institutions jump ship.

Intervention should be most likely for firms in industries or situations that are relatively accessible to well-informed outsiders: mature or low-

[16] Also, if larger stakes make intervention cheaper or more likely to succeed (because the institution controls more votes outright), the short-swing rule is even more inefficient; by reducing the institution's stake, it makes whatever intervention occurs more costly and ineffective.

[17] In the United States, SEC Rule 144A allows private resale of such shares subject to certain conditions, but this resale market is still relatively illiquid. See Carey et al. (1993).

[18] Indeed, Silber (1991) finds restricted shares place at an average discount of 34 percent relative to public share prices, and Hertzel and Smith (1993) find that private placements of restricted shares have a discount 13.5 percent greater than that on private placements of nonrestricted shares. Of course, these discounts may also reflect expected monitoring and intervention costs.

technology industries, situations where management is clearly subpar (so that even an average replacement is likely to help matters), or firms with general "focus" or "agency" problems (extraneous money-losing divisions, or excessive layers of management). By contrast, it may be harder for outsiders to know what to do in firms that specialize in new technologies, have a high R&D focus, or rely on other specialized intangible skills, and the same should be true in situations where intervention means assessing an uncertain change of focus, such as what types of R&D should be emphasized, or what direction a young industry is likely to take. Such "opaque" situations are also likely to involve delays in the resolution of intervention's impact, further reducing the likelihood of intervention.

Intervention's impact on trading profits is greatest in magnitude when barriers to gathering information are highest; therefore, all of these effects should be most intense for younger, smaller, or otherwise less well-known firms, and least intense for large, well-established firms with numerous analysts and extensive reporting in the press. Also, all else equal, those firms where risk is more idiosyncratic than systematic may provide the greatest potential for private information, making trading concerns more important.

As noted in the introduction, anecdotal evidence about intervention targets in the early 1990s is consistent with our predictions: large, well-established firms with very visible poor performance. Similarly, the case of Fidelity Magellan's selling activity in the late fall of 1995 seems consistent with our predictions: relatively young or small firms in risky and ever-changing industries (high-technology), where the public perception had been very positive. Indeed, because of the overall size of Fidelity, the business press has reported that Fidelity has unparalleled access to the management of the firms it invests in, giving it a large information advantage over other market participants.[19]

Our analysis suggests that the overall benefits of concentrated institutional ownership are greatest when incentives to intervene are highest. Given that an institution's limited wealth and need for diversification may limit the size of the stake it can hold in any one firm, these benefits will be most easily found in firms where intervention is achieved at relatively low levels (in terms of our model, where ν^* is relatively low). Thus, all else equal, we should expect concentration to be most useful, hence most common, for firms where intervention is more effective and more quickly resolved.

Zeckhauser and Pound (1990) present evidence that is consistent with our predictions on intervention and concentration. They find that, in low-R&D industries, there is a significant negative association between the presence of large outside shareholders and the firm's earnings/price ratio, but there is no significant association for firms in high-R&D industries. To the extent that lower earnings/price ratios proxy for higher earnings growth, this is consistent with the view that large shareholders are more likely to improve

[19] Note that the legal prohibition on using "inside" information would not apply to information such as in-person appraisals of the CEO's motives and ability.

firm performance in low-R&D firms, where intervention is likely to be more effective and more quickly resolved. Additionally, 39 percent of the firms in low-R&D industries have a large outside shareholder, but only 28 percent of the high-R&D firms do, which is consistent with the view that concentration is more likely in low-R&D firms.

Restricted shares limit institutions' cut-and-run behavior, so we would expect more sales of large blocks of restricted shares to outside investors in situations where the firm is young, small, or otherwise less well-known, as well as in firms where firm-specific risk is high. Consistent with this, Silber (1991) finds that publicly traded firms that issued restricted shares to outside investors during 1981–1988 tended to be small (average sales of $40 million); Hertzel and Smith (1993) find similar results for publicly traded firms that placed shares privately (restricted or otherwise) during 1980–1987. Hertzel and Smith also find that private placements of restricted shares have a positive announcement effect on a firm's publicly traded share price that is significantly higher (+7.8 percent) than that for private placements in general. Although this result may simply be due to signalling of favorable information rather than expectations of future monitoring by the new blockholder(s), they find that the effect is strongly correlated with issues of restricted shares to a single investor rather than to multiple investors, which is more consistent with the monitoring explanation.

VI. Conclusion

Our paper explores the tension between an institution's ability to trade on private information and its desire to use the information to intervene in a poorly performing firm. As we have shown, the institution's intervention decision depends not only on the direct benefit that it receives by intervening and increasing the value of its existing stake in the firm, but also on the impact of intervention on the institution's trading profits. When the market expects the firm to do poorly, this trading impact tends to be positive, encouraging intervention; when the market expects the firm to do well, the trading impact is actually negative, discouraging intervention.

The size of this trading impact varies with the degree of competition that the institution faces from other informed traders. As costs of gathering information fall, more informed traders enter the market, making prices more informative, diminishing the institution's trading profits, and thus reducing the importance of trading profits in the institution's intervention decision. Also, as intervention becomes more likely to succeed or the impact of successful intervention increases, the trading impact increases in importance. Finally, as the delay between intervention and the resolution of its success or failure increases, the trading impact is more likely to be negative, discouraging intervention.

These results have a number of implications for ownership structure. First, although a higher ownership stake always increases an institution's desire to intervene, the threshold at which intervention becomes attractive will

vary with the sign and size of the trading impact of intervention. Thus, concentration levels should be higher in relatively "transparent," well-understood firms or industries than in relatively "opaque" firms or industries where information is harder to come by and the effects of intervention may be more uncertain. Furthermore, firms where intervention's trading impact is large and possibly negative should be more inclined to issue restricted shares to institutions, because such a stake tilts the institution's trading preferences toward intervening and buying more shares rather than selling out. By contrast, short-swing provisions imposed on large ownership stakes reduce trading profits in general, which may encourage institutions to hold fewer shares—and intervene less often.

Clearly, the interactions between liquidity demand, speculation, and intervention are complex; our model has examined only a simple case. As noted in Section II, with heterogeneous speculators, an increase in liquidity demand should attract less efficient speculators on the margin, increasing the institution's equilibrium trading profits and their importance in the institution's intervention decision. Also, the institution's own liquidity needs may affect the intervention decision, particularly if such needs tilt the institution more toward selling rather than buying shares. Detailed analysis of these issues could lead to useful cross-sectional relationships between shareholder composition and intervention.

Appendix

Proof of Lemma 1: (i) Market makers price at the expected share value given a buy or sell. Liquidity buyers and sellers think that the firm is worth $q'X$, and the expected volume of each is Λ. The valuations and volumes of fully informed buyers and sellers are derived in the text. The expressions for P_A and P_B follow easily.

(ii–iii) The expressions for R_D, R_I, and R_S follow easily (these investors sell w shares that are truly worth 0 when the firm does badly and there is either no intervention or it fails, as appropriate, and buy w shares that are truly worth X at a price P_A when the firm does well or intervention succeeds). Q.E.D.

Proof of Proposition 2: Condition (i) follows from the usual intuition for equilibrium strategy choice: if one action yields a strictly higher return than the alternative, the institution will choose it with certainty; if both actions are tied for the highest return, the institution is willing to choose any mixture of them. Condition (ii) follows from the logic of free entry, as discussed in the text.

Existence follows from Kakutani's Fixed Point Theorem applied to the equilibrium price correspondence. The details are available on request and follow the same basic logic as our existence proof in Kahn and Winton (1996). Q.E.D.

PROPOSITION A.1 (Sufficient Conditions for Active Speculators): *Suppose that a large institution's wealth w is no more than $\frac{1}{2}$, and wX/g exceeds μ^{-2}, $[q(1-q)]^{-1}$, and $[q_{\max}(1-q_{\max})]^{-1}$. Then, regardless of the institution's choice of actions, speculators are active in equilibrium.*

Proof: Speculators won't become active if $R_S < 0$ for $S = 0$, so if we can show that $R_S \geq 0$ at $S = 0$ for any ownership stakes ν and action choice of the institution, we are done (because we allow randomized entry, S needn't be an integer). First, note that R_S increases with Λ (P_B increases and P_A decreases), so speculation is least attractive (ceteris paribus) when Λ is smallest, which occurs at $\nu = w$.

$R_S \geq 0$ is equivalent to $g/w \leq (1-q')\cdot P_B + q'\cdot(X - P_A)$. As just shown, this is least likely when $\Lambda = \mu(1-w)$ and $S = 0$, so we can write the RHS as

$$q'(1-q')X\cdot\frac{\Lambda(2\Lambda+\Sigma)}{(\Lambda+q'\Sigma)(\Lambda+(1-q')\Sigma)} = \frac{q'(1-q')X\cdot[2\mu^2(1-w)^2+\mu w(1-w)]}{\mu^2(1-w)^2+\mu w(1-w)+q'(1-q')w^2}, \tag{A1}$$

which is clearly increasing in $q'(1-q')$; thus, it is smallest at either $q' = q$ or $q' = q_{\max}$. Denote the minimum value of $q'(1-q')$ as ϕ; then $g/w \leq (1-q')\cdot P_B + q'\cdot(X - P_A)$ can be rearranged to yield

$$\left[\frac{g}{w\phi} - 2X\right]\cdot\mu^2(1-w)^2 + \left[\frac{g}{w\phi} - X\right]\cdot\mu w(1-w) + \frac{g}{w}w^2 \leq 0. \tag{A2}$$

If wX/g exceeds $\phi^{-1} = \max\{[q(1-q)]^{-1}, [q_{\max}(1-q_{\max})]^{-1}\}$, the first two terms in the LHS of the inequality are negative; if $w \leq \frac{1}{2}$, then $w^2 \leq w(1-w) \leq (1-w)^2$, and the LHS is less than or equal to

$$\left[\frac{g}{w\phi} - 2X\right]\cdot\mu^2\cdot w^2 + \left[\frac{g}{w\phi} - X\right]\cdot\mu\cdot w^2 + \frac{g}{w}w^2 \leq \left[-X\mu^2 + \frac{g}{w}\right]\cdot w^2. \tag{A3}$$

This is negative if wX/g exceeds μ^{-2}. Thus, when the conditions in the proposition hold, $S = 0$ implies $g/w \leq (1-q')\cdot P_B + q'\cdot(X - P_A)$ for any α, so speculators are active in equilibrium. Q.E.D.

PROPOSITION A.2 (Uniqueness of Equilibrium): *Suppose that the conditions of Proposition A.1 hold, so that $S > 0$ in equilibrium. Then, given the institution's stake ν and the other parameters of the model, there is only one probability of intervention α and one number of active speculators S that is an equilibrium.*

Proof: If $\delta w(X - P_A - P_B)$ is decreasing in q' when the condition $R_S = 0$ is imposed, there will be a unique equilibrium choice of α and S. To see this, note that $R_S = 0$ uniquely determines S as an equilibrium function of q'; following Proposition A.2, this is a quadratic equation with only one positive solution given our earlier conditions. q' is strictly increasing in α, and equilibrium returns are only affected by α through the prices (which are functions of q') and q' itself. If there are two equilibria, one will have lower α than the other, so $R_I - R_D$ must be weakly lower in the first (low α) equilibrium. $R_I - R_D$ has the same sign as $F \equiv (R_I - R_D)/(1 - q) = \delta\nu X - m + \delta w(X - P_A - P_B)$, so if $\delta w(X - P_A - P_B)$ is decreasing in q', so is F, and we have a contradiction.

Thus, it suffices to show that $X - P_A - P_B$ decreases in q' subject to the condition $R_S = 0$. First, note that determining S from $R_S = 0$ is the same as determining $(S + 1)w = \Sigma$, which is somewhat easier to work with. From the Implicit Function Theorem, $d\Sigma/dq' = -(\partial R_S/\partial q')/(\partial R_S/\partial \Sigma)$. We have

$$\frac{d(X - P_A - P_B)}{dq'} = \frac{\partial(X - P_A - P_B)}{\partial q'} - \frac{\partial(X - P_A - P_B)}{\partial \Sigma} \cdot \frac{\partial R_S/\partial q'}{\partial R_S/\partial \Sigma}. \tag{A4}$$

Rewriting the equation for $X - P_A - P_B$ from the text, we have

$$X - P_A - P_B = \frac{(1 - 2q')\Lambda(\Lambda + \Sigma)X}{\Lambda^2 + \Lambda\Sigma + q'(1 - q')\Sigma^2}. \tag{A5}$$

It follows that $\partial(X - P_A - P_B)/\partial q'$ is directly proportional to $-2(\Lambda^2 + \Lambda\Sigma + q'(1 - q')\Sigma^2) - (1 - 2q')^2\Sigma^2$, which is negative, while $\partial(X - P_A - P_B)/\partial\Sigma$ is directly proportional to $-(1 - 2q')$. Also, $R_S = 0$ is equivalent to

$$\frac{wq'(1 - q')X\Lambda(2\Lambda + \Sigma)}{\Lambda^2 + \Lambda\Sigma + q'(1 - q')\Sigma^2} = g. \tag{A6}$$

$\partial R_S/\partial q'$ is directly proportional to $1 - 2q'$ (R_S increases with $q'(1 - q')$, and $\partial[q'(1 - q')]/\partial q' = 1 - 2q'$). $\partial R_S/\partial\Sigma$ is negative: R_S is proportional to $(1 - q')P_B + q'(X - P_A)$, and P_A increases with Σ while P_B decreases.

It follows that $[\partial(X - P_A - P_B)/\partial\Sigma] \cdot [d\Sigma/dq']$ has the same sign as $-(1 - 2q')^2/(\partial R_S/\partial\Sigma)$, which is positive, and so $d(X - P_A - P_B)/dq'$ is strictly negative. Q.E.D.

Useful Derivatives for Remaining Proofs

$$\frac{\partial P_A}{\partial \Lambda} = \frac{-q'(1 - q')\Sigma X}{(\Lambda + q'\Sigma)^2} \quad \text{and} \quad \frac{\partial P_B}{\partial \Lambda} = \frac{q'(1 - q')\Sigma X}{(\Lambda + (1 - q')\Sigma)^2}. \tag{A7}$$

$$\frac{\partial P_A}{\partial \Lambda} + \frac{\partial P_B}{\partial \Lambda} = -\frac{(1 - 2q')q'(1 - q')\Sigma^2(2\Lambda + \Sigma)X}{(\Lambda + q'\Sigma)^2(\Lambda + (1 - q')\Sigma)^2}. \tag{A8}$$

$$\frac{\partial P_A}{\partial S} = -\frac{\Lambda}{S + 1}\frac{\partial P_A}{\partial \Lambda} \quad \text{and} \quad \frac{\partial P_B}{\partial S} = -\frac{\Lambda}{S + 1}\frac{\partial P_B}{\partial \Lambda}. \tag{A9}$$

Proof of Proposition 3: (i) Suppose that $\nu = 0$. Then F equals $-m + w(X - P_A - P_B)$. Set $\alpha = 0$, so that $q' = q$, and find the number of speculators S that sets R_S to zero; if F is negative, this is an equilibrium. Otherwise, equilibrium involves $\alpha > 0$, and we can define $\nu^* = 0$. (For the moment, assume $\alpha < 1$.)

Suppose that F is negative at $\nu = 0$, so that $\alpha = 0$. Then the equilibrium condition $R_S = 0$ defines a quadratic in $(S + 1)w/\Lambda$ whose solution depends only on q, w, g, and other underlying parameters. Thus, in this region, $(S + 1)/\Lambda$ is constant, which implies that P_A and P_B are constant. Thus the only change in F is from the direct impact term $\delta\nu X - m$, which increases in ν. Eventually, either $\nu = w$, or F equals 0; in the latter case, we have ν^*.

Once $F = 0$, equilibrium is determined by two conditions: $F = 0$ and $R_S = 0$. The Implicit Function Theorem implies that, for any parameter x, $d\alpha/dx$ equals $-[(\partial F/\partial x)(\partial R_S/\partial S) - (\partial F/\partial S)(\partial R_S/\partial x)]$ divided by $J \equiv (\partial F/\partial \alpha)\cdot(\partial R_S/\partial S) - (\partial F/\partial S)(\partial R_S/\partial \alpha)$ (J is the Jacobian). Because both P_A and P_B increase in α, $\partial F/\partial \alpha < 0$. $\partial R_S/\partial S$ is negative (an increase in S increases P_A and decreases P_B, decreasing R_S). $\partial F/\partial S = (\Lambda/(S + 1))(\partial(P_A + P_B)/\partial \Lambda)$ has the same sign as $-(1 - 2q')$. Finally,

$$\frac{\partial R_S}{\partial \alpha} = w\cdot\delta(1 - q)\cdot\left[(1 - q')\frac{\partial P_B}{\partial q'} - q'\cdot\frac{\partial P_A}{\partial q'} + X - P_A - P_B\right]. \tag{A10}$$

The bracketed term equals $\Lambda\cdot(\Lambda + \Sigma)$ times

$$\frac{1 - q'}{(\Lambda + (1 - q')\Sigma)^2} - \frac{q'}{(\Lambda + q'\Sigma)^2} + \frac{1 - 2q'}{(\Lambda + q'\Sigma)(\Lambda + (1 - q')\Sigma)}$$
$$= \frac{(1 - 2q')\Lambda(2\Lambda + \Sigma)}{(\Lambda + q'\Sigma)^2\cdot(\Lambda + (1 - q')\Sigma)^2}, \tag{A11}$$

which is proportional to $1 - 2q'$. This shows that J is positive. Thus, the sign of $d\alpha/dx$ is the opposite of that of the first determinant in the expression for $d\alpha/dx$, which equals $(\partial F/\partial x)(\partial R_S/\partial S) - (\partial F/\partial S)(\partial R_S/\partial x)$.

Now apply this to $d\alpha/d\nu$. We need to sign the determinant $(\partial F/\partial \nu)(\partial R_S/\partial S) - (\partial F/\partial S)(\partial R_S/\partial \nu)$. Note that $\partial R_S/\partial \nu = -\mu\cdot(\partial R_S/\partial \Lambda) = \mu\cdot((S + 1)/\Lambda)(\partial R_S/\partial S)$. Now,

$$\frac{\partial F}{\partial \nu} = \delta\left[X - w\cdot\frac{\partial(P_A + P_B)}{\partial \Lambda}(-\mu)\right] - m = \delta X - m + \mu\cdot\frac{S + 1}{\Lambda}\cdot\frac{\partial F}{\partial S}, \tag{A12}$$

so the determinant in question equals $(\partial R_S/\partial S)\cdot[(\partial F/\partial \nu) - (\mu(S + 1)/\Lambda)\cdot(\partial F/\partial S)] = (\partial R_S/\partial S)\cdot\delta X$, which is negative; this implies $d\alpha/d\nu$ is positive and proportional to δX.

If equilibrium involves $\alpha = 1$, similar arguments to the case when $\alpha = 0$ show that prices are constant as long as speculators are active, so that α remains at 1.

Proposition 3(ii) follows directly from the discussion of the sign of the trading impact of intervention, combined with the derivation of ν^* given in (i).

In (iii), $\alpha = 1$ requires that $F > 0$ for $q' = q_{\max}$. Because $q_{\max} > \frac{1}{2}$ implies $1 - 2q_{\max} < 0$, the trading impact is negative, and $F > 0$ requires that the direct impact $\delta\nu X - m$ is strictly positive. Q.E.D.

Proof of Corollary 4: (i) At ν^*, $\alpha = 0$ and $F = 0$, so $q' = q$ and $\delta\nu^* X + \delta w(X - P_A - P_B) - m \equiv H = 0$. By the Implicit Function Theorem, $d\nu^*/dq = -(\partial H/\partial q)/(\partial H/\partial \nu^*) = -w[\partial(X - P_A - P_B)/\partial q]/X$. Substituting in for $X - P_A - P_B$ at $q' = q$ yields that $d\nu^*/dq$ has the same sign as

$$-\frac{\partial}{\partial q}\left[\frac{1 - 2q}{\Lambda^2 + \Lambda\Sigma + q(1 - q)\Sigma^2}\right] = \frac{2}{\Lambda^2 + \Lambda\Sigma + q(1 - q)\Sigma^2} + \frac{(1 - 2q)^2\Sigma^2}{(\Lambda^2 + \Lambda\Sigma + q(1 - q)\Sigma^2)^2}, \tag{A13}$$

which is positive.

(ii) From the proof of Proposition 3(i), $d\alpha/dq$ equals $-[(\partial F/\partial x)(\partial R_S/\partial S) - (\partial F/\partial S)(\partial R_S/\partial x)]$ divided by J. As α and q only enter into F and R_S through q', it follows that $d\alpha/dq$ equals $-(\partial q'/\partial q)/(\partial q'/\partial \alpha) = -(1 - \alpha\delta)/(\delta(1 - q))$; and because α, $\delta \leq 1$, it follows that this is negative. Q.E.D.

Proof of Corollary 5: (i) Note that at ν^*, $\alpha = 0$ initially and $F = 0$, which implies $\delta\nu^* X + \delta w(X - P_A - P_B) = m > 0$. $\nu^* X + w(X - P_A - P_B)$ must be positive for slightly smaller ν as well, so the effect of an increase in δ for ν just below ν^* is to increase F, and the point at which F first equals 0 moves down.

(ii) From the proof of Proposition 3(i), when $\nu > \nu^*$, $d\alpha/d\delta$ has the same sign as $-[(\partial F/\partial \delta)(\partial R_S/\partial S) - (\partial F/\partial S)(\partial R_S/\partial \delta) \equiv D$. Noting that

$$\frac{\partial F}{\partial \delta} = \nu X + w(X - P_A - P_B) - \delta w\left[\frac{\partial P_A}{\partial \delta} + \frac{\partial P_B}{\partial \delta}\right], \tag{A14}$$

and

$$\frac{\partial R_S}{\partial \delta} = w\cdot\left[(1 - q')\frac{\partial P_B}{\partial \delta} - q'\frac{\partial P_A}{\partial \delta} - (P_A + P_B)\frac{\partial q'}{\partial \delta}\right], \tag{A15}$$

D can be written as

$$-[\nu X + w(X - P_A - P_B)]\frac{\partial R_S}{\partial S} + \delta w^2(P_A + P_B)\left[\frac{\partial P_A}{\partial S} + \frac{\partial P_B}{\partial S}\right]\frac{\partial q'}{\partial \delta}$$
$$+ \delta w^2\left[\frac{\partial P_A}{\partial q'}\frac{\partial P_B}{\partial S} - \frac{\partial P_B}{\partial q'}\frac{\partial P_A}{\partial S}\right]\frac{\partial q'}{\partial \delta}. \tag{A16}$$

Because $F \geq 0$ for $\nu \geq \nu^*$, $\nu X + w(X - P_A - P_B) \geq m/\delta > 0$, and the first term in D is positive. The second term has the same sign as $1 - 2q'$, while the third is negative (P_A and P_B are increasing in q', P_A is increasing in S, and P_B is decreasing in S). Since $\partial q'/\partial \delta$ equals $\alpha(1 - q)$, when α or δ is sufficiently small, the second and third terms are negligible. Q.E.D.

Proof of Corollary 6: (i) This follows from the impact of a change in X on F for ν close to ν^*; this is more complicated than Corollary 5(i), because although the direct impact of X on F is positive ($\delta\nu X + \delta w(X - P_A - P_B)$ is linear in X), increasing X also increases speculators' profits R_S, which leads to an increase in S. The net change in F is then $\partial F/\partial X + (\partial F/\partial S)(dS/dX)$. Using the Implicit Function Theorem, dS/dX equals $-(\partial R_S/\partial X)(\partial R_S/\partial S)$; algebra (available on request) shows that the net effect is still positive. Intuitively, an increase in S decreases the magnitude of the trading impact, but this is more than offset by the increase in magnitude that results from increasing X.

(ii) $d\alpha/dX$ has the same sign as $-[(\partial F/\partial X)(\partial R_S/\partial S) - (\partial F/\partial S)(\partial R_S/\partial X)]$. Algebra shows that this has the same sign as

$$\nu[(1 - q')(\Lambda + q'\Sigma)^2 + q'\cdot(\Lambda + (1 - q')\Sigma)^2] + (1 - 2q')w\Lambda^2, \tag{A17}$$

which is positive when $q' \leq \frac{1}{2}$ and ambiguous otherwise. However, the bracketed term is greater than Λ^2, which exceeds $(1 - 2q')\Lambda^2$, so if ν is close enough to w, this is positive even for $q' > \frac{1}{2}$. Q.E.D.

Proof of Corollary 7: (i) Clearly, a change in g doesn't affect ν_M. Higher g raises the barrier to speculation, so there are fewer speculators. In the region $\nu \leq \nu^*$, this increases the magnitude of the trading impact (more positive if $q < \frac{1}{2}$, more negative if $q > \frac{1}{2}$), and ν^* moves in the same direction.

(ii) $d\alpha/dg$ has the same sign as $-[(\partial F/\partial g)(\partial R_S/\partial S) - (\partial F/\partial S)(\partial R_S/\partial g)]$. Since $\partial F/\partial g = 0$ and $\partial R_S/\partial g = -1$, this has the same sign as $-\partial F/\partial S$, which is that of $1 - 2q'$ (see Proposition 3). Q.E.D.

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