# Wolf Pack Activism

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## Abstract

Blockholder monitoring is key to corporate governance, but blockholders large enough to exercise significant unilateral influence are rare. Mechanisms that enable small blockholders to exert collective influence are therefore important. We present a model in which one or more sizeable lead activists implicitly coordinate with many smaller followers in engaging target management. Our model formalizes a key source of complementarity across the engagement strategies of institutional blockholders, arising from their motivation to attract investment flows, which overcomes free riding even for small blockholders and enables coordinated engagement. We also characterize how wolf packs form.

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Keywords: corporate governance, blockholder monitoring, institutional investors, reputation concerns, strategic complementarity

JEL Classifications: G23, G34

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# Wolf Pack Activism *

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February 2018

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Blockholder monitoring is key to corporate governance, but blockholders large enough to exercise significant unilateral influence are rare. Mechanisms that enable small blockholders to exert collective influence are therefore important. We present a model in which one or more sizeable lead activists implicitly coordinate with many smaller followers in engaging target management. Our model formalizes a key source of complementarity across the engagement strategies of institutional blockholders, arising from their motivation to attract investment flows, which overcomes free riding even for small blockholders and enables coordinated engagement. We also characterize how wolf packs form.

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# 1 Introduction

Starting with Shleifer and Vishny (1986), economists have recognized the key role of blockholders in ameliorating problems arising from the separation of ownership and control. In particular, the concentration of ownership in the hands of a single large shareholder has been shown to enhance firm value, and more so the larger is the block. However, while blockholding is widely prevalent in the U.S., most blockholders are not large enough to exert significant unilateral influence in the face of recalcitrant management. Holderness (2009) documents that 96% of U.S. firms have at least one blockholder with 5% ownership. Yet, La Porta, Lopes de Silanes, and Shleifer (1999) document that 80% of the largest U.S. firms lack any single blockholder with a stake of at least 20%, a level that they argue generates effective control. Using data on a broader sample from Dlugosz et al (2006), we find that fewer than 15% of U.S. firms have a 20% outside blockholder.[1] As a result, mechanisms that enable small blockholders to gain collective influence are key to effective monitoring.

In this paper, we theoretically examine how small blockholders may gain such collective influence. Our study is of applied relevance because market observers allege that institutional investors do, in fact, act in concert to magnify each other's influence over management. For example, legal scholars allege that activist hedge funds often implicitly team up with other institutional investors to form so-called "wolf packs".[2] Anecdotal evidence suggests that campaigns spearheaded by one (or more) activist

[1]LaPorta et al (1999) also consider a smaller threshold of 10% for robustness and find no greater incidence of controlling blocks in the US. Using the 10% threshold in the Dlugosz et al (2006) data, we find that over half of US firms have no controlling outside blockholder.

[2]See, for example, Briggs (2006), Nathan (2009), Coffee and Palia (2015). The use of the wolf pack tactic to overcome management resistance has attracted a great deal of attention. For example, legistlation recently proposed in the U.S. Senate in response to the rise of hedge fund activism (the Brokaw Act) cites protecting businesses from activist wolf packs as a central goal. In addition, U.S. courts have upheld the use of unconventional measures undertaken by corporations to defend against wolf packs (Third Point LLC vs Ruprecht, 2014).

hedge funds with sizeable stakes often receive implicit support from fellow investors – both hedge funds and other institutional investors – with smaller stakes that do not cross the relevant reporting threshold. For example, the 2005 activist campaign led by TCI (8% stake) against Deutsche Borse received support not only from two other visible activists (Atticus 6.5% and Och-Ziff 5%), but also from participants with much smaller stakes, e.g., Jana 2%, Third Point 2%, RIT 1%, Alta 1%, and Parvus 1%.[3] The phenomenon is fairly widespread. For example, in conversation with us in 2016, Thomas Kirchner of Quaker Funds, an event-driven mutual fund that buys small ($< 1\%$) stakes in target firms in the immediate aftermath of 13-D filings by activist hedge funds, described the process by which lead and supporting activists interact as follows: "Lead activists are very well aware that there may be followers with smaller stakes like Quaker that will support them in a campaign, yet it's formally uncoordinated. Investors understand the activist's playbook and how their interests are aligned."

The success of an activism campaign therefore may depend on the participation of both sizeable leaders and smaller players with whom they are not formally coordinated. In our view, it is the support of these smaller players that is the most puzzling. This is because share price appreciation—the key consequence of a successful activism campaign—is poorly suited to fostering collective action among players who are small. Indeed, any given owner's incentive to engage with management is decreased by the engagement of others if share price appreciation is the sole source of benefits to activists. This is because, if sufficiently many others engage, then activism succeeds and price appreciation accrues to each small owner regardless of their own action.

We present a model of wolf pack activism that first and foremost provides a founda-

[3]Support from those with smaller stakes was revealed as a result of a leaked email published in Der Spiegel on 17 April 2015. We are very grateful to Julian Franks for providing us with this example.

tion for coordinated engagement among institutional investors with small blocks. In our model, wolf pack members are delegated portfolio managers that compete for the capital of investors who, in turn, choose among managers based on perceived skill. We show that such competition is sufficient to generate strategic complementarities that form a basis for group activism in the absence of formal coordination among investors.[4] Thus, we provide a microfounded mechanism to overcome free-riding by small blockholders in corporate governance. In addition, our model provides a dynamic characterization of trading decisions that anticipate the emergence of group activism.

In our baseline model, one large investor (the "lead activist") and a continuum of small ones must choose whether to engage with target management. Treating small institutional blockholders as a continuum helps us to emphasize the free-riding problem. We allow for multiple large investors in Section 3.4.[5] Each institutional owner can either engage target management—which requires their continued presence as owners—or exit their position by selling their stake. Activism is successful in raising firm value if the aggregate shareholdings of owners that choose to engage is sufficient to overcome the target managers' inclination and ability to resist. Each investor receives noisy private information about management's willingness to resist before making their engagement choice. Information quality differs across owners. Lead activists, as engagement spe-

[4]A starting point of our analysis is that the actions of the different investors is *formally* uncoordinated. This is consistent with legal constraints in the activism process: U.S. disclosure rules (Regulation 13D) require investors to file together as a group when their activities are formally coordinated. A group filing would potentially reduce trading profits and also risk triggering poison pills at an earlier stage, and therefore restrict the total holdings that can be achieved by the group. A distinct way to explicitly coodinate activities would be for the activist hedge fund to raise capital from other institutions ex ante and then unilaterally build up a stake that generates sufficient influence. However, in practice, this would be difficult, both because of poison pills and because crossing a 10% ownership threshold would render the activist fund an insider according to SEC regulation and subject their trades to greater scrutiny. Accordingly, our model features no pooling of capital and no direct communication between players, but rather provides a positive analysis that formalises the origins of implicit, endogenous coordination across stakeholders of different sizes.

[5]Between a tenth (in the extended Brav et al (2010) dataset, 1994 - 2011) and a quarter (in the Becht et al (2017) dataset, 2000-2010) of activism campaigns feature 13D filings by multiple activists.

cialists, have better information than small institutions. In turn, some "skilled" small institutions have better information than other "unskilled" small institutions.

Engagement is costly for institutional investors because of the opportunity cost associated with tying up capital in the target firm over the course of the campaign. As a result, we first show – as a benchmark – that the small institutions will never choose to engage in equilibrium if they *only* care about target share prices. Since small blockholders are never pivotal, and share price appreciation is non-excludable, it is never in their individual interest to pay the opportunity cost of engagement. Accordingly, coordinated engagement cannot arise in the absence of some excludable, i.e., private, benefit from activism.

Recognizing that wolf pack members are delegated portfolio managers suggests a potential source of such benefits. The empirical literature documents that a wide spectrum of money managers are subject to so-called "flow performance" relationships: their success relies on the approval of their investors.[6] Building on this, we model excludable rents as arising from competition for investor flows. Since skilled institutions have better information than unskilled institutions, they are better able to predict the viability of an activist campaign. Investors observe institutions' engagement choices (by observing their holdings) as well as the engagement outcome and make inferences about their ability. They believe that the information-gathering abilities of skilled institutions will result in higher future returns. As a result, a sufficient improvement in perceived ability (i.e., reputation) leads to additional inflow of capital for the institution, which represents an excludable rent. Since reputation is an equilibrium quantity, these rents are *endogenous*. We show that, in equilibrium, competition for flow generates strategic complementarity: rents arise only from participating in a successful activism campaign

[6] See, for example, Chevalier and Ellison (1997) for mutual funds or Lim, Sensoy, and Weisbach (2016) for hedge funds.

where success, in turn, is generated by sufficient participation. The key reason is that institutions who are unskilled *choose* never to engage, and thus it is only possible to stand out from the crowd by engaging. Engagement, in turn, delivers additional inflows of capital only in the case in which activism succeeds. Thus, competition for flows gives rise to coordinated engagement among small blockholders that enhances governance via shareholder activism.

Kedia, Starks, and Wang (2017) provide large sample evidence consistent with the idea that lead activists are supported in their engagement efforts by flow-motivated institutional investors who hold small blocks. They identify "activist friendly" institutions in a given firm by their previous record of voting against the firm's management in proxy votes, or voting against management of other firms targeted by activists. They show that greater ownership by such activist friendly institutions increases the probability of successful activism. Their sample consists of mutual funds, a class of institutions that are almost exclusively flow motivated due to their compensation structure (generally a flat fee based on assets under management). Similarly, Brav, Jiang, and Li (2017) find that activist hedge funds receive proxy voting support from mutual funds, especially from actively managed funds that are more likely to chase investor flows. Kedia et al also find that these activist friendly investors tend to remain invested in the firm following the initiation of an activism campaign for at least several quarters, which is consistent with our characterization of engagement. In our model, small skilled institutions remain invested in the firm if and only if they perceive that the campaign will be successful.

Our baseline model takes ownership stakes in the target firm as given. In the second component of our analysis, we develop a simple trading model that builds on our engagement model to characterize target share purchases by the lead activist and small institutions. Market observers highlight the dynamic nature of wolf pack formation, referring to a degree of unusual turnover around the declaration of a campaign by an activist hedge fund. For example, Nathan (2009) writes:

> The market's knowledge of the formation of a wolf pack (either through word of mouth or public announcement of a destabilization campaign by the lead wolf pack member) often leads to additional activist funds entering the fray against the target corporation, resulting in a rapid (and often outcome determinative) change in composition of the target's shareholder base seemingly overnight.

Furthermore, using U.S. activism data from 1994 to 2011 and focusing on the ten-day period following 13D filings, we find that for the largest tercile of firms—where activists are most likely to require the support of wolf packs—there is average abnormal turnover of over 30% of the activist's typical stake. This suggests that non-trivial wolf pack trading occurs after the public declaration of activism.

In our trading model, we assume the firm's free float is initially owned by passive investors who do not participate in activism. The lead activist first decides whether and how much to buy, and small institutions of unknown skill observe the lead activist's decision and then make their own purchase decisions. We show that the lead activist is more likely to buy the larger is the expected wolf pack, and that wolf pack members are more likely to buy the larger is the lead activist's stake.

Our model generates endogenous turnover in target firm shares because there can be gains from trade (even in the absence of any market frictions) between the initial owners of the firm and potential entrants in the form of small institutions because the latter assign positive probability to the prospect of earning inflows of capital to manage. The formation of a wolf pack is therefore synonymous in our model with turnover in the ownership of the target firm. We describe the testable implications of our model for turnover around 13D filings in Section 4.

**Related literature.** Our paper relates to three strands of the literature. At the most applied level, we contribute to the growing literature on hedge fund activism (surveyed by Brav, Jiang, and Kim, 2010). Our analysis provides one explanation for how activist hedge funds can create fundamental change at target companies in the face of hostile managers while typically owning only around 6% of the company's shares.

At a theoretical level, our analysis is related to the literature on blockholder monitoring (surveyed by Edmans 2014). Papers in this literature tend to focus either on blockholders who (as in our model) exercise "voice" by directly intervening in the firm's activities, or those who (unlike in our model) use informed trading, also called "exit," to improve stock price efficiency and encourage correct actions by managers. A few papers (e.g., Maug, 1998; Kahn and Winton, 1998; Faure-Grimaud and Gromb, 2004) allow blockholders to choose between exerting voice and exiting—a choice that blockholders also make in our model. Relative to these papers, exit is a less attractive option in our model since there are no trading profits, but voice is harder to motivate due to extreme free riding.

Dasgupta and Piacentino (2015) show that the ability to use exit as a governance mechanism is hindered when the blockholder is a flow-motivated fund manager. Flow motivations, modeled via reputational concerns, also play a key role in our paper. In contrast to Dasgupta and Piacentino (2015), in our paper reputational concerns play a positive role in creating a basis for group activism.

Several existing papers discuss the implications of having multiple blockholders. Winton (1993) shows that disaggregation of a block among multiple shareholders makes it harder to overcome free rider problems in monitoring. Zwiebel (1995) models the sharing of private control benefits as part of a coalitional bargaining game, and derives the equilibrium number and size of blockholders who try to optimally capture these benefits. Edmans and Manso (2011) model a group of equal-size block holders and ask whether their impact through both exit and voice is larger or smaller than if the same block were held by a single entity. Their main result is that while having a disaggregated stake makes voice less productive due to free rider problems, it helps make the exit channel more effective since the blockholders trade more aggressively when competing for trading profits. We take a very different perspective, asking how the activities of blockholders of different size affect their ability to implicitly coordinate around a target, and how it affects their initial decision to buy a block.

Noe (2002) studies a model in which strategic traders may choose to monitor management, which improves value. In his model, monitoring activities undertaken by different investors are perfect substitutes (i.e., if any one investor monitors, the full improvement in value is achieved), and the strategic investors play mixed strategies, where they generally mix between monitoring and buying vs not monitoring and selling. Instead of studying coordination among these monitors, therefore, Noe focuses on showing that there can be multiple monitors despite the substitutability because of trading opportunities in noisy financial markets. Cornelli and Li (2002) show how one or more traders (arbitrageurs) can accumulate enough shares to provide a solution to the free-rider problem in a takeover game by tendering their acquired shares. They focus on how noise in the market allows such traders to hide their trades in order to acquire the requisite number of shares, profiting from their privately held knowledge of entry. In contrast, we consider a noise-free market, in which all trades are transparent. Our focus, therefore, is not on how one or more shareholders are incentivized to become large by the possibility of trading profits, but rather on how a large number of infinitesimal shareholders can support a single large shareholder in her engagement efforts in the aftermath of trading, and how the endogenous private benefits generated by this engagement game can induce them to buy shares ex ante.

Finally, our paper makes a methodological contribution to the literature on global games (surveyed by Morris and Shin 2003). In this literature, equilibrium multiplicity in coordination games is resolved by assuming that players with complementary strategies receive noisy private signals. While existing papers take complementarities across players' strategies as given, in our model complementarities arise endogenously via the reputational concerns of small institutions: the payoffs for skilled institutions arise as a result of the equilibrium behavior of unskilled institutions.

# 2 The Benchmark Model

## 2.1 The Target Firm

Consider a publicly traded firm that is amenable to shareholder activism, in that value can be created by inducing a change in management's policies. Such a change can be induced only if investors who own shares successfully engage with management. All players are risk neutral.

**Ownership.** The firm has a continuum of shares outstanding of measure 1, of which a measure $\bar{A} \in (0, 1)$ is held by outsiders. The remaining shares are owned by insiders, such as management or founders, who are committed to the current operating strategy. Outside ownership is made up of three groups. A measure $A_L$ of shares is owned by a single "lead" activist investor. A measure $A_s$ is held by a continuum of small institutional blockholders. Treating small insititutional blockholders as a continuum helps us to emphasize the free-riding problem. The remainder $\bar{A} - A_L - A_s$ is owned by households. Households are passive and never engage management. We endogenize ownership in Section 4.

**Management intransigence.** The firm is characterized by $\eta \sim N\left(\mu_\eta, \frac{1}{\alpha_\eta}\right)$, a variable that measures the degree of difficulty in implementing changes in strategy. A natural source of such difficulty—which may vary across firms—is the willingness of current management to resist any proposed changes to strategy. We therefore refer to $\eta$ as management *intransigence.*

**Shareholder engagement.** Engagement succeeds if the measure of shares that engage, $m_e$, is no smaller than $\eta$: if $m_e \geq \eta$, the firm's value at the end of the game will be $P_h$, while otherwise it will be $P_l < P_h$. This "threshold" characterization is meant to capture the idea that, for any given level of management intransigence, there is some level of pressure from shareholders that will induce them to modify strategy, i.e., to "settle" with activists, perhaps because they become convinced that ultimate victory is unlikely enough should a formal proxy fight arise.[7] Since institutional owners are the only players who may engage, $m_e < \bar{A}$, and thus activism has some chance of success if and only if $\eta < \bar{A}$. To avoid biasing the model in favor of successful activism, we center intransigence on the measure of outside ownership, i.e., set $\mu_\eta = \bar{A}$, implying that there is never more than a 50% chance that activism succeeds.[8]

## 2.2 Institutional blockholders

**Information.** Institutional blockholders are distinguished by their quality of information about managerial entrenchment. In particular, each small institutional block-

[7]Accordingly, $\eta$ does not necessarily correspond to a particular voting threshold. Bebchuk et al (2016) document that a large and increasing number of activist campaigns result in such settlements rather than in formal proxy fights.

[8]Our qualitative results do not require that $\eta$ has a mean of $\bar{A}$. Choosing a different mean would simply shift the parameter spaces over which the characterizations in Propositions 2 and 3 are valid.

holder has a type ($\theta$) where $\theta \in \{G, B\}$. Type $G$ (i.e., skilled) institutions observe $\eta$ with small amounts of idiosyncratic noise at the beginning of the game. The noise in observing intransigence can be thought to be the result of (potentially imperfect) due diligence (research) carried out by each institution into the target firm. Each such skilled institution $i$ receives a private signal $x_{s,i} = \eta + \frac{1}{\alpha_s}\epsilon_{s,i}$ where $\epsilon_{s,i}$ is standard normal, independent of $\eta$, and iid across institutions. The parameter $\alpha_s$ measures the precision of the signal. Type $B$ (i.e., unskilled) institutions do not receive signals about $\eta$. Small institutions do not initially know their types but do know that, ex ante, $Pr(\theta = G) = \gamma$. They learn their types by observing whether or not they receive a signal. The lead activist observes $\eta$ perfectly at the beginning of the game, reflecting the fact that she specializes in activist strategies and enjoys an information advantage relative to smaller institutions.[9]

**Actions and payoffs.** Based on their information, each institutional blockholder must choose (simultaneously) whether to stay invested in the firm and engage target management ($E$) or exit their investment ($N$). Any institution that engages receives a final cash flow benefit commensurate to their proportionate ownership of the firm. If engagement succeeds, the lead activist who engages receives cash-flow benefits of $A_L P_h$ while—if a proportion $m_e^s$ of small institutions engaged—the engaging institutions would receive $A_s m_e^s P_h$ cash-flow benefits in aggregate, resulting in a payoff of $\frac{A_s m_e^s P_h}{A_s m_e^s} = P_h$ each. In case engagement fails, the corresponding payoffs are $A_L P_l$ and $P_l$ respectively. On the other hand, any institution that exits sells their investment to a risk neutral and competitive market maker who observes the identity of each seller and the volume transacted.

[9]It would be conceptually straightforward, though algebraically tedious, to generalise the information structure to cases where $L$'s information was imperfect but superior to that of the small institutions.

We think of activism campaigns as being led by a visible activist who is potentially supported behind the scenes by smaller institutions. Spearheading a campaign clearly requires the lead activist to commit capital over time and expend significant effort. Accordingly we assume that the lead activist incurs a total engagement cost $e_L$, reflecting the sum of opportunity costs of capital and effort costs. We are agnostic about the precise role played by small institutions in an activism campaign.[10] However, for small institutions to provide *any* form of credible support to the lead activist it is a necessary condition that they remain invested in the firm throughout the course of the activism campaign. Accordingly we assume that engaging the target costs each small institution $c_s$, reflecting the opportunity cost of tying up their capital in the target firm over the course of the campaign.

**Excludable benefits for the lead activist.** Since the lead activist takes a visible role in leading the activism campaign, it is natural to assume that she receives some excludable benefits conditional on the success of the campaign. We denote such benefits by $\beta_L$ and assume that $\beta_L > e_L$. There are many ways in which such benefits can arise. For example, activist hedge funds managers often appoint representatives to corporate boards as part of a successful campaign. This can endow them with valuable soft information or other private benefits.

## 2.3 No Wolf Packs: A free-riding benchmark

In this section we establish our benchmark result. At the beginning of the game, a measure $A_s\gamma$ of small institutions receive signals whereas the remainder (of measure $(1-\gamma)\,A_s$) do not. Since successful engagement becomes less likely the higher is $\eta$ and

[10] This may range, for example, from explicit behind the scenes pressure on management (McCahery, Sautner, and Starks, 2016) to passive support implicit in remaining invested until a potential proxy vote where it is understood that small institutions would support the lead activist.

because $E[\eta \mid x_{s,i}] = x_{s,i}$, throughout the paper we consider strategies for informed agents that are monotone in their signals. We allow for arbitrary strategies for uninformed agents.

**Proposition 1.** *In equilibrium the lead activist engages if and only if $\eta \leq \eta_s^{'} \equiv A_L$ and the small institutions never engage.*

All proofs are in the appendix. The intuition is as follows. Consider any small institution. If he chooses to hold on to his investment and engage, he sinks an opportunity cost $c_s$ and receives $P_h$ if engagement succeeds and $P_l$ otherwise. If, instead, he exits his investment, he then receives the market price upon exit. The market price upon exit reflects any inferences that can be drawn from observing the volume of trade. Since there is a continuum of institutions, in any monotone equilibrium the measure of institutions that sell will fully reveal management's intransigence level and (trivially) the measure of engaging institutions. Thus, the exit price will be exactly equal to the post-engagement firm value. In other words, by exiting the agent receives $P_h$ if engagement succeeds and $P_l$ otherwise without sinking any opportunity cost. Clearly, he will choose not to engage. Since no small institution engages, the lead activist will engage if and only if she can succeed on her own, i.e., if $\eta \leq \eta_s^{'} \equiv A_L$. In other words, wolf packs cannot arise in the benchmark version of our model.

At the broadest level, this benchmark is a special case of the free-riding results of Grossman and Hart (1980), Shleifer and Vishny (1986) and others: since rents accruing from price increases are non-excludable, no small institution that neglects the possibility of being pivotal will ever find it optimal to engage. We show below that the reputational concerns of institutional blockholders can help to overcome such free-riding.

# 3 Overcoming free-riding

## 3.1 Flow-motivated small institutional blockholders

To provide a potential solution to the free-rider problem for small institutions, it is necessary to model a source of excludable rents. To do so, we now recognize that small institutional blockholders are usually delegated portfolio managers whose success relies on the approval of their investors. Building on this, we model excludable rents as arising endogenously from a reputational mechanism in which small institutions can gain a reputation for being skilled via their participation in successful activism campaigns. All other elements of the model (including the cash flow benefits to all institutions and the lead activist's excludable benefits) remain unchanged.

We begin by describing investors who allocate funds to small institutions. The investor universe is made out of two classes. The first class is made up of investors who are not financially literate, i.e., the "dumb money." These investors cannot invest directly and do not understand complex investment strategies. Being aware of their own limitations, they are highly fee sensitive and are willing to pay only such low fees that managing dumb money is a zero NPV enterprise for institutions. The other class of investors are financially literate and of high intrinsic ability, i.e., "smart money." These investors are able to invest directly in financial markets without paying fees. Given their high intrinsic skills, these investors find it optimal to delegate only to institutions whose reputation for being informed is sufficiently high to indicate outperformance in the future.

The aggregate size of smart capital is large in comparison to the potential supply of reputable institutions, each of whom can only operate at finite scale. The smart money investors are willing to pay higher fees to institutions they hire, representing an

NPV of $R > 0$ at the optimal scale of operation to each small institution that attracts smart money. Since this incremental payoff is available only to funds with a sufficiently high reputation, we refer to $R$ as a *reputational rent*. Smart money investors monitor all available small institutions, and update their beliefs about each institution's type to some posterior $\widehat{\gamma}$ after they observe the outcome of the activism campaign and the institution's choices (engage or exit). If the posterior is high enough, i.e., $\hat{\gamma} \geq B$ for some $B \in (\gamma, 1)$, the smart money investors invest with the small institution which therefore gets the reputational rent $R$. It is worth noting that investors only have to observe whether or not a small institution stayed invested, and not the details of any potential engagement actions they might undertake. Since activism campaigns generally take place over many months, even standard regulatory filings will reveal institutional holdings at a sufficient frequency for such inferences.

## 3.2 Wolf Packs

In this section we present our main results showing that flow motivations of small institutions can overcome free riding and enable successful wolf pack activism. In our model, a measure $A_s(1-\gamma)$ of small institutions will discover at the beginning of the game (by not receiving a signal) that they are unskilled. For technical reasons we assume that a small measure $\lambda$ of these institutions randomize non-strategically, engaging with probability 1/2. In the sequel to Proposition 2 we let $\lambda \to 0$. The introduction of these randomising types ensures that an unskilled type can never gain reputation by taking the *wrong* action (i.e., engaging when engagement fails).[11]

[11] When skilled players have noise in their signals of $\eta$, with some probability they will make a mistake and engage when engagement fails. If in a proposed equilibrium all unskilled types are supposed to *not* engage, then choosing to engage can result in the inference that you are a good type even when you took the wrong action, i.e., that you are a skilled type who happened to get an incorrect signal. Adding a small amount of randomization that is commensurate with the amount of noise in the signals

Apart from the lead activist, there are three groups of institutional investors: (i) Skilled ($\theta = G$) small institutions in measure $A_s\gamma$, (ii) unskilled ($\theta = B$) small institutions in measure $A_s (1-\gamma)(1-\lambda)$, and (iii) randomizing small institutions in measure $A_s (1-\gamma)\lambda$. We start with the case where the magnitude of potential rents from acquiring a reputation for being informed are not too large, and subsequently analyze the case with larger reputational rents.

**Proposition 2.** *For $R \in (c_s, 2c_s)$ and $\lambda < \min\left[\frac{2\gamma(1-B)}{(1-\gamma)B}, \frac{2(B-\gamma)}{(1-\gamma)B}\right]$, there exists $\underline{\alpha}(\lambda) \in \mathbb{R}_+$ such that for all $\alpha_s \geq \underline{\alpha}(\lambda)$ in equilibrium:*

*(i) unskilled small institutions never engage*

*(ii) skilled small institutions engage iff their signal is below a unique threshold $x_s^*$,*

*(iii) engagement succeeds iff management intransigence is below a unique threshold $\eta_s^*$,*

*(iv) the lead activist engages if and only if $\eta \leq \eta_s^*$.*

*In the limit as $\alpha_s \to \infty$, the thresholds are given by:*

$$x_s^* = \eta_s^* = A_L + \gamma A_s\left(1 - \frac{c_s}{R}\right) + \frac{1}{2}A_s(1-\gamma)\lambda.$$

Since the lead activist's strategy is trivial—she engages whenever engagement will succeed—we provide intuition only for the behavior of the small institutions in the limiting case in which $\alpha_s \to \infty$. We first note that whenever skilled institutions employ monotone strategies with threshold $x_s^*$, there exists a critical threshold level of $\eta$, which we label $\eta_s^*$, such that engagement succeeds if and only if $\eta \leq \eta_s^*$. Further, it is easy to check that as $\alpha_s \to \infty$, $x_s \to \eta$ and $x_s^* \to \eta_s^*$. In other words, in threshold equilibria, skilled institutions always make correct choices in the limit as noise vanishes. This means that unskilled institutions can never earn reputational rents by engaging when

eliminates this unrealistic possibility.

engagement fails or not engaging when it succeeds.

Now consider the possibility that unskilled institutions always engage in equilibrium. Then, when engagement succeeds, the only owners who exit are randomising unskilled institutions. When $\lambda$ is small enough, almost all institutions, whether skilled or unskilled, choose to engage. Thus, the posterior update to reputation from engaging in the case engagement succeeds is very small, and not enough to generate reputational rents $R$. Yet, since skilled institutions never engage when engagement fails as $\alpha_s \to \infty$, there are also no reputational rents arising from engagement in case of failure. In effect, there are no reputational rents to be earned from engaging. Thus, their engagement incentives are identical to those in the case without flow motivations (Section 2.3) and it cannot be an equilibrium for unskilled institutions to always engage in equilibrium.

Next, consider the possibility that unskilled institutions never engage (i.e., always exit) in equilibrium. Then, by a similar argument to the previous case, there are no reputational rents to non-engagement as $\alpha_s \to \infty$ and for small enough $\lambda$. Engaging however, does deliver reputational rewards in case of success, because all skilled institutions engage in this case if $\alpha_s \to \infty$, whereas, for small $\lambda$, essentially no unskilled institution does. Thus, unskilled institutions would wish to deviate and engage if the expected reputational benefit from engagement exceeds its cost. Viewed from the perspective of uninformed unskilled institutions, the expected benefit is strictly smaller than $\Pr\left(\eta \leq \bar{A}\right) R = R/2$, however, whereas the cost is $c_s$. Thus, the condition $R < 2c_s$ is sufficient to ensure that the deviation is unattractive, and it is indeed an equilibrium for unskilled instutions to never engage. An important economic implication of this is that reputational rents can be achieved only by participating in a successful activism campaign. There are never rents for exiting, even when activism fails. The proof in the appendix also shows that unskilled institutions never mix in equilibrium

| Excludable payoffs | Engagement succeeds | Engagement fails |
|---|---|---|
| Engage | $R - c_s$ | $-c_s$ |
| Exit | 0 | 0 |

Table 1: Equilibrium excludable payoffs for skilled institutions

for $R \in (c_s, 2c_s)$.

We now turn to the skilled institutions. Since, as in Section 2.3, exit prices are fully revealing, the choice of whether to engage or not is only affected by reputational rents. As explained above, since unskilled institutions never engage in equilibrium, skilled institutions can only earn reputational rents by engaging when engagement succeeds. As a result, their reputational rents can be summarised as in Table 1.

The payoffs in Table 1 take the form of a standard binary action coordination game. If it were common knowledge among the skilled institutions that $\eta \in (0, \gamma A_s)$, then there would be multiple equilibria, including one in which *all* skilled institutions engage, and one in which *none* do. However, with incomplete information about $\eta$ as in our game, the equilibrium behavior of skilled institutions is uniquely pinned down. To understand why, note that the payoffs of any given skilled institution are determined jointly by the exogenous level of intransigence, $\eta$, and the endogenous measure of other skilled institutions who engage. In other words, in addition to uncertainty about $\eta$, *strategic uncertainty* also matters. With common knowledge of $\eta$, neither type of uncertainty is relevant. In the $\alpha_s \to \infty$ limit, however, while uncertainty about $\eta$ vanishes, strategic uncertainty does *not* vanish. As $\alpha_s \to \infty$, each skilled institution remains highly uncertain about his *relative* ranking in the population of skilled institutions. In particular, each skilled institution has *uniform* beliefs over the *proportion* of skilled institutions who have received signals about $\eta$ which are lower than his own. The presence of such strategic uncertainty limits the precision with which skilled agents can coordinate with each other and eliminates multiplicity. This insight derives from the literature on global games (surveyed by Morris and Shin 2003). In the global games literature, however, complementarities across players' strategies is taken as given. In our model, complementarities arise *endogenously* via the reputational concerns of small institutions: the payoffs for skilled institutions in Table 1 arise as a result of the equilibrium behavior of unskilled institutions.

Using the characterization of strategic uncertainty described above in the $\alpha_s \to \infty$ limit delivers a heuristic method for computing the threshold $\eta_s^*$, as follows. The skilled institution with signal $x_s^*$ must be indifferent between engaging and exiting. Further, all skilled institutions with signals lower than his will wish to engage. Let the proportion of skilled institutions with signals lower than his be denoted by $m_e^s$. Then in the limit as $\alpha_s \to \infty$, the skilled institution with signal $x_s^*$ believes that $m_e^s \sim U(0,1)$. Consider the case where $\lambda \to 0$, so that there are now no randomising unskilled institutions. Then since unskilled institutions do not engage, this skilled institution's evaluation of the probability of successful engagement is simply $\Pr(A_L + \gamma A_s m_e^s \geq \eta_s^*)$. Since $m_e^s \sim U(0,1)$ this can be rewritten as $1 - \frac{\eta_s^* - A_L}{\gamma A_s}$, giving rise to the indifference condition:

$$R\left(1 - \frac{\eta_s^* - A_L}{\gamma A_s}\right) = c_s,$$

which immediately implies that $\eta_s^* = A_L + \gamma A_s \left(1 - \frac{c_s}{R}\right)$, which is exactly the value of $\eta_s^*$ in Proposition 2 for $\lambda \to 0$.

We can now utilize the limiting properties of beliefs in our game to characterize equilibria for $R > 2c_s$ when noise vanishes. In particular, we can show that the pure strategy equilibrium derived above continues to exist for higher levels of reputational rents, but only up to a point. For excessively high rents, it becomes too tempting for unskilled institutions to engage in an attempt to capture these rents, thus making it impossible for anyone to gain reputation. In addition, we show that for moderate levels of reputational rents, a mixed strategy equilibrium co-exists with the pure strategy equilibrium. In the mixed strategy equilibrium, unskilled institutions engage with some probability while skilled institutions follow a threshold strategy similar to that in the pure strategy equilibrium. Formally, we show:

**Proposition 3.** *For $\lambda < \min\left[\frac{2\gamma(1-B)}{(1-\gamma)B}, \frac{2(B-\gamma)}{(1-\gamma)B}, \frac{\gamma}{1-\gamma}\right]$, there exist $\bar{R} > \underline{R} > 2c_s$ such that in the limit as $\alpha_s \to \infty$ :*

*I. For $R \in \left(2c_s, \bar{R}\right)$, there exists a pure strategy equilibrium that is identical to the one characterized in Proposition 2.*

*II. For $R \in \left(\underline{R}, \bar{R}\right)$, there also exists a mixed strategy equilibrium in which*

*(i) unskilled small institutions engage with probability $p_e$,*

*(ii) skilled small institutions engage iff their signal is below a unique threshold $\hat{x}_s$,*

*(iii) engagement succeeds iff management intransigence is below a unique threshold $\hat{\eta}_s$,*

*(iv) the lead activist engages if and only if $\eta \leq \hat{\eta}_s$,*

*where:*

$$\hat{x}_s = \hat{\eta}_s = A_L + \gamma A_s \left(1 - \frac{c_s}{R}\right) + (1-\gamma) A_s p_e + \frac{1}{2} A_s (1-\gamma) \lambda$$

*and*

$$p_e = \frac{1}{(1-\gamma) A_s} \left[\bar{A} - A_L - \gamma A_s \left(1 - \frac{c_s}{R}\right) - \frac{1}{2} A_s (1-\gamma) \lambda + \frac{1}{\sqrt{\alpha_\eta}} \Phi^{-1} \left(\frac{c_s}{R}\right)\right].$$

Though multiple equilibria exist for the parameter space $R \in \left(\underline{R}, \bar{R}\right)$ they are qualitatively similar. In particular, as we show in the proof in the appendix, in neither equilibrium is it possible to gain reputation by exiting when engagement fails. Indeed, it would be hard to sustain such behavior in equilibrium because it requires that unskilled institutions be willing to pay the cost of remaining invested and engaging even when reputation can potentially be gained simply by exiting.

### 3.3 Feedback between wolf packs and lead activists

The results above allow us to characterize how the presence of flow motivated small investors in wolf packs affect the strategy of the lead activist. In particular, when a lead activist can rely on the presence of a wolf pack, she becomes more aggressive in her engagement strategy, and as a result engagement succeeds more often. Formally, for $\lambda \to 0$:

**Corollary 1.** *There exists a range of intransigence levels* $min[\hat{\eta}_s, \eta_s^*] - \eta_s^{'} = \gamma A_s \left(1 - \frac{c_s}{R}\right)$ *for which engagement succeeds if and only if small institutions are flow motivated.*

We emphasize that flow motivations are not only sufficient, but also necessary for this result since as $R \to c_s$, i.e., as net reputational rents vanish, $min[\hat{\eta}_s, \eta_s^*] - \eta_s^{'} \to 0$.

While our focus is on the effect of wolf packs on the leader, there is a *distinct* mechanism by which the leader also has an effect on the aggressiveness of the wolf pack. In particular, it is clear that the intransigence threshold below which engagement succeeds ($\hat{\eta}_s$ or $\eta_s^*$) increases in the size of the leader's stake, $A_L$, and at a higher rate than it increases in $A_s$. Thus, replacing some measure of small institutions with a single large player with that measure of ownership causes everyone to engage more often by implicitly improving coordination. This coordination effect arises from the known effect of incorporating a large player in a coordination game (Corsetti et al 2004).

## 3.4 Model generalizations

**Multiple Lead Activists.** In our baseline analysis we consider only one lead activist, but empirically there are sometimes multiple activists with stakes large enough to require 13D filings (Becht et al, 2017). The model can be generalized to allow for this. For instance, imagine there are $K$ lead activists each with a stake of size $A_L/K$, each of whom observes $\eta$ without error, and each of whom has an excludable benefit $\beta_L^i$ from successful activism along with an engagement cost $e_L^i < \beta_L^i$, where $i \in \{1, ..., K\}$. In this case, it is straightforward to see that they will tend to act together in any equilibrium since they all face qualitatively identical incentives. Thus, whenever they perceive that engagement will succeed, they will wish to engage to capture their excludable benefit, and whenever they perceive that engagement will fail they will want to exit. The only complication relative to the model above is that the probability of success will depend upon the exact number of lead activists that engage, which creates an additional coordination problem and therefore may potentially give rise to multiple equilibria.

However, there always exists an equilibrium with $K$ lead activists that replicates the baseline analysis. In particular, there exists an equilibrium in which each of the $K$ lead activists engages if and only if the total lead activist capital engaging is $K \cdot \frac{A_L}{K} = A_L$, and small institutions best-respond to such behavior. This equilibrium delivers identical outcomes to that in which a single lead activist of size $A_L$ engages if and only if engagement succeeds with her individual participation.

**Richer Reputation Rents.** In our baseline analysis reputation rents are all or nothing: i.e., an institution gets a benefit of $R$ if and only if they reach a sufficiently high reputation $B$. The model can be generalized to allow for richer structures of reputation rents. For example, imagine that a reputation lower than the prior $\gamma$ delivers a negative reputation rent $R_0 < 0$, a reputation higher than $B$ delivers a large rent $R_2 > 0$, whereas an intermediate reputation in the range $(\gamma, B)$ delivers an intermediate rent $R_1 \in (0, R_2)$. It is then easy to show that the core workings of the model are unchanged in this richer case. For example, as long as $R_2 - R_0 > c_s$, i.e., opportunity costs are smaller than the largest potential incremental reputation gain, and $R_2 - R_1 < 2c_s$, i.e., the incremental payoff from a high reputation is not excessive, we can recover qualitatively identical outcomes to those described in Proposition 2.

# 4 Wolf pack formation

In this section we endogenize the ownership structure of the target firm in a two-period dynamic extension of the model. From here forward we refer to the activism game described above as the *activism period* ($t = 2$), and add an earlier *trading period* ($t = 1$). The firm enters the trading period in a state of "non-amenability" wherein it is commonly understood that no improvements can be made to its current operating strategy. Its ownership at that point consists of $1 - \bar{A}$ insider ownership and $\bar{A}$ outside ownership that is made up entirely of households. At the beginning of the trading period, the firm switches to a state of amenability with some probability, upon which the firm is described as in Section 2.

If and only if the firm becomes amenable to activism, the lead activist enters the model and considers whether to acquire a stake in the firm. Even though the lead activist does not expend effort during the trading period, buying in requires her to commit capital to the firm. Accordingly, parallel to the small institutions in the activism period she pays an opportunity cost of $c_L$ for buying in.[12] She faces a capital

[12] It would be straightforward to allow the opportunity cost to scale with the size of the lead activist's stake.

constraint whereby she can buy only up to a measure $\bar{A}_L < \bar{A}$. For simplicity, as in the activism game, all trades take place through a risk neutral and competitive market maker who observes the identity of each buyer and seller and the volume transacted, which implies that prices are always fair. We assume that households are always willing to buy or sell at fair prices, so the market maker can purchase shares from households to satisfy any demand from institutions that is less than $\bar{A}$ in aggregate. The lead activist's trading decision is immediately publicly observable.

Small institutions exist in a total mass $\bar{A}_s \leq \bar{A} - \bar{A}_L$ and observe both the firm's amenability and the lead activist's trading decision before deciding whether to purchase shares. If they do purchase shares, they are committed to holding their investment until the beginning of the activism stage, at which point they play the activism game described above. As in the activism period, they pay an opportunity cost for investing in the firm during the trading period. Since the time lag between their purchase and the start of the activism stage may be shorter than the time they have to stay invested in the activism stage if they choose to engage, we assume the opportunity cost for investing in the trading period is a scaled version of the opportunity cost in the activism period, i.e., $\delta c_s$ for some $\delta \in (0, 1]$.

## 4.1 Entry by small institutions

First consider the small institutions' purchase decision conditional on the lead activist's decision. Small institutions do not yet know their type, but purchasing shares at this stage allows them to potentially earn reputation rents $R$ in the activism period, should they turn out to be skilled. Throughout this section we focus on the limiting pure-strategy equilibrium in the activism period where $\alpha_s \to \infty$ and $\lambda \to 0$. Given this, a small institution's expected payoff for purchasing shares is given by

$$\gamma Pr\left[\eta \leq A_L + \gamma A_s\left(1 - \frac{c_s}{R}\right)\right](R - c_s) - \delta c_s,$$

where $A_L \in \left[0, \bar{A}_L\right]$ is the realized stake of the lead activist going into the activism stage and $A_s \in [0, \bar{A}_s]$ is the institution's expectation of the mass of small institutions that will purchase shares. Note that trading profits do not appear in this condition since prices are always fair and reflect all available information. We have the following result.

**Proposition 4.** *For any given $A_L$ there exist $\hat{c}(\bar{A}_s, A_L) < c^*(\bar{A}_s, A_L)$ such that for any $c \in [\hat{c}(\bar{A}_s, A_L), c^*(\bar{A}_s, A_L)]$ there exists an equilibrium in which each small institution buys in if and only if $c_s \leq c$. Furthermore, $\hat{c}(\bar{A}_s, A_L)$* and $c^*(\bar{A}_s, A_L)$ are both increasing in $A_L$, and $c^*(\bar{A}_s, A_L)$ is increasing in $\bar{A}_s$.

Any potential equilibrium must have a threshold characterization because, for any given level of ownership by the lead activist and other small institutions, each individual small institution will choose to buy in if and only if the opportunity cost $c_s$ is no higher than the expected equilibrium benefit. Further, the buying behavior of small institutions involves a feedback. If other small institutions are expected to buy in for a relatively high $c_s$ this encourages any given small institution to buy in for such $c_s$ because the presence of a larger measure of small institutions makes it more likely that engagement will succeed, giving a higher probability of earning the reputation rent $R$. However, eventually $c_s$ becomes high enough that even if all small institutions buy in and engage, it is still not attractive for individual institutions to buy in. In turn, if $c_s$ becomes sufficiently small, each institution would be happy to buy in no matter what other small instituions choose. Thus, there exist a continuum of potential threshold values of $c_s$, bounded between $\hat{c}(\bar{A}_s, A_L)$ and $c^*(\bar{A}_s, A_L)$, such that small institutions enter if and only if $c_s$ is below the equilibrium threshold.

The range of potential threshold values depend on whether the lead activist invested and on the ultimate size of her stake. This is because the participation of the lead activist, and her level of influence over the final outcome, affect the probability of successful engagement and thus the potential returns for small institutions. In addition, the range of potential threshold values depends on the maximal potential size of the wolf pack, measured by $\bar{A}_s$, since a larger wolf pack also increases the probability of successful engagement.

If the entry of the lead activist is synonymous with a 13-D filing, then Proposition 4 gives the empirical implication that abnormal turnover in target shares is more likely following a 13D filing, and more so the larger is the activist's stake and the larger is the likely pool of potential wolf pack members.

## 4.2 Entry by the lead activist

As we have shown above, the lead activist benefits from the support of wolf packs. The multiplicity identified in Section 4.1 requires that we make some selection with regard to the equilibrium behavior of small institutions. We focus on the pareto optimal equilibrium, where for any given $A_L$, small institutions buy in maximally, i.e., for $c_s \leq c^* \left(\bar{A}_s, A_L\right)$. With this selection, we have the following result.

**Proposition 5.** *The lead activist's buy in decision can be characterized as follows:*
*(i) If the lead activist buys in, she always buys up to her full capital limit* $\bar{A}_L$*.*
*(ii) There exists* $c_L^*(\bar{A}_s, c_s)$ *such that the lead activist will buy in conditional on amenability if and only if* $c_L < c_L^*(\bar{A}_s, c_s)$*.*

*(iii) The threshold $c_L^*(\bar{A}_s, c_s)$ is weakly increasing in $\bar{A}_s$ and is higher when a wolf pack is expected to materialize after the leader buys in, i.e., if $c_s \leq c^*\left(\bar{A}_s, \bar{A}_L\right)$.*

The lead activist's purchases at the trading stage affect her expected payoffs (arising from the activism stage) in two ways. First, by buying in larger quantities she directly affects the probability of successful engagement and thus raises the probability of earning excludable rents $\beta_L - e_L$. Second, her buying decision indirectly affects the probability of successful engagement by influencing the behavior of the small institutions. In particular, since $c^*(\bar{A}_s, A_L)$ is increasing in $A_L$, the lead activist can induce higher purchases (and thus higher expected support in engagement) by small institutions by purchasing a larger stake, as long as $c_s \leq c^*\left(\bar{A}_s, \bar{A}_L\right)$. Instead, if $c_s > c^*\left(\bar{A}_s, \bar{A}_L\right)$, even maximal purchases by the lead activist will not induce small institutions to buy in. However, even in this case the lead activist benefits from the direct effect of buying in larger quantities on the probability of successful engagement. Thus, regardless of the opportunity costs of small institutions and the mass of available such institutions, if the lead activist chooses to buy in, she will always do so maximally. However, whether she chooses to buy in at all depends on whether she can expect wolf pack support, and how large the wolf pack will be. In particular, the level of her own opportunity cost below which she will buy in increases if she expectes a wolf pack to materialize and, conditional on materializing, if the size of the wolf pack is larger. Thus, if the entry of the lead activist is synonymous with a 13-D filing, Proposition 5 gives the empirical implication that lead activists are more likely to file a 13D when they expect higher turnover in target shares.

## 4.3 Discussion

**Trading profits.** In our model markets are fully transparent for simplicity, ruling out trading profits. However, it is entirely possible that trading profits play a role in the formation of wolf packs. For example, prospective wolf pack members may be able to generate profits in non-transparent markets because of skill at predicting potential targets, or private pre-filing communication from lead activisits (i.e., tip-offs).[13] In our setting, this would enhance the incentive for buying in by small institutions, but would lead to their potentially trading at an earlier stage than our model envisions. Such trading profits would thus complement our mechanism.

It is also important to note that any trading profits must anticipate future potential increases in cash flows, which in turn arise from successful engagement. In order for wolf pack members' actions to be value relevant, they must affect the probability of successful activism, not just reflect rent seeking via trading. Our model of engagement provides a micro-foundation to understand how value-relevant actions by small wolf pack members can be supported in equilibrium.

**Coordination vs herding.** Our analysis features a static model of engagement in which complementarities arise endogenously, and a trading model which anticipates the subsequent engagement game. In our model, the entry of a lead activist precipitates additional entry by small institutions (and thus enhanced turnover) due to the fact that the lead activist's presence enhances coordinated engagement. Some elements of the abnormal turnover in wolf pack formation could also be interpreted as some form of herding. For example, wolf pack members could be irrationally following lead activists' buy-in decisions in the belief that it will lead to additional trading profits (even though

[13]Kovbasyuk and Pagano (2014) provide a theoretical analysis of the optimal strategy for publicizing arbitrage opportunities.

post-13D filing prices should anticipate any expected price appreciation).

More intriguingly, post-13D turnover could also be interpreted as reputational herding by flow-motivated mutual funds (Scharftein and Stein 1990). Our story is very different. In reputational herding models, a desire for conformity leads to a sequence of similar decisions as later decision makers wish to avoid being perceived in a negative light. In contrast, there is no desire for comformity in our trading model. The increased turnover in the trading model arises because the entry of the lead activist enhances subsequent coordination and thus improves the chances for successful engagement. The coordination motive, in turn, arises from the endogenous reputation mechanism in our static engagement game. Furthermore, in reputational herding models there is no real effect whereby many players taking a similar action leads to better economic outcomes. In our setting, reputation is important but it is gained only if coordinated action leads to successful activism.

Our model therefore provides a distinct empirical prediction that is not consistent with either of the herding frameworks: if, as we suggest, coordinated action leads to a higher probability of successful activism, then value creation in activism should be positively correlated with the realized size of the wolf pack.

# 5 Conclusion

The possibility of coordinated engagement by shareholders has important implications for corporate governance. In this paper we show that implicit coordination among institutional investors can play a powerful role in activist campaigns even when those institutions hold small blocks. One of the key characteristics of institutional investors, who now own a majority of corporate equity, is that they are delegated portfolio managers who rely on the continued approval of their investor base to be successful. As Franklin Allen emphasized in his AFA Presidential Address (Allen 2001), the incentives faced by money managers can have a significant impact on financial markets. Our study suggests that these incentives can have even wider-ranging implications, for example by affecting the nature of shareholder activism. In particular, we show that money managers' competition for investor capital can give rise to strategic complementarity in their engagement strategies, providing a basis for coordinated shareholder activism. Our analysis thus provides a lens through which to view activist wolf packs, a tactic that has generated significant attention.

Our results should enable empirical researchers to better study the mechanics and implications of wolf pack tactics. Future work could also examine the role that explicit collusion or intentional information leakage might play in either substituting for or complementing the implicit coordination mechanism we model.

# Appendix

**Proof of Proposition 1:** A monotone strategy for informed small institutions can be characterized by a threshold as follows:

$$\sigma_I(x_{s,i}) = \begin{cases} E & \text{if } x_{s,i} \leq x_s^* \\ N & \text{otherwise} \end{cases},$$

for $x_s^* \in \mathbb{R} \cup \{-\infty, \infty\}$. If informed agents follow monotone strategies with threshold $x_s^*$, denoting by $\sigma_U$ the proportion of uninformed small institutions that engage, the total mass of shares that engage if the lead activist engages is given by

$$A_L + A_s \gamma Pr(x_{s,i} \leq x_s^* \mid \eta) + (1-\gamma) A_s \sigma_U.$$

Engagement will succeed if and only if

$$A_L + A_s \gamma Pr(x_{s,i} \leq x_s^* \mid \eta) + (1-\gamma) A_s \sigma_U \geq \eta.$$

Since the right hand side is decreasing in $\eta$ while the left hand side is increasing in $\eta$, there is a $\eta^*(A_L, \sigma_I, \sigma_U)$ such that engagement succeeds for $\eta \leq \eta^*(A_L, \sigma_I, \sigma_U)$. The lead activist always engages whenever engagement succeeds with her participation because $\beta_L > c_L$. Hence, $\eta^*(A_L, \sigma_I, \sigma_U)$ is the relevant threshold to consider. Now consider an informed institution. His payoff to engaging is as follows:

$$Pr(\eta \leq \eta^*(A_L, \sigma_I, \sigma_U) \mid x_i) P_h + Pr(\eta > \eta^*(A_L, \sigma_I, \sigma_U) \mid x_i) P_l - c_s,$$

whereas his payoff to exiting is $E\left(P_{sell} \mid x_i\right)$, where $P_{sell}$ is the price at which he sells his shares upon exit. The monotonicity of strategies implies that the sales volume reveals $\eta$ and thus whether engagement succeeds or not. Hence

$$P_{sell} = \begin{cases} P_h & \text{if } \eta \leq \eta^*\left(A_L, \sigma_I, \sigma_U\right) \\ P_l & \text{otherwise} \end{cases}.$$

Thus, his payoff from exiting is

$$Pr\left(\eta \leq \eta^*\left(A_L, \sigma_I, \sigma_U\right) \mid x_i\right) P_h + Pr\left(\eta > \eta^*\left(A_L, \sigma_I, \sigma_U\right) \mid x_i\right) P_l,$$

which is strictly higher than his payoff to engaging. An identical argument holds for each uninformed institution. Given that small institutions never engage, $\eta^*\left(A_L, \sigma_I, \sigma_U\right) = A_L$.■

**Proof of Proposition 2:** Denote by $\mathbf{1}_L$ the indicator function that is equal to 1 if the lead activist is present. Denote the probability with which each unskilled institution engages by $p_e \in [0,1]$. $p_e$ is formally a function of $\mathbf{1}_L$, but we suppress this dependence here for notational brevity as we shall show below that the strategies of the small unskilled institutions are independent of the presence of the lead activist in equilibrium. The strategies of the skilled small institutions will depend on $\mathbf{1}_L$, $p_e$ and $\lambda$. Denote the threshold by $x_s^*\left(\mathbf{1}_L, p_e, \lambda\right)$. Since $x_{s,j}|\eta \sim N\left(\eta, \frac{1}{\alpha_s}\right)$, for each $\eta$, the measure of engagement by small institutions is given by

$$A_s \gamma \Pr\left(x_{s,j} \leq x_s^*\left(\mathbf{1}_L, p_e, \lambda\right)|\eta\right) + A_s\left(1-\gamma\right)\left(1-\lambda\right) p_e + A_s\left(1-\gamma\right)\frac{\lambda}{2}.$$

The lead activist will engage if present if and only if

$$A_L + A_s\gamma \Pr\left(x_{s,j} \leq x_s^*\left(\mathbf{1}_L, p_e, \lambda\right)|\eta\right) + A_s\left(1-\gamma\right)\left(1-\lambda\right)p_e + A_s\left(1-\gamma\right)\frac{\lambda}{2} \geq \eta.$$

Thus engagement is successful if and only if:

$$\mathbf{1}_L A_L + A_s\gamma\Phi\left(\sqrt{\alpha_s}\left(x_s^*\left(\mathbf{1}_L, p_e, \lambda\right) - \eta\right)\right) + A_s\left(1-\gamma\right)\left(1-\lambda\right)p_e + A_s\left(1-\gamma\right)\frac{\lambda}{2} \geq \eta.$$

The LHS is decreasing in $\eta$, the RHS is increasing in $\eta$, so there exists $\eta_s^*\left(p_e, \lambda\right)$ such that engagement is successful if and only if $\eta \leq \eta_s^*\left(p_e, \lambda\right)$, where $\eta_s^*\left(p_e, \lambda\right)$ is defined by

$$\begin{array}{c} \mathbf{1}_L A_L + A_s\gamma\Phi\left(\sqrt{\alpha_s}\left(x_s^*\left(\mathbf{1}_L, p_e, \lambda\right) - \eta_s^*\left(\mathbf{1}_L, p_e, \lambda\right)\right)\right) + \\ A_s\left(1-\gamma\right)\left(1-\lambda\right)p_e + A_s\left(1-\gamma\right)\frac{\lambda}{2} \end{array} = \eta_s^*\left(\mathbf{1}_L, p_e, \lambda\right). \tag{1}$$

Which implies that

$$x_s^*\left(\mathbf{1}_L, p_e, \lambda\right) = \begin{array}{c} \eta_s^*\left(\mathbf{1}_L, 0, \lambda\right) + \\ \frac{1}{\sqrt{\alpha_s}}\Phi^{-1}\left(\frac{\eta_s^*\left(\mathbf{1}_L, 0, \lambda\right) - \mathbf{1}_L A_L - A_s(1-\gamma)(1-\lambda)p_e - A_s(1-\gamma)\frac{\lambda}{2}}{A_s\gamma}\right) \end{array}.$$

Note that this implies that as $\alpha_s \to \infty$, $x_s^*\left(\mathbf{1}_L, p_e, \lambda\right) \to \eta_s^*\left(\mathbf{1}_L, 0, \lambda\right)$.

We now compute the posterior reputation of each small institution in equilibrium. Since individual small institutions may engage ($E$) or exit ($N$), and engagement may succeed ($S := \{\eta \leq \eta_s^*\left(p_e, \lambda\right)\}$) or fail ($F := \{\eta > \eta_s^*\left(p_e, \lambda\right)\}$), there are four possible posterior reputations: $\hat{\gamma}(S,E), \hat{\gamma}(F,E), \hat{\gamma}(S,N)$, and $\hat{\gamma}(F,N)$.

$$\begin{aligned}
\hat{\gamma}(S,E) &= \Pr(\theta=G|S,E) \\
&= \frac{\frac{A_s\gamma}{A_s}\Pr(S,E|\theta=G)}{\frac{A_s\gamma}{A_s}\Pr(S,E|\theta=G)+\frac{A_s(1-\gamma)(1-\lambda)}{A_s}\Pr(S)\,p_e+\frac{A_s(1-\gamma)\lambda}{A_s}\frac{1}{2}} \\
&= \frac{\gamma\Pr(x_s\le x_s^*(\mathbf{1}_L,p_e,\lambda),S)}{\gamma\Pr(x_s\le x_s^*(\mathbf{1}_L,p_e,\lambda),S)+(1-\gamma)(1-\lambda)\Pr(S)\,p_e+(1-\gamma)\Pr(S)\frac{\lambda}{2}} \\
&= \frac{\gamma\Pr(x_s\le x_s^*(\mathbf{1}_L,p_e,\lambda)|S)}{\gamma\Pr(x_s\le x_s^*(\mathbf{1}_L,p_e,\lambda)|S)+(1-\gamma)(1-\lambda)\,p_e+(1-\gamma)\frac{\lambda}{2}}.
\end{aligned}$$

By analogy

$$\begin{aligned}
\hat{\gamma}(F,E) &= \frac{\gamma\Pr(x_s\le x_s^*(\mathbf{1}_L,p_e,\lambda)|F)}{\gamma\Pr(x_s\le x_s^*(\mathbf{1}_L,p_e,\lambda)|F)+(1-\gamma)(1-\lambda)\,p_e+(1-\gamma)\frac{\lambda}{2}}, \\
\hat{\gamma}(S,N) &= \frac{\gamma\Pr(x_s> x_s^*(\mathbf{1}_L,p_e,\lambda)|S)}{\gamma\Pr(x_s> x_s^*(\mathbf{1}_L,p_e,\lambda)|S)+(1-\gamma)(1-\lambda)(1-p_e)+(1-\gamma)\frac{\lambda}{2}}, \\
\hat{\gamma}(F,N) &= \frac{\gamma\Pr(x_s> x_s^*(\mathbf{1}_L,p_e,\lambda)|F)}{\gamma\Pr(x_s> x_s^*(\mathbf{1}_L,p_e,\lambda)|F)+(1-\gamma)(1-\lambda)(1-p_e)+(1-\gamma)\frac{\lambda}{2}}.
\end{aligned}$$

Denoting by $I$ the information set of a given player and by $\mathbf{1}$ the indicator function which is equal to one if its argument is true, the payoffs from engagement are given by:

$$\Pr(S|I)\left[\mathbf{1}(\hat{\gamma}(S,E)\ge B)R+P_h\right]+(1-\Pr(S|I))\left[\mathbf{1}(\hat{\gamma}(F,E)\ge B)R+P_l\right]-c_s,$$

whereas the payoffs from exit are given by:

$$\Pr(S|I)\left[\mathbf{1}(\hat{\gamma}(S,N)\ge B)R\right]+(1-\Pr(S|I))\left[\mathbf{1}(\hat{\gamma}(F,N)\ge B)R\right]+E(P_{sell}\mid I),$$

where $P_{sell}$ is the price at which he sells his shares upon exit. In case the lead activist is present, observing whether she sold or not reveals whether engagement succeeds or not perfectly. In case the lead activist is absent, the monotonicity of strategies implies that the sales volume reveals $\eta$ and thus whether engagement succeeds or not. Hence

$$P_{sell} = \begin{cases} P_h & \text{if } \eta \leq \eta_s^* (p_e, \lambda) \\ P_l & \text{otherwise} \end{cases}.$$

As a result, the payoffs from exit can be rewritten as:

$$\Pr(S|I)\left[\mathbf{1}\left(\hat{\gamma}(S,N) \geq B\right) R + P_h\right] + \left(1 - \Pr(S|I)\right)\left[\mathbf{1}\left(\hat{\gamma}(F,N) \geq B\right) R + P_l\right].$$

First consider the unskilled small institutions, so that $I = \varnothing$. We first show that:

**Lemma 1.** *For $\lambda < \min\left[\frac{2\gamma(1-B)}{(1-\gamma)B}, \frac{2(B-\gamma)}{(1-\gamma)B}\right]$ there exists $\underline{\alpha}_I(\lambda) \in \mathbb{R}_+$ such for all $\alpha_s \geq \underline{\alpha}_I(\lambda)$, unskilled small institutions must choose $p_e = 0$ in any pure strategy equilibrium.*

**Proof of Lemma:** First we show that for sufficiently precise signals, $p_e = 0$ is a best response by unskilled institutions to a monotone strategy with threshold $x_s^*(0, \lambda)$ used by skilled institutions. For $p_e = 0$ the posteriors are as follows:

$$\hat{\gamma}(S,E) = \frac{\gamma \Pr\left(x_s \leq x_s^*\left(\mathbf{1}_L, 0, \lambda\right)|S\right)}{\gamma \Pr\left(x_s \leq x_s^*\left(\mathbf{1}_L, 0, \lambda\right)|S\right) + (1-\gamma)\frac{\lambda}{2}} \underset{\alpha_s \to \infty}{\to} \frac{\gamma}{\gamma + (1-\gamma)\frac{\lambda}{2}}.$$

For $\lambda < \frac{2\gamma(1-B)}{(1-\gamma)B}$, $\frac{\gamma}{\gamma+(1-\gamma)\frac{\lambda}{2}} > B$, and thus there exists $\underline{\alpha}_1(\lambda) \in \mathbb{R}_+$ such that for $\alpha_s \geq \underline{\alpha}_1(\lambda)$, $\hat{\gamma}(S,E) \geq B$.

$$\hat{\gamma}(F,E) = \frac{\gamma \Pr\left(x_s \leq x_s^*\left(\mathbf{1}_L, 0, \lambda\right)|F\right)}{\gamma \Pr\left(x_s \leq x_s^*\left(\mathbf{1}_L, 0, \lambda\right)|F\right) + (1-\gamma)\frac{\lambda}{2}} \underset{\alpha_s \to \infty}{\to} 0.$$

Thus, for any $\lambda$, there exists $\underline{\alpha}_2(\lambda) \in \mathbb{R}_+$ such that for $\alpha_s > \underline{\alpha}_2(\lambda)$, $\hat{\gamma}(F,E) < B$.

$$\hat{\gamma}(S,N) = \frac{\gamma \Pr(x_s > x_s^*(\mathbf{1}_L, 0, \lambda)|S)}{\gamma \Pr(x_s > x_s^*(\mathbf{1}_L, 0, \lambda)|S) + (1-\gamma)(1-\lambda) + (1-\gamma)\frac{\lambda}{2}} \underset{\alpha_s \to \infty}{\to} 0.$$

Thus, for any $\lambda$, there exists $\underline{\alpha}_3(\lambda) \in \mathbb{R}_+$ such that for $\alpha_s > \underline{\alpha}_3(\lambda)$, $\hat{\gamma}(S,N) < B$.

$$\begin{aligned}
\hat{\gamma}(F,N) &= \frac{\gamma \Pr(x_s > x_s^*(\mathbf{1}_L, 0, \lambda)|F)}{\gamma \Pr(x_s > x_s^*(\mathbf{1}_L, 0, \lambda)|F) + (1-\gamma)(1-\lambda) + (1-\gamma)\frac{\lambda}{2}} \\
&\underset{\alpha_s \to \infty}{\to} \frac{\gamma}{\gamma + (1-\gamma)(1-\lambda) + (1-\gamma)\frac{\lambda}{2}} \\
&= \frac{\gamma}{\gamma + (1-\gamma)\left(1-\frac{\lambda}{2}\right)}.
\end{aligned}$$

For $\lambda < \frac{2(B-\gamma)}{(1-\gamma)B}$, $\frac{\gamma}{\gamma+(1-\gamma)\left(1-\frac{\lambda}{2}\right)} < B$, and thus there exists $\underline{\alpha}_4(\lambda) \in \mathbb{R}_+$ such that for $\alpha_s > \underline{\alpha}_4(\lambda)$, $\hat{\gamma}(F,N) < B$. Now, setting

$$\underline{\alpha}_I(\lambda) := \max\left[\underline{\alpha}_1(\lambda), \underline{\alpha}_2(\lambda), \underline{\alpha}_3(\lambda), \underline{\alpha}_4(\lambda)\right],$$

for $\alpha_s \geq \underline{\alpha}_I(\lambda)$, we can write the payoffs for unskilled small institutions from engaging as follows:

$$\Pr(S)(R + P_h) + (1 - \Pr(S))P_l - c_s,$$

whereas payoffs from exiting are

$$E(P_{sell} \mid \varnothing) = \Pr(S) P_h + (1 - \Pr(S))P_l.$$

Thus, $p_e = 0$ is optimal whenever

$$\Pr(S) \leq \frac{c_s}{R},$$

which is always satisfied because $\Pr(S) = \Pr(\eta \leq \eta_s^*(0,\lambda)) < \Pr(\eta \leq 1) = \frac{1}{2}$ since $\eta_s^*(0,\lambda) < 1$, whereas $\frac{c_s}{R} \geq \frac{1}{2}$ since $R \leq 2c_s$.

Next we show that $p_e = 1$ cannot arise in equilibrium. For $p_e = 1$ the posteriors are as follows:

$$\begin{aligned}
\hat{\gamma}(S,E) &= \frac{\gamma \Pr(x_s \leq x_s^*(\mathbf{1}_L, 1, \lambda) | S)}{\gamma \Pr(x_s \leq x_s^*(\mathbf{1}_L, p_e, \lambda) | S) + (1-\gamma)(1-\lambda) + (1-\gamma)\frac{\lambda}{2}} \\
&\underset{\alpha_s \to \infty}{\to} \frac{\gamma}{\gamma + (1-\gamma)(1-\lambda) + (1-\gamma)\frac{\lambda}{2}} \\
&= \frac{\gamma}{\gamma + (1-\gamma)\left(1-\frac{\lambda}{2}\right)}.
\end{aligned}$$

This is identical to the case for $p_e = 0$ and $\hat{\gamma}(F,N)$. Thus, for $\alpha_s > \underline{\alpha}_4(\lambda)$, $\hat{\gamma}(S,E) < B$. Similarly it is easy to see that for $\alpha_s > \underline{\alpha}_3(\lambda)$, $\hat{\gamma}(F,E) < B$ while for $\alpha_s > \underline{\alpha}_2(\lambda)$, $\hat{\gamma}(S,N) < B$. Finally,

$$\hat{\gamma}(F,N) = \frac{\gamma \Pr(x_s > x_s^*(\mathbf{1}_L, 1, \lambda) | F)}{\gamma \Pr(x_s > x_s^*(\mathbf{1}_L, 1, \lambda) | F) + (1-\gamma)\frac{\lambda}{2}} \underset{\alpha_s \to \infty}{\to} \frac{\gamma}{\gamma + (1-\gamma)\frac{\lambda}{2}},$$

which is again identical to the case for $p_e = 0$ and $\hat{\gamma}(S,N)$. Thus, for $\alpha_s \geq \underline{\alpha}_1(\lambda)$, $\hat{\gamma}(F,N) \geq B$. Now, for $\alpha_s \geq \underline{\alpha}_I(\lambda)$, we can write the payoffs for unskilled institutions from engaging as follows:

$$\Pr(S) P_h + (1 - \Pr(S)) P_l - c_s,$$

whereas payoffs from exiting are

$$E\left(P_{sell} \mid \varnothing\right) = \Pr\left(S\right) P_h + \left(1 - \Pr(S)\right)\left(P_l + R\right).$$

Since $\Pr\left(S\right) P_h + \left(1 - \Pr(S)\right)\left(P_l + R\right) > \Pr\left(S\right) P_h + (1 - \Pr(S))P_l$, $p_e = 1$ can never be a best response to $x_s^*\left(1, \lambda\right)$. This concludes the proof of the lemma. $\square$

**Lemma 2.** *For $\lambda < \min\left[\frac{2\gamma(1-B)}{(1-\gamma)B}, \frac{2(B-\gamma)}{(1-\gamma)B}\right]$ there exists $\underline{\alpha}_{II}\left(\lambda\right) \in \mathbb{R}_+$ such for all $\alpha_s \geq \underline{\alpha}_{II}\left(\lambda\right)$, unskilled small institutions cannot choose $p_e \in (0, 1)$ in equilibrium.*

Proof of Lemma: For $p_e \in (0, 1)$ the posteriors are given by the general expressions above. Note that since $\hat{\gamma}\left(F, E\right)$ and $\hat{\gamma}\left(S, N\right)$ are bounded in $p_e$, there exist $\underline{\alpha}_5\left(\lambda\right) \in \mathbb{R}_+$ and $\underline{\alpha}_6\left(\lambda\right) \in \mathbb{R}_+$ such that, for any $p_e$, for $\alpha_s \geq \underline{\alpha}_5\left(\lambda\right)$, $\hat{\gamma}\left(F, E\right) < B$ and for $\alpha_s \geq \underline{\alpha}_6\left(\lambda\right)$, $\hat{\gamma}\left(S, N\right) < B$. Now consider $\alpha_s \geq \underline{\alpha}_{II}\left(\lambda\right) := \max\left[\underline{\alpha}_5\left(\lambda\right), \underline{\alpha}_6\left(\lambda\right)\right]$. For any $p_e \in (0, 1)$, $\lambda$:

$$\lim_{\alpha_s \to \infty} \hat{\gamma}\left(S, E\right) = \frac{\gamma}{\gamma + \left(1 - \gamma\right)\left(1 - \lambda\right) p_e + \left(1 - \gamma\right)\frac{\lambda}{2}}.$$

Since $\lim_{\alpha_s \to \infty} \hat{\gamma}\left(S, E\right)$ evaluated at $p_e = 0$ is strictly greater than B when $\lambda < \frac{2\gamma(1-B)}{(1-\gamma)B}$, and $\lim_{\alpha_s \to \infty} \hat{\gamma}\left(S, E\right)$ is decreasing in $p_e$, there clearly exists a $\overline{p}_e > 0$ such that $\lim_{\alpha_s \to \infty} \hat{\gamma}\left(S, E\right) > B$ if and only if $p_e \leq \overline{p}_e$.

For $p_e > \overline{p}_e$ and any $\alpha_s > \underline{\alpha}_{II}\left(\lambda\right)$, the payoff to engaging is $\Pr\left(S\right) P_h + (1 - \Pr(S))P_l - c_s$. But the payoff to not engaging is never less than $\Pr\left(S\right) P_h + (1 - \Pr(S))P_l$. Thus, $p_e \in \left(\overline{p}_e, 1\right)$ cannot arise in equilibrium. The only possibility is that $p_e \in \left(0, \overline{p}_e\right]$. Fix such a $p_e$, and suppose there exists some $\alpha_s \geq \underline{\alpha}_{II}\left(\lambda\right)$ such that for such a pair $\left(p_e, \alpha_s\right)$ we have $\hat{\gamma}\left(S, E\right) > B$. There are two possibilities:

Either for that $\left(p_e, \alpha_s\right)$, $\hat{\gamma}\left(F, N\right) \leq B$, in which case the payoffs to engaging are:

$$\Pr\left(S\right)\left(R + P_h\right) + (1 - \Pr(S))P_l - c_s,$$

whereas payoffs from exiting are

$$E\left(P_{sell} \mid \varnothing\right) = \Pr\left(S\right) P_h + (1 - \Pr(S))P_l.$$

Having, $p_e \in (0,1)$ requires that

$$\Pr\left(S\right) = \frac{c_s}{R},$$

which is impossible because $\Pr\left(S\right) < \frac{1}{2}$ and $\frac{c_s}{R} \geq \frac{1}{2}$.

The other possibility is that for that $(p_e, \alpha_s)$, $\hat{\gamma}\left(F, N\right) > B$ in which case the payoffs to engaging are

$$\Pr\left(S\right)\left(R + P_h\right) + (1 - \Pr(S))P_l - c_s,$$

whereas payoffs from not engaging are

$$E\left(P_{sell} \mid \varnothing\right) + (1 - \Pr(S))R = \Pr\left(S\right) P_h + (1 - \Pr(S))\left(P_l + R\right).$$

Having, $p_e \in (0,1)$ requires that

$$\begin{aligned} \Pr\left(S\right) R - c_s &= (1 - \Pr(S))R \\ \text{i.e., } \Pr\left(S\right) &= \frac{1}{2} + \frac{c_s}{2R}, \end{aligned}$$

which is again impossible because $\Pr\left(S\right) < \frac{1}{2}$. Thus, for any $\lambda$ and $\alpha_s \geq \underline{\alpha}_{II}\left(\lambda\right)$, $p_e \in (0,1)$ cannot arise in equilibrium. This concludes the proof of the lemma.$\square$

Define $\underline{\alpha}_{III}\left(\lambda\right) := \max\left[\underline{\alpha}_{I}\left(\lambda\right), \underline{\alpha}_{II}\left(\lambda\right)\right]$. For $\lambda < \min\left[\frac{2\gamma(1-B)}{(1-\gamma)B}, \frac{2(B-\gamma)}{(1-\gamma)B}\right]$ and $\alpha \geq \underline{\alpha}_{III}\left(\lambda\right)$, we have now shown that unskilled institutions choose $p_e = 0$ in equilibrium. We focus on these parameters for the remainder of the proof.

Consider the putative equilibrium thresholds for the skilled institutions which are given by $x_s^*(0,\lambda)$. The payoffs from engagement are given by:

$$\Pr\left(\eta \leq \eta_s^*\left(\mathbf{1}_L, 0, \lambda\right) | x_{s,j}\right)\left(R + P_h\right) + \left(1 - \Pr\left(\eta \leq \eta_s^*\left(\mathbf{1}_L, 0, \lambda\right) | x_{s,j}\right)\right) P_l - c_s,$$

whereas the payoffs from exit are given by:

$$E\left(P_{sell} \mid x_{s,j}\right) = \Pr\left(\eta \leq \eta_s^*\left(\mathbf{1}_L, 0, \lambda\right) | x_{s,j}\right) P_h + \left(1 - \Pr\left(\eta \leq \eta_s^*\left(\mathbf{1}_L, 0, \lambda\right) | x_{s,j}\right)\right) P_l.$$

Thus, the net expected payoff from engagement is given by

$$\Pr\left(\eta \leq \eta_s^*\left(\mathbf{1}_L, 0, \lambda\right) | x_{s,j}\right) R - c_s$$

which is clearly decreasing in $x_{s,j}$. The existence of the dominance regions and continuity jointly imply that there exists $x_s^*(0,\lambda) \in \mathbb{R}$ such that

$$\Pr\left(\eta \leq \eta_s^*\left(\mathbf{1}_L, 0, \lambda\right) | x_s^*\left(\mathbf{1}_L, 0, \lambda\right)\right) R - c_s = 0.$$

Further, since $\eta | x_{s,j} \sim N\left(\frac{\alpha_\eta \mu_\eta + \alpha_s x_{s,j}}{\alpha_\eta + \alpha_s}, \frac{1}{\alpha_\eta + \alpha_s}\right)$, we have the following condition:

$$\Phi\left(\sqrt{\alpha_\eta + \alpha_s}\left(\eta_s^*\left(\mathbf{1}_L, 0, \lambda\right) - \frac{\alpha_\eta \mu_\eta + \alpha_s x_s^*\left(\mathbf{1}_L, 0, \lambda\right)}{\alpha_\eta + \alpha_s}\right)\right) = \frac{c_s}{R}. \tag{2}$$

Solving (1) for $x_s^*\left(\mathbf{1}_L, 0, \lambda\right)$ at $p_e = 0$ gives

$$x_s^*\left(\mathbf{1}_L, 0, \lambda\right) = \eta_s^*\left(\mathbf{1}_L, 0, \lambda\right) + \frac{1}{\sqrt{\alpha_s}} \Phi^{-1}\left(\frac{\eta_s^*\left(\mathbf{1}_L, 0, \lambda\right) - \mathbf{1}_L A_L - A_s\left(1-\gamma\right)\frac{\lambda}{2}}{A_s \gamma}\right).$$

Substituting into (2) gives:

$$\Phi\left(\sqrt{\alpha_\eta+\alpha_s}\left(\eta_s^*(\mathbf{1}_L,0,\lambda)-\frac{\alpha_\eta\mu_\eta+\alpha_s\left(\eta_s^*(\mathbf{1}_L,0,\lambda)+\frac{1}{\sqrt{\alpha_s}}\Phi^{-1}\left(\frac{\eta_s^*(\mathbf{1}_L,0,\lambda)-\mathbf{1}_LA_L-A_s(1-\gamma)\frac{\lambda}{2}}{A_s\gamma}\right)\right)}{\alpha_\eta+\alpha_s}\right)\right) = \frac{c_s}{R},$$

$$\text{i.e., } \Phi\left(\eta_s^*(\mathbf{1}_L,0,\lambda)\frac{\alpha_\eta}{\sqrt{\alpha_\eta+\alpha_s}}-\frac{\alpha_\eta\mu_\eta}{\sqrt{\alpha_\eta+\alpha_s}}-\frac{\sqrt{\alpha_s}}{\sqrt{\alpha_\eta+\alpha_s}}\Phi^{-1}\left(\frac{\eta_s^*(\mathbf{1}_L,0,\lambda)-\mathbf{1}_LA_L-A_s(1-\gamma)\frac{\lambda}{2}}{A_s\gamma}\right)\right) = \frac{c_s}{R}. \quad (3)$$

Taking the derivative of this relative to $\eta_s^*(\mathbf{1}_L,0,\lambda)$ we obtain:

$$\phi\left(\eta_s^*(\mathbf{1}_L,0,\lambda)\frac{\alpha_\eta}{\sqrt{\alpha_\eta+\alpha_s}}-\frac{\alpha_\eta\mu_\eta}{\sqrt{\alpha_\eta+\alpha_s}}-\frac{\sqrt{\alpha_s}}{\sqrt{\alpha_\eta+\alpha_s}}\Phi^{-1}\left(\frac{\eta_s^*(\mathbf{1}_L,0,\lambda)-\mathbf{1}_LA_L-A_s(1-\gamma)\frac{\lambda}{2}}{A_s\gamma}\right)\right)\times \left(\frac{\alpha_\eta}{\sqrt{\alpha_\eta+\alpha_s}}-\frac{\sqrt{\alpha_s}}{\sqrt{\alpha_\eta+\alpha_s}}\frac{1/A_s\gamma}{\phi\left(\Phi^{-1}\left(\frac{\eta_s^*(\mathbf{1}_L,0,\lambda)-\mathbf{1}_LA_L-A_s(1-\gamma)\frac{\lambda}{2}}{A_s\gamma}\right)\right)}\right).$$

As $\alpha_s\to\infty$ the above expression reduces to

$$\phi\left(-\Phi^{-1}\left(\frac{\eta_s^*(\mathbf{1}_L,0,\lambda)-\mathbf{1}_LA_L-A_s(1-\gamma)\frac{\lambda}{2}}{A_s\gamma}\right)\right)\left(-\frac{1/A_s\gamma}{\phi\left(\Phi^{-1}\left(\frac{\eta_s^*(\mathbf{1}_L,0,\lambda)-\mathbf{1}_LA_L-A_s(1-\gamma)\frac{\lambda}{2}}{A_s\gamma}\right)\right)}\right)<0.$$

Continuity in $\alpha_s$ implies that there exists an $\underline{\alpha}_{IV}(\lambda)\in\mathbb{R}_+$ such that for $\alpha\geq\underline{\alpha}_{IV}(\lambda)$, the left hand side of (3) is monotone in $\eta_s^*(\mathbf{1}_L,0,\lambda)$. Thus there can be only one solution $\eta_s^*(\mathbf{1}_L,0,\lambda)$. Existence of a solution can be verified by taking the limit of (3) as $\alpha_s\to\infty$:

$$\Phi\left(-\Phi^{-1}\left(\frac{\eta_s^*(\mathbf{1}_L,0,\lambda)-\mathbf{1}_LA_L-A_s(1-\gamma)\frac{\lambda}{2}}{A_s\gamma}\right)\right)=\frac{c_s}{R},$$

so that

$$\eta_s^*(\mathbf{1}_L,0,\lambda)=\mathbf{1}_LA_L+A_s\gamma\left(1-\frac{c_s}{R}\right)+A_s(1-\gamma)\frac{\lambda}{2}.$$

The proof is completed by setting $\underline{\alpha}(\lambda):=\max\left[\underline{\alpha}_{III}(\lambda),\underline{\alpha}_{IV}(\lambda)\right]$.■

**Proof of Proposition 3**:

Proof of Part I: As shown in the proof of Lemma 1, as long as $\lambda < \min\left[\frac{2\gamma(1-B)}{(1-\gamma)B}, \frac{2(B-\gamma)}{(1-\gamma)B}\right]$ and $\alpha_s \geq \underline{\alpha}_I(\lambda)$, we can write the payoffs for unskilled small institutions from engaging as follows:

$$\Pr(S)(R + P_h) + (1 - \Pr(S))P_l - c_s,$$

whereas payoffs from exiting are

$$E(P_{sell} \mid \varnothing) = \Pr(S)\,P_h + (1 - \Pr(S))P_l.$$

Thus, $p_e = 0$ is optimal if and only if

$$\Pr(S) \leq \frac{c_s}{R}.$$

We shall now show that, in the limit as $\alpha_s \to \infty$, this condition is satisfied for $R \in \left(2c_s, \bar{R}\right)$ for some $\bar{R}$. It is easy to see, by a brief extension of the arguments used to prove Proposition 2 that skilled institutions will again find it optimal to use monotone strategies and that there will be a unique threshold $x_s^*$. The marginal skilled institution (with signal $x_s^*$) must be indifferent between engaging and exiting. All skilled institutions with signals lower than his will wish to engage. Denoting the proportion of such agents by $e_s$, in the limit as $\alpha_s \to \infty$, the marginal institution believes that $e_s \sim U(0,1)$. Since unskilled institutions do not engage in the proposed equilibrium, this skilled institution's evaluation of the probability of successful engagement is simply $\Pr\left(A_L + \gamma A_s e_s + (1-\gamma)A_s\frac{\lambda}{2} \geq \eta_s^*\right)$. Since $e_s \sim U(0,1)$ this can be rewritten as $1-\frac{\eta_s^*-A_L-(1-\gamma)A_s\frac{\lambda}{2}}{\gamma A_s}$, giving rise to the indifference condition:

$$R\left(1-\frac{\eta_s^*-A_L-(1-\gamma)\,A_s\frac{\lambda}{2}}{\gamma A_s}\right)=c_s,$$

which immediately implies that $\eta_s^*=A_L+\gamma A_s\left(1-\frac{c_s}{R}\right)+\frac{1}{2}A_s\,(1-\gamma)\,\lambda$, as required. We now evaluate the unconditional probability of success $Pr(S)$ as follows:

$$Pr\left(\eta\leq A_L+\gamma A_s\left(1-\frac{c_s}{R}\right)+\frac{1}{2}A_s\,(1-\gamma)\,\lambda\right)$$

$$=\Phi\left(\sqrt{\alpha_\eta}\left(A_L+\gamma A_s\left(1-\frac{c_s}{R}\right)+\frac{1}{2}A_s\,(1-\gamma)\,\lambda-\bar{A}\right)\right).$$

We now compare the above expression to $\frac{c_s}{R}$ for $R\geq 2c_s$. When $R=2c_s$,

$$Pr(S)=\Phi\left(\sqrt{\alpha_\eta}\left(A_L+\gamma A_s\frac{1}{2}+\frac{1}{2}A_s\,(1-\gamma)\,\lambda-\bar{A}\right)\right)<\Phi\,(0)=\frac{1}{2}=\frac{c_s}{R}.$$

However, it is clear that $Pr(S)$ is increasing in $R$ while $\frac{c_s}{R}$ is decreasing in $R$. Hence there exists a threshold $\bar{R}$ such that $\Pr\,(S)\leq\frac{c_s}{R}$ if and only if $R<\bar{R}$. For future reference, note that:

$$\Phi\left(\sqrt{\alpha_\eta}\left(A_L+\gamma A_s\left(1-\frac{c_s}{\bar{R}}\right)+\frac{1}{2}A_s\,(1-\gamma)\,\lambda-\bar{A}\right)\right)=\frac{c_s}{\bar{R}}\tag{4}$$

Proof of Part II: As shown in the proof of Lemma 2, as long as $\lambda<\min\left[\frac{2\gamma(1-B)}{(1-\gamma)B},\frac{2(B-\gamma)}{(1-\gamma)B}\right]$ and $\alpha_s\geq\underline{\alpha}_{II}\,(\lambda)$, the only possible potential mixed equilibrium is one in which $Pr(S)=\frac{c_s}{R}$ and $p_e\leq\bar{p}_e$. Again, it is easy to see, by a brief extension of the arguments used to prove Proposition 2 that skilled institutions will find it optimal to use monotone strategies and that there will be a unique threshold $\hat{x}_s$. The marginal skilled institution (with signal $\hat{x}_s$) must be indifferent between engaging and exiting. All skilled institutions with signals lower than his will wish to engage. Denoting the proportion of such agents by $e_s$, in the limit as $\alpha_s \to \infty$, the marginal institution believes that $e_s \sim U(0,1)$. Since unskilled institutions engage with probability $p_e$ in the proposed equilibrium, this skilled institution's evaluation of the probability of successful engagement is simply $\Pr\left(A_L + \gamma A_s e_s + (1-\gamma) A_s p_e + (1-\gamma) A_s \frac{\lambda}{2} \geq \hat{\eta}_s\right)$. Since $e_s \sim U(0,1)$ this can be rewritten as $1 - \frac{\hat{\eta}_s - A_L - (1-\gamma) A_s p_e - (1-\gamma) A_s \frac{\lambda}{2}}{\gamma A_s}$, giving rise to the indifference condition:

$$R\left(1 - \frac{\hat{\eta}_s - A_L - (1-\gamma) A_s p_e - (1-\gamma) A_s \frac{\lambda}{2}}{\gamma A_s}\right) = c_s,$$

which immediately implies that $\hat{\eta}_s = A_L + \gamma A_s \left(1 - \frac{c_s}{R}\right) + (1-\gamma) A_s p_e + \frac{1}{2} A_s (1-\gamma) \lambda$, as required. Now, using the fact that $Pr(S) = \frac{c_s}{R}$ we have that

$$\Phi\left(\sqrt{\alpha_\eta}\left(A_L + \gamma A_s \left(1 - \frac{c_s}{R}\right) + (1-\gamma) A_s p_e + \frac{1}{2} A_s (1-\gamma)\lambda - \bar{A}\right)\right) = \frac{c_s}{R},$$

so that

$$p_e = \frac{1}{(1-\gamma) A_s}\left[\bar{A} - A_L - \gamma A_s \left(1 - \frac{c_s}{R}\right) - \frac{1}{2} A_s (1-\gamma)\lambda + \frac{1}{\sqrt{\alpha_\eta}} \Phi^{-1}\left(\frac{c_s}{R}\right)\right] \quad (5)$$

as required. Upon inspection of (5) we see that $p_e$ is decreasing in $R$. Further, for $\lambda < \frac{\gamma}{1-\gamma}$, setting $R = 2c_s$ in (5) gives $p_e > 1$, while in the limit as $p_e \to 0$ (5) coincides with (4). Thus, there exists a $\underline{R} > 2c_s$ such that $p_e \in (0, \bar{p}_e)$ only for $R \in \left(\underline{R}, \bar{R}\right)$. ■

**Proof of Proposition 4**: Each small institution will purchase shares if and only if they expect the following condition to hold:

$$\gamma Pr\left[\eta \leq A_L + \gamma A_s\left(1 - \frac{c_s}{R}\right)\right](R - c_s) \geq \delta c_s.$$

For given $A_L$ and $A_s$ the LHS is clearly decreasing in $c_s$ while the RHS is increasing in $c_s$. A given opportunity cost $c$ will define a threshold equilibrium in which all small institutions purchase shares if and only if $c_s < c$ if, for all $c_s \leq c$ we have

$$\gamma Pr\left[\eta \leq A_L + \gamma \bar{A}_s\left(1 - \frac{c_s}{R}\right)\right](R - c_s) \geq \delta c_s,$$

while for all $c_s > c$ we have

$$\gamma Pr\left[\eta \leq A_L\right](R - c_s) < \delta c_s.$$

We define $c^*(\bar{A}_s, A_L)$ as the $c$ that makes the following hold with equality for a given $A_L$ and $\bar{A}_s$:

$$\gamma Pr\left[\eta \leq A_L + \gamma \bar{A}_s\left(1 - \frac{c}{R}\right)\right](R - c) = \delta c.$$

We similarly define $\hat{c}(\bar{A}_s, A_L)$ as the $c$ that makes the following hold with equality for a given $A_L$:

$$\gamma Pr\left[\eta \leq A_L\right](R - c) = \delta c.$$

It is straightforward to see that $\hat{c}(\bar{A}_s, A_L) < c^*(\bar{A}_s, A_L)$ and that any $c \in [\hat{c}(\bar{A}_s, A_L), c^*(\bar{A}_s, A_L)]$ will satisfy the given conditions for defining a threshold equilibrium.

For the final statement in the proposition, it is sufficient to note that the LHS of each expression is increasing in $A_L$ and (weakly) increasing in $\bar{A}_s$. ■

**Proof of Proposition 5**: For any choice of $A_L$ the payoff of the lead activist will be:

$$Pr\left[\eta \leq A_L + \gamma I\left[c_s \leq c^*\left(\bar{A}_s, A_L\right)\right]\bar{A}_s\left(1 - \frac{c_s}{R}\right)\right](\beta_L - e_L) - c_L,$$

where $I[\cdot]$ is the indicator function. For any $c_s \leq c^*\left(\bar{A}_s, \bar{A}_L\right)$, the lead activist's payoffs are increasing in $A_L$, because by increasing $A_L$ the lead activist increases his potential excludable payoff directly (via the direct effect of his own presence) and (weakly) increasing the size of the wolf pack because $c^*\left(\bar{A}_s, A_L\right)$ is increasing. Thus, as long as

$$Pr\left[\eta \leq \bar{A}_L + \gamma\bar{A}_s\left(1 - \frac{c_s}{R}\right)\right](\beta_L - e_L) - c_L \geq 0,$$

the lead activist optimally buys in up to his full capital limit $\bar{A}_L$. This defines $c_L^*(\bar{A}_s, c_s)$ for $c_s \leq c^*\left(\bar{A}_s, \bar{A}_L\right)$.

For $c_s > c^*\left(\bar{A}_s, \bar{A}_L\right)$, the lead activist's payoffs are given by

$$Pr\left[\eta \leq A_L\right](\beta_L - e_L) - c_L,$$

which is again increasing in $A_L$, albeit here only via the direct effect of her own presence. Thus, again, as long as

$$Pr\left[\eta \leq \bar{A}_L\right](\beta_L - e_L) - c_L \geq 0,$$

the lead activist optimally buys in up to her full capital limit $\bar{A}_L$. This defines $c_L^*(\bar{A}_s, c_s)$ for $c_s > c^*\left(\bar{A}_s, \bar{A}_L\right)$. Since $Pr\left[\eta \leq \bar{A}_L + \gamma\bar{A}_s\left(1 - \frac{c_s}{R}\right)\right] > Pr\left[\eta \leq \bar{A}_L\right]$, this threshold is clearly lower. The statement that the threshold is weakly increasing in $\bar{A}_s$ follows from the fact that the LHS of the above equations are all weakly increaing in $\bar{A}_s$. ■

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