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Abstract

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Keywords

acquisition, corporate governance, merger, proxy fight, search, shareholder activism, takeover

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Finance and Financial Management

Corporate Control Activism

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Abstract

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KEYWORDS: Acquisition, Corporate Governance, Merger, Proxy Fight, Shareholder Activism, Takeover.

JEL CLASSIFICATION: D74, D83, G23, G32, G34

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*“I’d like to thank these funds [Carl Icahn, Nelson Peltz, Jana Partners, Third Point] for teeing up deals because they’re coming in there and shaking up the management and many times these companies are being driven into some form of auction.” Thomas H. Lee, a private equity fund manager.*¹

1 Introduction

Corporate boards have the power to resist a takeover of their company, for example, by issuing a shareholder rights plan (“poison pill”).² In principle, directors should use this power to negotiate a higher takeover premium or to reject coercive bids. However, the separation of ownership and control creates agency conflicts (Berle and Means (1932)), and therefore, there is a risk that this power would be abused to protect insiders’ private benefits of control and block takeovers that would otherwise create a shareholder value.³ In those cases, the resistance to takeovers can be overcome only if the majority of directors are voted out in a contested election (“proxy fight”). In fact, the power of shareholders to unseat directors is often used by the courts as the basis for allowing boards to block takeovers in the first place (Gilson (2001)).

Shareholders, however, cannot vote out the incumbent directors unless an alternative slate is put on the ballot. Empirically, bidders rarely launch proxy fights to replace all or part of the resisting target board. Most proxy fights are launched by activist hedge funds (Fos (2017)),⁴ who often demand from companies they invest in to sell all or part of their assets (Brav et al. (2008), Becht et al. (2017)). Greenwood and Schor (2009) and Boyson et al. (2016) document hundreds of activist campaigns that resulted with a takeover bid by a third party, and argue a causal link. For example, in 2014, the board of PetSmart agreed to be bought out for \$8.7

¹The New York Times, “Will Credit Crisis End the Activists’ Run?”, 8/27/2007.

²Under most jurisdictions, including Delaware, merger proposals can be brought to a vote for a shareholder approval only by the board of directors. Alternatively, tender offers do not require a vote, but they are vulnerable to poison pills, which can be adopted on short notice and make a takeover virtually impossible.

³Jenter and Lewellen (2015) provide evidence consistent with managers being reluctant to relinquish control due to career concerns. See also Walkling and Long (1984), Martin and McConnell (1991), Agrawal and Walkling (1994), Hartzell et al. (2004), and Wulf and Singh (2011)), who show that target CEOs typically suffer from poor career prospects following takeovers.

⁴Fos (2017) documents 632 proxy fights between 2003 and 2012, out of which only 5% were sponsored by corporations (i.e., potential bidders), 70% by activist hedge funds, and the rest by other shareholders.

billion after facing months-long pressure, which included the threat of a proxy fight from one of its largest shareholders, the activist hedge fund Jana Partners.⁵ As another example, in 2013, the private-equity firm KKR acquired Gardner Denver for \$3.7 billion after the activist hedge fund ValueAct Capital accumulated a 5% stake in the company, filed a schedule 13D, and agitated for its sale. Highlighting the activist’s role in the deal, KKR’s co-CEO, George Roberts, said: “We wouldn’t have bought Gardner Denver had not an activist shown up. They are a nicer form of what in the old days the green mailers and the hostile raiders used to do. They were great for our business.”⁶

In principle, both bidders and activist investors can use proxy fights to pressure companies to sell, but the evidence suggests that this tactic is mostly employed by activists, not bidders. Why? What is the relative advantage of activists, if any? In this paper we propose a novel theory that answers these questions and explains the unique role of activist investors in the M&A market. In the spirit of Occam’s razor, our main argument is simple. We argue that bidders have a *commitment problem* from which activist investors are immune. This commitment problem manifests itself into a stronger conflict of interests between the bidder and target shareholders, which limits the ability of the bidder to win a proxy fight. An important contribution of the paper is identifying this commitment problem, its potential remedies, and implications. We further argue that shareholder activism is the market solution for the bidder’s commitment problem. Our theory therefore proposes that the unique role of activist investors in the M&A market is making corporate assets available for sale.⁷

What is the bidder’s commitment problem, and why are activists more resilient? Crucially, a proxy fight (to oust the resisting target directors) is not a referendum on the terms of the takeover, but rather a vote on the composition of the board. Once the bidder’s nominees are elected, the bidder will be tempted to abuse his control of the target board, exploit its access to the target’s proprietary information, divert resources, and low-ball the takeover premium. Indeed, as their counter-party, the bidder has the opposite preferences of target shareholders.

⁵See The New York Times, “Under Pressure From Jana, PetSmart Says It Will Explore Potential Sale”, 8/19/2014; The New York Times, “Elliott and Jana, Activist Investors, Are Behind 2 Big Buyouts”, 12/15/2014; and The Deal Pipeline, “Jana Unveils Potential Board Slate for PetSmart”, 11/21/2014.

⁶Reuters, “Activism, Economy Weighed on M&A in 2013, Issues Could Linger”, 12/19/2013.

⁷We focus on takeovers, but our theory can be applied to divestitures and assets sales as well.

Without a remedy to this commitment problem, target shareholders cannot trust the bidder; they will vote against his nominees and the proxy fight will fail. By contrast, activist investors buy shares with the expectation that the target will be acquired. Unlike bidders, activists are typically on the sell-side of the negotiating table and have incentives to bargain the highest takeover premium possible. In other words, activists have a weaker commitment problem. Since activists enjoy a higher credibility when campaigning against incumbents, they are also more effective in pressuring companies to sell.

In Section 2, we formalize these arguments by analyzing a simple dynamic bargaining model in which the identity of the target board, who is negotiating an acquisition agreement on behalf of target shareholders, is endogenized by an interim proxy fight stage. The proxy fight can be initiated by the bidder or the activist, but its success requires the vote of target shareholders.

Our analysis highlights three key assumptions: (i) the bidder's commitment problem cannot be easily solved; (ii) relative to the bidder, the activist is more likely to be on the sell-side; (iii) relative to the incumbent board, who can at least partially resist a takeover, the activist has a weaker conflict of interest with target shareholders. We discuss the validity of these three assumptions in detail in Section 3. Consider the first assumption. While the existing institutional and legal framework provides remedies that can potentially alleviate the bidder's commitment problem, they are either imperfect or costly to implement. For example, enforcement of directors' fiduciary duties requires litigation which is often costly, uncertain, and limited to verifiable outcomes. Alternatively, the bidder can recruit independent nominees. However, since verifying their true independence is both costly and imperfect, shareholders may remain suspicious of their motives. Moreover, it exposes the bidder to the risk that these nominees, if elected, will be tougher than needed (to protect their reputation) and ultimately hurt the prospects of the takeover. As another option, the bidder can combine a proxy fight with a tender offer, but this tactic is not a perfect panacea either. Among other things, it exposes the bidder to the free-rider problem of Grossman and Hart (1980). We discuss other potential remedies as well, and conclude that the bidder's commitment problem cannot be easily resolved.

Our second assumption asserts that an activist, who is not the counter-party to the trans-

action, is more likely to be on the sell-side than a bidder. In general, the incentives of activists to negotiate a high takeover premium could be distorted by derivatives, ownership in the bidding firm, or explicit and implicit agreements with the bidder. In most jurisdictions, however, these arrangements have to be disclosed when votes are solicited, and if they are concealed, they expose the activist to a legal risk. As long as the masking of these arrangements is costly, shareholders are more likely to trust an activist than a bidder to represent their interests on the board.

More fundamentally, however, bidders and activists differ even if the latter have the resources to make a takeover bid. While a typical bidder cannot create value unless he acquires more than 50% of the target, activist hedge funds often make proposals that can increase the standalone value of the target even if its ownership structure does not change. Target shareholders know that if they elect an activist to the board and then reject her takeover bid, the activist will inevitably implement her value-increasing proposal to maximize the value of her stake in the target. As a result, once elected to the board, the ability of an activist to abuse her power by low-balling a subsequent takeover offer is limited. In this regard, activists are more resilient than strategic buyers and private equity funds to the commitment problem.

Finally, target shareholders will replace the incumbent directors with an activist only if they believe that the latter will show less resistance to the takeover, as required by our third assumption. Indeed, relative to incumbents, activists are likely to have fewer private benefits from keeping the target as an independent firm: Their tenure on the board is shorter (since they seek an exit of their investment), they have other sources of income (they manage a portfolio of 10-15 firms), and their human capital is not tied to the target. Moreover, activists have more to gain from a takeover: They typically own 8-9% of the target, which is significantly higher than the average ownership of a CEO or a director of a public company. The activist in our model can pressure the incumbents to sell not because she is perfectly aligned with other shareholders of the target, but rather, because the activist is less likely to resist a value increasing takeover.

As a whole, our theory proposes that activist investors have an inherent advantage relative to bidders in pressuring entrenched incumbents to sell. Importantly, our key observation is

in relative terms. It does not imply that bidders can never run a successful proxy fight, but it suggests that these events are less frequent than campaigns in which an activist pushes a company to sell. This prediction is supported by the fact that most proxy fights are launched by activists and not by bidders (Fos (2017)), and by the empirical evidence of Greenwood and Schor (2009) and Boyson et al. (2016) cited above.

To study the implications of activist interventions on the M&A market, in Section 4 we endogenize the ownership of the activist in the target and the decision of the bidder to perform due diligence and engage in takeover negotiations. In general, activists invest either because they believe the company is likely to become a takeover target (“selection”) or because they can facilitate its takeover by putting the company into play (“treatment”). When the treatment effect is in play, bidders interpret the presence of an activist as a signal that the target is available for sale, and as a result, they are more likely start takeover negotiations when the target has an activist as a shareholder. Effectively, the activist in our model is soliciting offers by reassuring bidders that they will face a weaker opposition to the takeover, if the offer is fair. This analysis highlights the *complementarity* between shareholder activism and takeovers, an observation that has several policy and empirical implications that we discuss in detail in Section 4.

While the aforementioned empirical literature finds evidence that is consistent with the treatment effect (e.g., the probability of a takeover is several times higher when an activist hedge fund is a shareholder of the target), it is hard to rule out the possibility of a selection effect. We provide necessary and sufficient conditions under which the treatment effect exists in equilibrium. We show that the model’s comparative statics is sensitive to the existence of the treatment effect, a feature that can be used to create identification strategies for empirical research. For example, if only the selection effect is in play, the volume of M&A decreases with the severity of the agency problems in target firms. This is intuitive, as with more private benefits of control the incumbents are more likely to resist takeover bids. However, when the treatment effect is in play, more resistance of incumbents to takeovers can result in a *higher* volume of M&A. Intuitively, the resistance of incumbents to takeovers provides activist investors with opportunities to facilitate transactions that otherwise would not have taken

place. Knowing that activists would pressure the incumbents to accept a takeover offer as long as the offer is fair, potential bidders have stronger incentives to approach these companies, thereby increasing the overall probability of a successful takeover. Based on this logic, the treatment effect can be identified by a positive relationship between the severity of agency problems in the cross section of target firms and the likelihood of a takeover.

Our paper is related to the literature on takeovers and shareholder activism (for surveys, see Becht et al. (2003) and Edmans (2014), respectively). Unlike studies in which the bidder is also a target shareholder (e.g., Shleifer and Vishny (1986), Hirshleifer and Titman (1990), Kyle and Vila (1991), Burkart (1995), Maug (1998), Singh (1998), and Bulow et al. (1999)), our analysis emphasizes the benefit from separating the capacity to disentrench boards from the capacity to increase firm value through acquisitions. The interaction between bidders and target blockholders was also studied by Burkart et al. (2000), Cornelli and Li (2002), Gomes (2012), and Burkart and Lee (2015). Different from these papers, however, we focus on agency problems within the target firm and on the ability of activists to relax the resistance of incumbents to takeovers.⁸ Finally, proxy fights as a mechanism to transfer corporate control were studied by Shleifer and Vishny (1986), Harris and Raviv (1988), Bhattacharya (1997), Maug (1999), Yilmaz (1999), Bebchuk and Hart (2001), and Gilson and Schwartz (2001). We add to this literature by identifying the commitment problem of bidders in takeovers and the relative advantage of activists in utilizing proxy fights to relax managerial resistance.

2 The commitment problem in takeovers

In this section we formally identify the bidder's commitment problem in takeovers and the role of activist investors in mitigating its inefficiencies.

⁸Models in which the target board can resist a takeover offer have also been studied by Bagnoli et al. (1989), Baron (1983), Berkovitch and Khanna (1990), Hirshleifer and Titman (1990), Harris and Raviv (1988), and Ofer and Thakor (1987).

2.1 Setup

Consider a model with a bidder, an activist investor, passive investors (institutional or retail), and one public firm, the target. The target is run by its incumbent board of directors. We do not distinguish between the manager and other board members; we treat them as one. We normalize the total number of target shares to one. Each share carries one vote. According to the target’s governance rules, a successful takeover requires at least 50% of its voting rights.

The standalone value of the target is $q \geq 0$. The bidder can add a value of $\Delta > 0$ by acquiring the target. If the bidder is a corporation in a related industry then Δ is the net operational or financial synergy that results from the merger. If the bidder is a private equity fund then Δ is the net operational improvement from a going private transaction.⁹ To focus the analysis on agency problems as the key friction, we assume that q and Δ are commonly known. We relax this assumption in Appendix G, and show that the main results continue to hold under information asymmetries. We also assume that the activist cannot affect the standalone value of the target or make a takeover bid. These assumptions are relaxed in Section 3.2.2 and Appendix F.

The bidder negotiates with the target board a cash offer to acquire all target shares. He cannot bypass the target board and make a tender offer directly to target shareholders, possibly because the target board can block these attempts using poison pills,¹⁰ or because overcoming the free-rider problem of Grossman and Hart (1980) is too costly. In Section 2.2.1 we relax this assumption and show that the main results hold as long as the incumbent can at least partially resist a takeover. As depicted in Figure 1, there are two rounds of negotiations which are separated by a proxy fight stage. In each round, the proposer is decided randomly and independently. With probability $s \in (0, 1)$ the proposer is the target board, and with probability $1 - s$ the proposer is the bidder. The proposer makes a take-it-or-leave-it offer to

⁹A takeover can increase shareholder value but at the same time destroy value to other stakeholders (e.g., employees or costumers). We assume that the target board, its shareholders, and the bidder do not internalize these externalities, and therefore, they have no effect on the equilibrium outcome.

¹⁰Corporate boards can adopt a poison pill on a short notice; it does not have to be in place prior to the takeover to deter bidders (“shadow pills”). Triggering a poison pill by moving forward with a tender offer significantly dilutes the bidder and is therefore extremely costly. Virtually all tender offers are conditioned on the redemption of a poison pill exactly for this reason. Moreover, a poison pill has never been intentionally triggered by a bidder, which is consistent with the pill being a powerful takeover deterrent.

the other party, and so, s represents the bargaining power of the target firm.¹¹ We denote by π_j the takeover premium per share paid by the bidder if an acquisition agreement is reached in round $j \in \{1, 2\}$. Any acquisition agreement must be approved by a majority of the target shareholders in a vote. At any voting stage, target shareholders do not play weakly dominated strategies. If target shareholders approve the agreement, each shareholder receives $q + \pi_j$ per share and the target is acquired by the bidder.

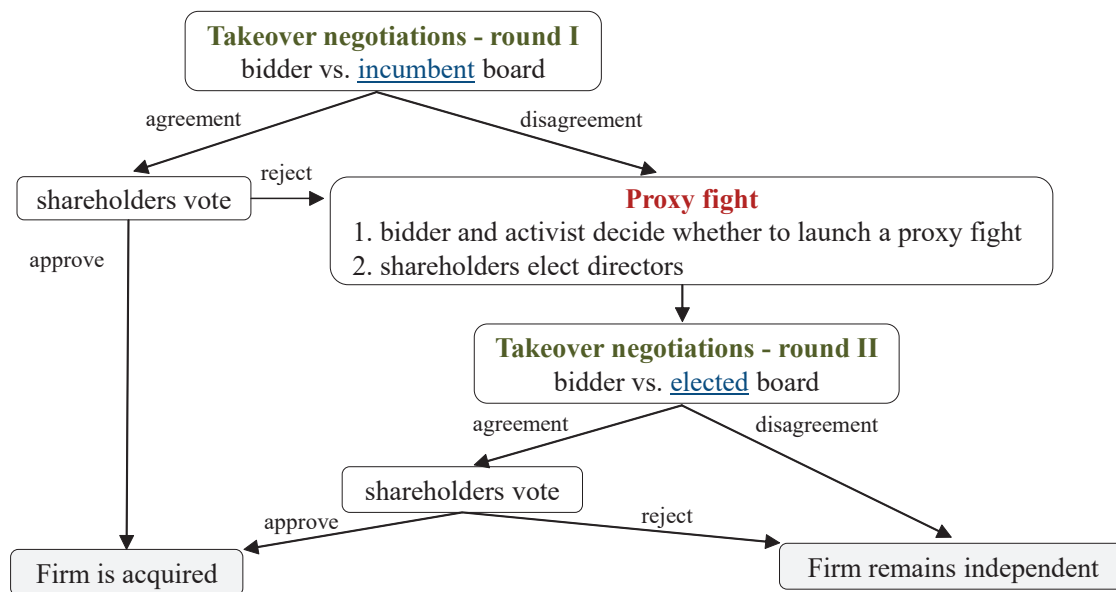


Figure 1 - Takeover negotiations and a proxy fight

If no agreement is reached at the first round or if shareholders vote down a proposed agreement, the bidder and the activist decide simultaneously whether to run a proxy fight to replace the incumbent board.¹² If a proxy fight is initiated, the challenger incurs a non-reimbursable campaigning cost $\kappa > 0$. Target shareholders then decide whether to vote for the incumbent or one of the rival teams. The team that receives the largest number of votes is

¹¹The Nash bargaining protocol can be microfounded using Rubinstein’s (1982) model of alternating offers.

¹²We implicitly assume that the majority of directors stand for reelection. In 2013, only 11% of the S&P 500 companies had a classified board, down from 57% in 2003 (see sharkrepellent.net: “Governance Activists Set Their Sights on Netflix’s Annual Meeting” and “2003 Year End Review”). Alternatively, winning a short slate proxy fight is sufficient to change the dynamic in the board and the ability of the incumbents to protect their private benefits of control. See Bebchuk et al. (2002) for a discussion on staggered board.

elected and takes control of the target board. If shareholders are indifferent between electing the rival (the bidder or the activist) and retaining the incumbent, they choose the latter.

Winning a proxy fight gives the rival team the right to negotiate on behalf of the target shareholders an acquisition agreement with the bidder in the second round. That is, the newly elected directors can redeem the poison pill, if such exists, and resume negotiations.¹³ The newly elected directors maximize the value of the party with which they are affiliated, even if it conflicts with maximizing target shareholder value. In other words, the bidder and the activist cannot commit to act in the best interests of target shareholders (see Section 3 for a discussion). Once the proxy fight stage ends, a second round of negotiations between the bidder and the target board (which may now be populated with the newly elected directors) takes place. The second round has the same protocol as the first round, with the exception that if no agreement is reached or shareholders reject the deal, the target remains independent and its standalone value is realized.

2.1.1 Payoffs

All agents are risk-neutral and have a zero discount rate.

Incumbent: The incumbent board owns $n \geq 0$ target shares and has private benefits of control $B_I > 0$ which are lost if the firm is acquired or if shareholders elect a new board. These benefits may include excessive salaries, perquisites, investment in ‘pet’ projects, access to private information, pleasure of command, prestige, or publicity. We assume that compensation contracts, including golden parachutes,¹⁴ cannot fully align the incentives of the incumbent board with the shareholders, which is consistent with the evidence by Jenter and Lewellen (2015). Moreover, we assume that the enforcement of the board’s fiduciary duties is not sufficiently strong to eliminate the consumption of these private benefits.¹⁵ We denote the incumbent board’s private benefits *per share* by $b \equiv B_I/n$.

¹³Provisions that make pills nonredeemable are illegal in most states, including New York and Delaware.

¹⁴Hartzell et al. (2004) point out that golden parachutes are often constrained due to IRS tax restrictions.

¹⁵In principle, shareholders can limit the extent of the board’s private benefits by setting the compensation of directors, changing the corporate charter, choosing the state of incorporation, etc. In Appendix C we show that in our framework target shareholders could in fact benefit from incumbent boards with $b > 0$.

Activist: The activist owns $\alpha \geq 0$ shares of the target, which we endogenize in Section 4. The activist may be conflicted with other target shareholders: she obtains private benefits $B_A \geq 0$ from controlling the target board as an independent firm. We do not rule out $B_A \geq B_I$, so the activist may even have larger private benefits than the incumbent board.

Bidder: The bidder has a toehold of $m \geq 0$ target shares. Once the bidder has taken control of the operations of the target, he can potentially divert corporate resources as private benefits if the firm remains independent, for example, by exploiting the privileged access as a board member to the target's proprietary information or through self-dealing transactions.¹⁶

Passive target shareholders: All other shares of the target are owned by passive investors, who have no private benefits and ability (or incentives) to run a proxy fight. We assume that collectively these investors hold more than 50% of the target voting rights: $n + \alpha + m < 0.5$.

2.2 Analysis

We study Subgame Perfect Equilibria in pure strategies and solve the game backward. All proofs not in the main text are in the Appendix.

Lemma 1 (Second round of negotiations) *Suppose the first round of negotiations has failed. Then, the expected target shareholder value in the second round of negotiations is*

$$q + \begin{cases} \pi_I \equiv \mathbf{1}_{b \leq \frac{\Delta}{1-m}} \cdot [s \frac{\Delta}{1-m} + (1-s)b] & \text{if the incumbent retains control,} \\ \pi_A \equiv \mathbf{1}_{\frac{B_A}{\alpha} \leq \frac{\Delta}{1-m}} \cdot [s \frac{\Delta}{1-m} + (1-s) \frac{B_A}{\alpha}] & \text{if the activist controls the board,} \\ 0 & \text{if the bidder controls the board.} \end{cases} \quad (1)$$

To understand Lemma 1, suppose first that the incumbent is reelected. Since it is the second and last round of negotiations, the incumbent can block the takeover. Therefore, he would agree to sell the firm only if the offer embeds a premium higher than b , his private benefits per share. On the other hand, the bidder makes a profit of $\Delta - (1-m)\pi_2$ if he acquires the

¹⁶See Atanasov et al. (2014) for a discussion on the various forms of tunneling, and Atanasov et al. (2010), Bates et al. (2006), and Gordon et al. (2004) for evidence on tunneling in the U.S.

target by paying a premium of π_2 for each of the $1 - m$ he does not already own. Therefore, the highest premium the bidder can afford to pay is $\frac{\Delta}{1-m}$. There are two cases to consider:

1. Suppose $b \leq \frac{\Delta}{1-m}$. If the incumbent is the proposer then he would demand a premium of $\frac{\Delta}{1-m}$. If the bidder is the proposer he would offer the lowest premium that is acceptable to the incumbent board and target shareholders, which is b . Indeed, target shareholders approve any agreement that offers them more than the target standalone value, q . Note that the bidder overcomes the incumbent's resistance to the takeover by compensating him for the loss of his private benefits of control. In this case, the entrenchment of the incumbent benefits target shareholders (at least ex-post) since it forces the bidder to offer a higher premium without endangering the deal. Overall, if $b \leq \frac{\Delta}{1-m}$ then the incumbent and the bidder reach an agreement and the expected takeover premium is $s\frac{\Delta}{1-m} + (1-s)b$.
2. If $\frac{\Delta}{1-m} < b$ then the bidder cannot afford to compensate the incumbent for the loss of his private benefits of control. The bidder walks away from the takeover negotiations, no agreement is reached, and the target remains independent under the incumbent's control. In this case, the entrenchment of the incumbent board results with an inefficient outcome which is at the core of our analysis: a value-increasing takeover is rejected.¹⁷

Overall, the expected shareholder value under the incumbent's control is $q + \pi_I$. Similarly, the expected shareholder value if the activist is elected is $q + \pi_A$. The only difference is that under the activist's control the target board has private benefits per share of $\frac{B_A}{\alpha}$ instead of b .

This dynamic changes when the bidder wins the proxy fight. Since the bidder gains the authority to negotiate on behalf of target shareholders, effectively, the bidder sits on both sides of the negotiating table! Unlike the activist, the bidder is interested in acquiring the target for the lowest price possible. Therefore, regardless of the proposer's identity, the bidder would be tempted to offer target shareholders their reservation price q . Moreover, the bidder would be tempted to exploit his control of the target board to divert corporate resources as private benefits. *This is the bidder's commitment problem in takeovers.* Notice that this argument does not imply that if a bidder wins a proxy fight, the offered takeover premium

¹⁷If $\frac{n}{1-m}\Delta < B_I < \Delta$ then a takeover is the efficient outcome under the incumbent's control even when the incumbent's private benefits are taken into account.

should necessarily drop. If the bidder believes that he can win a proxy fight and capture the target board even without resolving the commitment problem, he would low-ball the takeover premium in advance (in the first round), anticipating his ability to abuse the power of the target board once elected. This discussion completes the proof of Lemma 1.

Target shareholders, however, rationally expect the bidder to abuse the power of the board, and therefore, they never elect him to their board. Since running a proxy fight is both costly and inefficacious, the bidder does not run a proxy fight in any equilibrium of the subgame. This result holds regardless of the gains from the takeover (Δ), the cost of running a proxy fight (κ), the size of the bidder's toehold (m), the incumbent board's private benefits of control (b), the activist's private benefits of control (B_A/α), and whether or not the activist is also running a proxy fight. The next result shows that unlike the bidder, the activist can win a proxy fight.

Proposition 1 (Proxy fight) *Suppose the first round of negotiations has failed. Then:*

- (i) *The bidder never runs a proxy fight.*
- (ii) *The activist runs a proxy fight if and only if*

$$\pi_A - \pi_I \geq \kappa/\alpha. \tag{2}$$

If the activist runs a proxy fight, she wins the control of the target board and then reaches an acquisition agreement with the bidder in which the latter pays an expected takeover premium of π_A .

Proposition 1 establishes our observation that although both bidders and activists can launch a proxy fight and face the same costs of doing so, only activists can effectively challenge the resistance of incumbents and facilitate a takeover. Unlike the bidder, shareholders expect the activist to negotiate a premium of $\pi_A \geq 0$ if they elect her to the board. Being on the sell-side gives the activist an advantage relative to the bidder when campaigning against the incumbent. Nevertheless, shareholders elect the activist only if she is expected to outperform the incumbent, that is, $\pi_A > \pi_I$. The activist, however, does not necessarily start a proxy

fight even if she expects to win it. If the activist does not challenge the incumbent, the value of the activist's stake is $\alpha(q + \pi_I)$. If the activist runs and wins a proxy fight, the value of her stake increases to $\alpha q + \max\{\alpha\pi_A, B_A\}$, but she has to bear the cost κ . Notice that if $\pi_A > \pi_I$ then $\alpha\pi_A \geq B_A$, that is, if shareholders are willing to elect the activist to the board, it must be both feasible and in the best interest of the activist to negotiate a deal in which the bidder is expected to pay a premium π_A . The activist runs a proxy fight if and only if she can win the proxy fight and the increase in the value of her stake is higher than the cost of running a proxy fight, which gives condition (2). This discussion completes the proof of Proposition 1.

To gain more insight on condition (2), we consider two cases:

1. If $\frac{\Delta}{1-m} < b$ then (2) is equivalent to

$$\delta/\alpha \leq \frac{\Delta}{1-m} < b \quad (3)$$

where

$$\delta \equiv B_A + \max\{0, \frac{\kappa - B_A}{s}\}. \quad (4)$$

In this case, shareholders expect the target to remain independent if they reelect the incumbent (since $\frac{\Delta}{1-m} < b$) and to be sold for a strictly positive premium if they support the activist (since $\delta/\alpha \leq \frac{\Delta}{1-m} \Rightarrow B_A/\alpha \leq \frac{\Delta}{1-m}$). Indeed, the activist is less biased than the incumbent ($B_A/\alpha < b$), and as a result, her threat to run a proxy fight is credible. Here, the activist's presence complements the effort of the bidder to acquire the target.

2. If $b \leq \frac{\Delta}{1-m}$ then (2) is equivalent to

$$b + \frac{\kappa/\alpha}{1-s} < B_A/\alpha \leq \frac{\Delta}{1-m}. \quad (5)$$

In this case, the incumbent will reach an agreement with the bidder if he is reelected, but under this agreement shareholders receive a takeover premium of π_I , which is lower than the premium that the activist can negotiate, $\pi_A > \pi_I$. Shareholders support the activist's attempt to replace the incumbent not because it is only the only way to sell the firm, but rather because they are concerned that the incumbent is selling the target for a price that is too low. Since the

activist challenges the deal with the intent of “forcing” the bidder to sweeten his offer (Jiang et al. (2015)), the activist reduces the rents the bidder obtains from the takeover.¹⁸

Accounting for the proxy fight stage and the second round of negotiations, the next result characterizes the equilibrium of the game.

Proposition 2 (First round of negotiations) *A unique equilibrium exists. If*

$$\min \{b, \delta/\alpha\} \leq \frac{\Delta}{1-m} \tag{6}$$

then the bidder reaches an agreement (with the incumbent board) in the first round of negotiations in which the bidder pays a takeover premium per share of

$$\pi_1^* = \begin{cases} \pi_A & \text{if } \pi_A - \pi_I \geq \kappa/\alpha, \\ \pi_I & \text{otherwise,} \end{cases} \tag{7}$$

and acquires full control of the target. If (6) does not hold, no proxy fight is initiated and the target remains independent under the incumbent’s control.

To understand Proposition 2, consider two cases. First, if $\pi_A - \pi_I < \kappa/\alpha$ then the activist has no effect on the outcome of the takeover. Without the intervention of the activist, the bidder and the incumbent reach an agreement if and only if $b \leq \frac{\Delta}{1-m}$, in which case the target is sold for a premium π_I . Second, if $\pi_A - \pi_I \geq \kappa/\alpha$ then all parties involved correctly anticipate that if the first round of negotiations fails, the activist would run and win a proxy fight, take control of the target board, and then negotiate an acquisition agreement with an expected premium of π_A . Since the activist’s threat of running a proxy fight is credible, any first round offer below $q + \pi_A$ is rejected by shareholders, and any offer above $q + \pi_A$ is rejected by the bidder. The incumbent board understands that the takeover is inevitable, and therefore, accepts any offer higher than $q + \pi_A$ in order to avoid the adverse consequences of losing the proxy fight (e.g., embarrassment or loss of reputation). As a result, the bidder reaches an agreement with the

¹⁸This intuition also applies to cases where the incumbent is too motivated to sell the firm, e.g., in management buyouts or when incumbents are promised large bonuses if the takeover succeeds (Grinstein and Hribar (2004) and Hartzell et al. (2004)).

incumbent board in the first round in which the target is sold for a premium π_A . In these cases, the credible threat of the activist to run a proxy fight is sufficient to change the outcome of the takeover.¹⁹

2.2.1 Limited veto power and tender offers

Assuming that bidders can never bypass the target board and go straight to shareholders by making a tender offer is not necessary for our main results. Our arguments only require that corporate boards can partially resist a takeover (through a poison pill or any other defense measure). In Appendix B, we analyze an extension in which the bidder can overcome the resistance of the board (i.e., the poison pill) with some probability and make a tender offer to target shareholders. Similar to the baseline model, the bidder never runs a proxy fight because of the commitment problem. The activist runs a proxy fight if and only if condition (2) holds, with the exception that κ is replaced by κ/λ , where $\lambda \in [0, 1]$ is the probability that the target board can block the takeover. Intuitively, if λ is low then the bidder has an alternative mean by which he can overcome the resistance of the board, and therefore, the activist has fewer incentives to run a proxy fight in order to facilitate the takeover. In other words, there is *substitution* between the bidder's ability to bypass the target board through tender offers and the activist's ability or need to unseat the incumbent through a proxy fight. Ceteris paribus, one would expect activists to play a smaller role in the market for corporate control in jurisdictions in which boards have weaker power to block deals, such as the U.S. in the 1980s or the U.K.

3 Discussion

3.1 Overcoming the commitment problem

A key observation from our analysis is that bidders suffer from a commitment problem that harms their credibility, and consequently, limits their ability to challenge an entrenched target board. Can this commitment problem be solved? That is, can target shareholders ever trust a

¹⁹Note that condition (6) is the union of $b \leq \frac{\Delta}{1-m}$ and $\pi_A - \pi_I \geq \kappa/\alpha$.

bidder to maximize their value if they give him the power to negotiate on their behalf? Below we discuss different ways by which the bidder can alleviate or overcome this commitment problem.²⁰ We argue that these solutions are either imperfect or costly to implement. If so, since activist investors suffer from the commitment problem to a lesser extent, they maintain their relative advantage in pressuring companies to sell. This prediction is consistent with the fact that activists run and win proxy fights much more frequently than bidders do.

3.1.1 Legal environment

Effective and strong investor protection laws can help shareholders enforce directors' fiduciary duties and commit the bidder not to abuse the power of the target board once elected. For example, when evaluating whether directors have complied with their fiduciary duties in the context of M&A transactions, the Delaware court is likely to apply a stricter standard of review (Entire fairness rather than Business judgment) if a priori there is a particular concern that the target board members are conflicted with their shareholders. However, there is no guarantee that the courts or regulators would be able to tell apart related-party transactions that make economic sense from those which do not. Moreover, litigation and enforcement are often costly, uncertain, and limited to verifiable outcomes. In practice, there is a considerable variation in how different countries cope with corporate self-dealing (e.g., Djankov et al. 2008), suggesting that a perfect solution may not exist.

3.1.2 Recruiting independent nominees

The bidder might consider recruiting independent nominees to represent him on the target board. However, this strategy has several shortcomings. First, finding "truly independent" nominees that are willing to represent the bidder and have the relevant expertise can be time-consuming and expensive. Second, even if the bidder could identify independent nominees, target shareholders (as well as judges) may still be uncertain and suspicious about their true

²⁰Clearly, if the cost of running a proxy fight is too high then the bidder would not make this commitment even if he could. In Appendix D we show it is possible that the activist's threat of running a proxy fight is credible while the bidder's threat is not (assuming he committed to act in the best interest of target shareholders), even though they face the same cost κ .

motives and incentives. Building a consensus on the independence of the bidder's nominees requires shareholders to perform background checks, inspect the nominees' business ties and social networks, and verify their disclosures. All of these are costly, time consuming, and imperfect. Without a consensus, the bidder will be tempted to appoint biased nominees (i.e., nominees that would maximize the bidding firm value) and pretend that they are in fact independent. As a result, target shareholders would not be able to trust the bidder. Third, truly independent nominees are likely to care about their reputation. These individuals will have strong incentives to avoid any discontent (or litigation) from target shareholders once elected to the board, and hence they may be overly cautious. In effort to demonstrate their independence, these individuals might be tougher than needed, turn against the bidder, and ultimately hurt his effort to acquire the target (a case in point is Air Products's failed attempt to acquire Airgas in 2010).²¹ Under those circumstances, the bidder may give up the attempt to replace the incumbent directors.

Overall, our underlying assumption is a short supply of truly independent nominees with the relevant expertise and high integrity. If the supply of these exceptional individuals is abundant, many agency problems, including the one in this paper, could be easily solved.

3.1.3 Proxy fight combined with a tender offer

In the U.S., the bidder can run a proxy fight and at the same time make a tender offer that remains pending until after the director elections. This tactic, however, is not a perfect solution for the bidder's commitment problem for two different reasons:

1. It is well known that the free-rider problem in tender offers can result with inefficiencies and deter bidders from approaching targets (Grossman and Hart (1980)). In fact, this is the reason why Bebchuk and Hart (2001) view the arrangement of a proxy fight combined with a tender offer as imperfect.²²

²¹Air Products won a proxy fight in which it successfully appointed 3 directors to the board of Airgas. Although these 3 directors were nominated by Air Products, they turned against Air Products (claiming the takeover offer was too low) and helped Airgas's management to block the takeover. Air Products eventually dropped its bid and the takeover failed.

²²Bebchuk and Hart (2001) propose amending the existing rules governing mergers to allow acquirers to bring a merger proposal directly to a shareholder vote without the approval of the board of directors. Under

2. Under this arrangement, the tender offer is made conditional on the redemption of the poison pill (and other conditions such as securing funds to finance the offer). But it is the target board members who ultimately decide whether to rescind the pill. So, if the bidder wins the proxy fight and takes control of the target board, the bidder has two options. First, redeem the pill and consume the takeover (if indeed target shareholders tender their shares). Second, keep the pill in place, let the tender offer expire, and make a new offer. This is exactly the commitment problem: The bidder wishes he could commit to rescinding the pill after taking control of the board, but what forces him to do so? For example, the bidder can always argue that with the control of the board he also got access to private information about the target that was not available before (which is common in hostile situations), and this new information does not justify the price. In fact, as we noted previously, anticipating this chain of events, the bidder will low-ball the offer in the first place, avoiding the need to reduce it if he wins the proxy fight. If shareholders have rational expectations, they would not elect the bidder to the board.

3.1.4 Competition

Competition for the target firm (whenever exists) can also limit the bidder's ability to expropriate target shareholders. Low-balling the takeover premium while a superior competing bid is outstanding can be challenging (e.g., the Revlon Rule under the Delaware corporate law). Yet, by controlling the target board, the bidder can still exploit his access to the target's private information and divert resources, thereby deterring competition. In fact, due to a bidder's privileged access to the target's private information, the competitors are likely to suffer from the winner's curse. Overall, the commitment problem is likely to be weaker when there are competing bids for the target, although the problem cannot be entirely resolved.

the proposed new rule, the bidder can effectively commit to a certain acquisition price. Our analysis suggests that if a proposal of this nature is adopted, then the role of activist investors in the M&A market would be diminished.

3.1.5 Reputation

Serial acquirers or private equity funds, who repeatedly interact in the market for corporate control, might be able to develop reputation for not expropriating target shareholders. However, building and maintaining good reputation is costly (i.e., avoiding the temptation to extract value today), it depends on the presence of public histories of past outcomes, and it can create unintended distortions. Our analysis suggests that repeated bidders (e.g., private equity investors or serial acquirers) will suffer from the commitment problem, but to a lesser extent than one-time players.

3.2 Corporate control activism

Our second key observation asserts that, unlike bidders, activists can pressure incumbents to sell. This argument requires target shareholders to believe that the activist is on their side of the negotiating table (rather than on the bidder's side), and that if the activist has the capacity to make a takeover bid for the target, the activist will not abuse the power of the board once elected (unlike a bidder in the same situation). Moreover, shareholders must also believe that the activist would resist the takeover, if at all, to a lesser extent than the incumbent. Below, we examine these conditions in detail.

3.2.1 Are activists truly on the sell side of the negotiating table?

As target shareholders, activists have incentives to maximize the return on their investment by negotiating the highest takeover premium the bidder is willing to pay. This premise, however, relies on the assumption that the activist's economic ownership in the target is not offset by derivatives. Moreover, it assumes that the activist has no ownership in the bidding firm or any other explicit or implicit agreement with the bidder (e.g., the collaboration between Pershing Square and Valeant during its unsolicited bid for Allergan in 2014).

If these are real concerns, then the activist would lose her credibility, and therefore, her ability to pressure the incumbent to sell. Note, however, that according to SEC Rule 14a-9, activists are required to disclose their net economic exposure to the target and the bidding firm as part of the proxy solicitation process. Moreover, Collin-Dufresne et al. (2016) document

that activist investors rarely trade derivatives, putting into question the extent of empty voting (Hu and Black (2006, 2007), Kahan and Rock (2007)) as a common practice used by activists. These considerations, however, do not rule out the possibility that if the activist wins the control of the target board, the bidder could offer her side-payments (i.e., bribe) in return for a favorable treatment. Nevertheless, side-payments are outright illegal, and bribing a third party (such as an activist hedge fund manager) involves the risk of being caught. As long as this legal risk is present and the consequences of being caught are not trivial, target shareholders are likely to be more suspicious of the bidder's motives than the activist's.

3.2.2 Activists as bidders - do they suffer from a weaker commitment problem?

Reselling the target The analysis rules out the possibility that the activist would acquire the target herself and then quickly resell it to a potential bidder. If this strategy is feasible, target shareholders may not trust an activist for the same reasons they would not trust a bidder. This strategy, however, is unlikely to be profitable for several reasons. First, it embeds the risk of not finding a buyer for the target in a timely fashion. Second, even if the activist finds a buyer, her bargaining power at the resale transaction is likely to be very low: Once the activist acquires the target, potential buyers will take advantage of the fact that the activist bought the target with the sole purpose of reselling it and that she does not have the ability or incentives to run the company herself. Third, even if the activist succeeds in reselling the company at a significantly higher price than she bought it, the activist bears the risk that former shareholders will sue her for a breach of her fiduciary duties, using the price differential as a hard evidence. Importantly, the commitment problem of the activist in this case is weaker than the commitment problem of the bidder in the baseline model: When the bidder takes the firm private or merges it with his existing assets (rather than reselling it to a third party), a verifiable evidence against the bidder (such as the price differential) is less likely to emerge. For these reasons, it is unlikely that the activist will employ this strategy once elected to the board, and as a result, the activist is more likely to be trusted by target shareholders.

Increasing the standalone value of the target The commitment problem arises in our setup since the bidder cannot (or has no incentives to) create value unless he acquires more than

50% of the voting rights of the target. For example, a strategic bidder can realize the synergy only if the target is merged into the acquiring firm, and a private equity fund can execute the operational improvements only if the firm is taken private, insulating it from public markets. However, activist hedge funds (as well as other financial buyers) may have the expertise and incentives to propose and execute operational, financial, or governance related policies that increase the standalone value of the target, even if its ownership structure does not change. We argue that activists who have the capacity to make a takeover bid and the ability to increase the standalone value of the target (as a substitute to a takeover) are more resilient to the commitment problem in takeovers, compared to bidders who need to own majority of the target to realize synergies.

For this purpose, consider a modification of the baseline model where the activist plays the role of the bidder. Suppose that a value of Δ can be created if the activist's proposal is implemented. The proposal can be successfully implemented either by the incumbent or by the activist. If the proposal is implemented, the incumbent loses his private benefits of control. The key assumption is that the proposal can be implemented even if the target remains independent after the failure of the second round of negotiations.

Proposition 3 *Suppose the first round of negotiations fails. If the activist can increase the standalone value of the target, she runs a proxy fight if and only if*

$$\frac{\kappa/\alpha}{1-\alpha} \leq \frac{\Delta}{1-\alpha} < b, \tag{8}$$

and whenever the activist runs a proxy fight, she wins.

Intuitively, while the activist may be tempted to low-ball the takeover offer once she gets control of the target board, these attempts are doomed to fail since target shareholders know that if they reject the offer, the activist will inevitably implement the value-increasing proposal in order to maximize the value of her own stake in the target. Therefore, shareholders would not fear electing the activist to the board even if she can make a takeover bid. In this respect, financial buyers such as activist hedge funds are more resilient than strategic buyers to the

commitment problem in takeovers.²³

3.2.3 Are activists less biased against takeovers than incumbents?

The bias of the activist and the incumbent against the takeover is determined by their ownership in the target and the amount of private benefits of control they obtain from keeping the target independent. Given the private benefits, larger ownership effectively implies a smaller bias against the takeover. There are two reasons why activists are likely to be less biased than incumbents, that is, $\frac{B_A}{\alpha} < \frac{B_I}{n}$:

1. Activists are likely to have fewer private benefits from keeping the target as an independent firm ($B_A \leq B_I$). It is quite rare to find an activist staying on the board of a portfolio company for more than a year (partly because insider trading rules put restrictions on activists, who ultimately seek to exit and pursue other investment opportunities). A short tenure on the board limits the ability of activist hedge fund managers to consume private benefits (such as perquisites, publicity, prestige) from keeping the firm independent. Moreover, executives and directors of public companies are unlikely to find a good substitute for their job if a takeover takes place and they are fired (e.g., Harford (2003)). Their firm-specific investment could be lost if the target is acquired. By contrast, activist hedge fund managers hold a portfolio of 10-15 firms and their reputation depend on the aggregate performance of their portfolio.
2. Activists own a larger stake in the target ($\alpha \geq n$). In practice, activists typically own 8-9% of the target firm when they run a campaign (e.g., Brav et al. (2008)), while managers and directors typically own much less. For example, Murphy (2013) finds that the median percentage ownership of CEOs in S&P 500 firms is around 0.5%. For non-CEO executives the numbers are even lower, and directors typically earn annually no more than \$250K, a large portion of which is in fixed salaries.

²³Consistent with this argument, Boyson et al. (2016) find that in 15% of the events in their sample the activist is also making a takeover bid to the target company.

4 Activist's position building and deal solicitation

Building on the insights from the baseline model, in this section we extend it to study the implications of activist interventions in the M&A market.

4.1 Modified setup

Suppose Δ is initially unknown and let $\zeta \in \{0, 1\}$ be a random variable with a common prior $\Pr[\zeta = 1] = \mu \in (0, 1)$. If $\zeta = 0$ then the firm is not a viable target and $\Delta \leq 0$ with certainty. If $\zeta = 1$ then the acquisition can create value and $\Pr[\Delta > 0 | \zeta = 1] > 0$. The cumulative distribution function of Δ conditional on $\zeta = 1$ is given by F , which is differentiable and has full support over the real line. We assume $E[\Delta | \zeta = 1] \leq 0$, which guarantees that the bidder will not acquire the target without first performing due diligence of Δ , as we specify below. Intuitively, corporate assets with which the bidder can create enough synergies to compensate for transaction costs (as well as distraction of management and employees, increased uncertainty, and additional regulations) are scarce.

At the outset, the activist privately observes signal $y \in \{0, 1\}$ on ζ where

$$\Pr[y = 1 | \zeta] = \begin{cases} 1 & \text{if } \zeta = 1 \\ 1 - \phi & \text{if } \zeta = 0 \end{cases} \quad (9)$$

and $\phi \in (0, 1]$. If $y = 0$ then the activist infers with certainty that $\zeta = 0$. If $y = 1$ she updates her beliefs about $\zeta = 1$ upward from μ to $\hat{\mu} \equiv \frac{\mu}{1 - \phi(1 - \mu)}$. The activist does not own shares of the target initially, but she can submit an order to buy $\alpha \geq 0$ shares from a risk-neutral, competitive, and uninformed market maker. Short sales are not allowed. The share price, denoted by p , is set equal to the expected value of the target conditional on the total order flows. For simplicity, we assume that the market maker can condition the price on the order-flow if and only if the order is strictly larger than $\bar{\alpha} \in (0, 1)$. That is, the stock is perfectly liquid (illiquid) for small (large) orders.²⁴ Alternatively, $\bar{\alpha}$ can be interpreted as the disclosure

²⁴A previous version of the paper assumed the existence of liquidity traders a la Kyle (1985) and showed that similar results hold under this alternative formulation.

threshold for regulations 13D or 13G. Moreover, we assume that buying up to $\bar{\alpha}$ shares does not trigger a poison pill if such exists. Empirically, $\bar{\alpha} \in [5\%, 10\%]$. We also assume that the activist has limited funds, denoted by $R > 0$, that she can use to invest in the target. If the activist is indifferent between investing and not, we assume that she does not invest.

The bidder perfectly observes ζ and the number of shares bought by the activist. For simplicity, we abstract from the bidder's decision to build a toehold and assume $m = 0$. The bidder then decides whether to perform due diligence:²⁵ He can pay $c \geq 0$ and learn the exact value of Δ . The cost c , which is privately observed by the bidder, is drawn from a continuous cumulative distribution G with full support on $[0, \infty)$, and it is independent of all other random variables. If the bidder performs due diligence, Δ becomes public and the takeover negotiations unfold as in the baseline model.

Finally, we focus on cases in which the activist can facilitate the takeover: We assume $B_A(1 - s) \leq \kappa$, which guarantees that condition (5) does not hold for any α .²⁶

4.2 Analysis

We solve for the Perfect Bayesian Equilibrium in pure strategies of the extended model. We start with the following corollary of Proposition 2.

Corollary 1 *Suppose the bidder performs due diligence and the activist owns α shares of the target. Conditional on ζ , the expected shareholder value is $q + \zeta v(\alpha)$, the bidder's expected profit is $\zeta(w(\alpha) - v(\alpha))$, and the expected value (net of any private benefits) created by the takeover is $\zeta w(\alpha)$, where*

$$v(\alpha) = \int_b^\infty \pi_I(\Delta) dF(\Delta) + \int_{\min\{b, \delta/\alpha\}}^b \pi_A(\Delta, \alpha) dF(\Delta) \quad (10)$$

²⁵Our assumption that the bidder's decision to perform due diligence is made after the activist's position is revealed is consistent with Boyson et al. (2016), who find that in 70% of the events in their sample a takeover bid is announced within 2 years of a hedge fund initiating an activist campaign.

²⁶If $B_A > \kappa/(1 - s)$ then the anticipation that the activist will put pressure on the target board to demand a higher premium would weaken the incentives of the bidder to perform due diligence.

and

$$w(\alpha) = \int_{\min\{b, \delta/\alpha\}}^{\infty} \Delta dF(\Delta). \quad (11)$$

All three terms strictly increase in α when $\delta/\alpha < b$, and are invariant to α otherwise.²⁷

Since on average the takeover does not create value, the bidder never acquires the target without first performing due diligence. According to Corollary 1, if the bidder performs due diligence then his expected net profit conditional on ζ and α is $\zeta \cdot (w(\alpha) - v(\alpha)) - c$. As a result, the bidder performs due diligence if and only if $\zeta = 1$ and $c < w(\alpha) - v(\alpha)$. This observation implies that the expected takeover premium conditional on $\zeta = 1$ and α is

$$h(\alpha) \equiv G(w(\alpha) - v(\alpha))v(\alpha). \quad (12)$$

Since $w(\alpha) - v(\alpha)$ and $v(\alpha)$ weakly increase in α , the expected takeover premium also weakly increases in α .

The decision of the activist to buy target shares depends on the share price p and her private information about Δ . If $y = 0$ then the activist expects any takeover attempt to fail for sure. Since the activist cannot profit from investing in the target, she does not buy any of its shares. By contrast, if $y = 1$ then a takeover is possible and investing in the target can be profitable. The next result characterizes the equilibrium.

Proposition 4 *A unique equilibrium always exists. The equilibrium satisfies the following:*

- (i) *The activist buys $\alpha^* = \min\{\alpha^{**}, \bar{\alpha}\}$ shares of the target if $y = 1$ and no share otherwise, where $\alpha^{**} > 0$ is the unique solution of*

$$\alpha(q + \mu h(\alpha)) = R. \quad (13)$$

²⁷The function $v(\alpha)$ is generally non-monotonic in α : higher α increases the incentives of the activist to run a proxy fight, but conditional on running a proxy fight, higher α also reduces the bias of the activist against the takeover, and therefore, harms her ability to bargain a higher takeover premium (π_A decreases in α). In the proof of Corollary 1 we make a technical assumption that guarantees $v'(\alpha) > 0$. The monotonicity is only necessary for the uniqueness of the equilibrium.

(ii) If the activist buys $\alpha \geq 0$ shares of the target, the share price is given by

$$p(\alpha, \alpha^*) = q + \begin{cases} \mu h(\alpha^*) & \text{if } \alpha \leq \bar{\alpha} \\ \hat{\mu} h(\alpha) & \text{if } \alpha > \bar{\alpha}. \end{cases} \quad (14)$$

(iii) For any $\alpha \geq 0$, the bidder performs due diligence if and only if $\zeta = 1$ and $c < w(\alpha) - v(\alpha)$. If the bidder performs due diligence then the takeover negotiations unfold as described by Proposition 2 given the actual stake of the activist in the target and the realization of Δ .

In equilibrium, the market maker expects the activist to buy α^* shares if and only if $y = 1$, which happens with probability μ . The activist buys less than $\bar{\alpha}$ shares to conceal her position from the market maker, and therefore, the latter sets the share price $q + \mu h(\alpha^*)$ as long as $\alpha \leq \bar{\alpha}$. Off-equilibrium, if the activist buys more than $\bar{\alpha}$ shares, the market maker assumes $y = 1$ and prices the shares accordingly as given by (14). Given this price function, the activist's expected profit conditional on $y = 1$ from buying α shares is given by

$$\Pi(\alpha, \alpha^*) = \alpha (q + \hat{\mu} h(\alpha) - p(\alpha, \alpha^*)). \quad (15)$$

An equilibrium requires $\alpha^* \in \arg \max_{\alpha \in [0, \bar{\alpha}]} \Pi(\alpha, \alpha^*)$ subject to $\alpha p(\alpha, \alpha^*) \leq R$. In equilibrium, the activist exhausts her funds unless doing so requires buying more than $\bar{\alpha}$ shares, that is, either $\alpha^* = \bar{\alpha}$ or $\alpha^* p(\alpha^*, \alpha^*) = R$ (the latter condition is equivalent to (13)). Indeed, the activist will buy additional shares of the target as long as she can take advantage of her informational advantage (i.e., $\alpha \leq \bar{\alpha}$) and has the resources to do so (i.e., $\alpha p(\alpha, \alpha^*) \leq R$). This explains $\alpha^* = \min \{\alpha^{**}, \bar{\alpha}\}$.

4.2.1 Selection vs. treatment

Generally, the equilibrium exhibits either “selection” or “treatment”. If the equilibrium exhibits selection, the activist's stake is too small so the threat of running a proxy fight is not credible, that is, $\delta/\alpha^* \geq b$. Since the activist has no informational advantage relative to the bidder, she cannot affect his decision to perform due diligence by sharing her information ei-

ther. However, since $\phi > 0$, the activist has incentives to speculate: Knowing the firm is likely to be a target when $y = 1$ gives the activist informational advantage (relative to the market maker) that makes the purchase of shares a profitable investment. In these cases, the activist invests in firms that are likely to be targets, but her investment has no real effect.

If the equilibrium exhibits treatment, the activist buys a stake that gives her enough incentives to challenge the board and sufficient credibility to get the support of shareholders when campaigning against the incumbent. Essentially, the activist invests in firms that are likely to be targets, and by doing so, she increases the probability of a takeover. There are two effects. First, if $\delta/\alpha^* < \Delta < b$ then the activist can pressure the incumbent to accept an offer that he would otherwise reject. Second, if $\delta/\alpha^* < b$ then regardless of the value of Δ , the activist increases the likelihood that a takeover offer is made by *soliciting* a deal: The presence of the activist as a target shareholder signals the bidder that the incumbent is likely to be pressured by its shareholders to sell the firm, and therefore, the bidder has stronger incentives to perform due diligence and start takeover negotiations. In other words, activist investors not only facilitate takeovers once the offer is on the table, but they can also increase the likelihood that a company becomes a takeover target in the first place.²⁸ This observation also implies that policies and regulations that undermine shareholder activism but do not affect bidders directly will still have a significant effect on takeovers. For example, the legalization of two-tier “anti-activism” poison pills will adversely affect M&A even if “standard pills” that prevent takeovers are already prevalent.²⁹

The equilibrium exhibits treatment if and only if $\delta/\alpha^* < b$. The next corollary follows from the characterization of α^* in Proposition 4.

Corollary 2 *The equilibrium exhibits treatment if and only if*

$$\delta \max \left\{ \frac{q + \mu h(0)}{R}, \frac{1}{\bar{\alpha}} \right\} < b. \quad (16)$$

²⁸Similarly, if the activist were to acquire a stake after the bidder approaches the target, the anticipation that an activist would show up and pressure the target board to accept the takeover offer can also increase the bidder’s incentives to engage in takeover negotiations.

²⁹In 2014, the Delaware court allowed Sotheby’s to keep a unique two-tier poison pill that was purposely meant to block the activist hedge fund Third Point from increasing its ownership in Sotheby’s above 10%. See *THIRD POINT LLC v. Ruprecht*, Del: Court of Chancery 2014.

According to Corollary 2 (and the explicit form of δ as given by (4)), the equilibrium is *more* likely to exhibit treatment if the firm is less likely to be a target for a takeover in the first place (small μ), the target firm is smaller (small q), running a proxy fight is less costly (small κ), the stock is more liquid or the disclosure requirements are lenient (large $\bar{\alpha}$), or the activist has more resources (large R). All of these effects are intuitive, perhaps except for the effect of μ . All else being equal, larger μ increases the share price of target, and given the activist's limited resources, constrains her ability to build a sufficiently large position in the target which is necessary to pressure the incumbent to sell. Also note that for sufficiently small values of b the equilibrium exhibits selection, and for sufficiently large values of b the equilibrium exhibits treatment, as one might expect.³⁰ The effect of B_A is ambiguous: Higher B_A harms the credibility of the activist but also gives her more incentives to run proxy fight, if she can win. The latter effect dominates if B_A is small.

According to Proposition 4, the ex-ante probability of a takeover in equilibrium is

$$\theta^* = \mu G(w(\alpha^*) - v(\alpha^*)) \times (1 - F(\min\{b, \delta/\alpha^*\})). \quad (17)$$

When the equilibrium exhibits selection, the activist has no real effect. Yet, the probability of a takeover is higher when the activist is present as a target shareholder than when she is not. To see why, note that if $y = 0$ then the activist buys no target shares, and since $\zeta = 0$, a takeover never takes place. If $y = 1$ then the activist becomes a target shareholder and the conditional probability of a takeover is strictly positive, $\theta^* > 0$. Intuitively, since the activist uses her private information on ζ to speculate on a takeover of the target, her presence is correlated with a higher expected synergy and a higher probability that the bidder makes an offer. This observation is the reason why identifying a casual link between activists' presence and the likelihood of a takeover is challenging.

The comparative statics of θ^* with respect to b can help to distinguish between the selection and the treatment effects in equilibrium. It is trivial to show that if the equilibrium exhibits selection ($\delta/\alpha^* < b$) then the probability of a takeover is always strictly decreasing in b . Intuitively, higher b implies that the bidder has a lower probability of reaching an agreement

³⁰Note that while $h(0)$ depends on b , it is bounded from above by $E[\Delta|\Delta \geq 0]$.

with the incumbent at favorable terms, and hence, weaker incentives to perform due diligence. This can be seen in Figure 2 by the fact that at any point left to the red vertical line, which marks the border of the selection region, the curve is downward sloping. Since in the selection region the activist has no effect on the takeover, the same pattern holds if the activist is not present as a target shareholder. This can be seen by the black curve in Figure 2 which depicts the probability of a takeover in the absence of an activist. However, the probability of a takeover can *increase* with b when the equilibrium exhibits treatment. Indeed, the blue curve in Figure 2 is upward sloping when b is to the right of the red vertical line.³¹

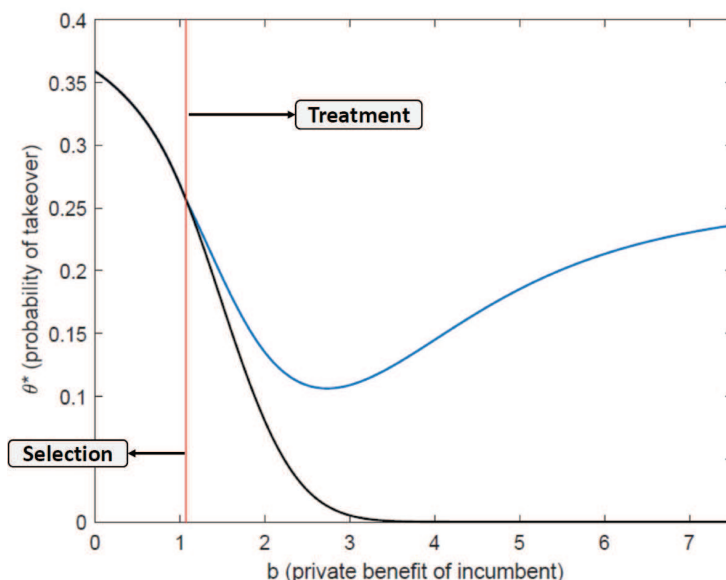


Figure 2 - The effect of b on the probability of a takeover, θ^* .³²

To understand this result, note that higher b has two effects on the takeover premium in equilibrium. First, higher b increases the premium paid when the synergy is large. Indeed, if $b \leq \Delta$ then the bidder can afford to pay a higher premium to convince the incumbent to forgo his private benefits and sell. Second, higher b also increases the credibility of the activist's threat to run a proxy fight. That is, the interval $[\delta/\alpha^*, b)$ expands. Since the incumbent is

³¹More generally, in Appendix E we give conditions under which the probability of a takeover when b is large and the equilibrium exhibits treatment is higher than when b is small and the equilibrium exhibits selection.

³²The example in Figure 2 is generated under the assumptions that $B_A = 0.1$, $\kappa = 0.1$, $\phi = 0.5$, $\mu = 0.8$, $s = 0.9$, $q = 10$, $\Pr[\Delta > 0 | \zeta = 1] = 0.5$, $\Delta | \Delta > 0 \sim \log N(1, 0.5)$, $c \sim \log N(-2.5, 0.5)$, $\bar{\alpha} = 10\%$, $R = 1$. Under this example, the activist's stake (as a function of b) is around 9.5% in equilibrium, which is unique.

negotiating under the activist’s pressure in this range, the bidder pays a smaller premium. If b is sufficiently large, then the likelihood of $b \leq \Delta$ decreases relative to the likelihood of $\Delta \in [\delta/\alpha^*, b)$, and the latter effect dominates the former. That is, the bidder can expect to pay a lower takeover premium, as determined by the activist’s bargaining power. In this case, higher b increases the bidder’s incentives to perform due diligence, and thereby, the overall probability of a takeover. Therefore, contrary to the common wisdom, the probability of a takeover can increase with the private benefits that incumbents obtain from keeping their firm independent.

5 Conclusion

This paper studies the role of activist investors in the market for corporate control. We identify a commitment problem that prevents bidders from unseating resisting and entrenched incumbent directors of target companies through proxy fights. Unlike bidders, activists are on the same side of the negotiating table as other shareholders of the target, and hence, enjoy higher credibility when campaigning against the incumbent board. Building on this insight, we demonstrate that although both bidders and activists can use similar techniques to challenge corporate boards (i.e., proxy fights), activists are more effective in relaxing the resistance of incumbent directors to takeovers. The fact that most proxy fights are launched by activists and not by bidders, and the large number of activist campaigns that resulted in a takeover bid by a third party, are consistent with shareholder activism being the market solution for the bidder’s commitment problem.

Our analysis also highlights the complementarity between shareholder activism and takeovers. Activists benefit from the possibility that companies in which they invest will become a takeover target, while bidders, who interpret the presence of an activist as a signal that the target is available for sale, are more likely start takeover negotiations when the target has an activist as a shareholder. We show that since the model’s comparative statics is sensitive to the existence of the treatment effect in equilibrium, our analysis can be used to create identification strategies of the treatment effect of shareholder activism in takeovers. Overall, the analysis sheds light on the interaction between M&A and shareholder activism.

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A Proofs of main results

Proof of Proposition 2. Suppose condition (6) holds and $\pi_A - \pi_I \geq \kappa/\alpha$. Notice that these conditions are not mutually exclusive. Based on Proposition 1, if the first round of the negotiations fails, the activist will run and win a proxy fight. Moreover, based on Lemma 1, in the second round of the negotiations the activist and the bidder will reach an agreement in which the bidder is expected to pay $q + \pi_A$. Therefore, in the first round of negotiations, the incumbent board will reject any offer lower than $q + \pi_A$. Similarly, the bidder will not agree to pay more than $q + \pi_A$ per share, since he can always wait for the second round of negotiations, and pay $q + \pi_A$ after the activist wins the proxy fight. Notice that $\pi_A \leq \frac{\Delta}{1-m}$. Overall, if there are arbitrarily small waiting costs to either the bidder or the incumbent board, they will reach an agreement in the first round of negotiations in which the bidder pays a premium of π_A .

Second, suppose condition (6) holds and $\pi_A - \pi_I < \kappa/\alpha$. Based on Proposition 1, if the first round of the negotiations fails, the activist will not run a proxy fight. Therefore, if the first round of the negotiations fails, the incumbent retains control of the board. Moreover, note that if $\pi_A - \pi_I < \kappa/\alpha$ then it must be either $b \leq \frac{\Delta}{1-m}$ or $\frac{\Delta}{1-m} < \delta/\alpha$. Since $\min\{b, \delta/\alpha\} \leq \frac{\Delta}{1-m}$, it must be $b \leq \frac{\Delta}{1-m}$. Based on Lemma 1, if $b \leq \frac{\Delta}{1-m}$ then in the second round of the negotiations the incumbent and the bidder will reach an agreement in which the bidder is expected to pay $q + \pi_I$. Therefore, similar to the argument above, the bidder and the incumbent board will reach an agreement in the first round in which the bidder pays a premium of π_I .

Next, suppose condition (6) does not hold. Then, both conditions (3) and (5) are violated, and therefore, condition (2) is violated as well. Based on Proposition 1, the activist never runs a proxy fight. Therefore, if the first round of the negotiations fails, the incumbent retains control of the board. Based on Lemma 1, if $\frac{\Delta}{1-m} < b$ then the incumbent board and the bidder will not reach an agreement in the second round of negotiations, and the target would remain independent. Therefore, in the first round of negotiations, the incumbent board will reject any offer lower than $q + b$, and the bidder will not agree to pay more than $q + \frac{\Delta}{1-m}$ per share. Since $\frac{\Delta}{1-m} < b$, the parties will not reach an agreement in the first round as well, and the target remains independent in equilibrium. ■

Proof of Proposition 3 . If the second round of negotiations succeeded and the target is acquired by the activist, then the activist implements his proposal if it has not been implemented yet. Therefore, the post takeover target value is $q + \Delta$. If the second round of negotiations failed and the firm remains independent (that is, its ownership structure did not change), there are two cases. First, if the activist controls the target board then she implements her proposal

if it has not been implemented yet, and the target value is $q + \Delta$. Second, if the incumbent board retains control then he implements the proposal if and only if $b \leq \Delta$, and hence, the target value is $q + \mathbf{1}_{\{b \leq \Delta\}} \Delta$.

Consider the second round of negotiations. There are two cases. First, suppose that either the activist controls the target board or the incumbent retains control and $b \leq \Delta$. The activist's proposal is implemented whether or not the bid fails. For this reason, the activist will not offer more than $q + \Delta$ per share. Moreover, target shareholders will not accept offers lower than $q + \Delta$, since they can always reject the bid and obtain a value of $q + \Delta$ once the proposal is implemented. Therefore, whether or not target is acquired, the activist's payoff is $\alpha(q + \Delta)$ and the shareholder value is $q + \Delta$. Second, suppose incumbent board retains control and $b > \Delta$. If the negotiations fail, the proposal will not be implemented and the activist's payoff would be αq . If the activist acquires the firm, her payoff is $q + \Delta - (1 - \alpha) \pi_2$, where π_2 is the offer made to target shareholders. Therefore, the activist is willing to offer up to $q + \frac{\Delta}{1 - \alpha}$ per share. The incumbent board and the activist will reach an agreement if and only if $b \leq \frac{\Delta}{1 - \alpha}$. If $\frac{\Delta}{1 - \alpha} < b$ then the takeover fails and the shareholder value is q . If $\Delta < b \leq \frac{\Delta}{1 - \alpha}$ then the incumbent and the activist reach an agreement in which $\pi_2 \geq q + b > q + \Delta$. Therefore, target shareholders approve any agreement reached by the activist and the incumbent, and target is acquired by the activist. In this case, the expected shareholder value is $q + s \frac{\Delta}{1 - \alpha} + (1 - s) b$.

Consider the proxy fight stage. There are three cases to consider. First, if $b \leq \Delta$ then the activist's payoff is $\alpha(q + \Delta)$ whether or not she gets the control of the board. Therefore, she has no reason to run and incur the cost of a proxy fight. Second, if $\Delta < b \leq \frac{\Delta}{1 - \alpha}$ then the activist always loses the proxy fight if he decides to start one. The reason is that shareholders know that if they elect the activist they will get $q + \Delta$ whereas if they reelect the incumbent, the activist will take over the target and pay shareholders on average $q + s \frac{\Delta}{1 - \alpha} + (1 - s) b$, which is strictly higher. Anticipating her defeat, the activist never runs a proxy fight in this region. Third, if $\frac{\Delta}{1 - \alpha} < b$ then the shareholder value is $q + \Delta$ if the activist gets the control of the board, and q otherwise. Therefore, shareholders always elect the activist if she runs a proxy fight. The activist's payoff is $\alpha(q + \Delta) - \kappa$ if he runs a proxy fight, and αq otherwise. Therefore the activist runs a proxy fight only if $\kappa/\alpha \leq \Delta$. Combining this condition with $b > \frac{\Delta}{1 - \alpha}$ yields (8). ■

Proof of Corollary 1. Based on Proposition 2,

$$v(\alpha) = \begin{cases} \int_b^{\frac{B_A}{\alpha}} \pi_I(\Delta) dF(\Delta) + \int_{\frac{B_A}{\alpha}}^{\infty} \pi_A(\Delta, \alpha) dF(\Delta) & \text{if } b < \frac{B_A}{\alpha} - \frac{\kappa/(1-s)}{\alpha} \\ \int_b^{\infty} \pi_I(\Delta) dF(\Delta) & \text{if } \frac{B_A}{\alpha} - \frac{\kappa/(1-s)}{\alpha} \leq b < \delta/\alpha \\ \int_b^{\infty} \pi_I(\Delta) dF(\Delta) + \int_{\delta/\alpha}^b \pi_A(\Delta, \alpha) dF(\Delta) & \text{if } \delta/\alpha < b \end{cases}$$

The assumption $B_A \leq \kappa/(1-s)$ implies $\frac{B_A}{\alpha} - \frac{\kappa/(1-s)}{\alpha} \leq 0$, and therefore, $v(\alpha)$ can be rewritten as in (10). The comparative statics of $w(\alpha)$ with respect to α is trivial. Based on (10), we can write

$$w(\alpha) - v(\alpha) = (1-s) \left[\int_{\min\{b, \delta/\alpha\}}^{\infty} \Delta dF(\Delta) - b(1-F(b)) - \frac{B_A}{\alpha} [F(b) - F(\min\{b, \delta/\alpha\})] \right],$$

and therefore

$$w(\alpha)' - v(\alpha)' = (1-s) \begin{cases} 0 & \text{if } b < \delta/\alpha \\ (\delta/\alpha) \frac{\max\{0, \kappa - B_A\}/s}{\alpha^2} f(\delta/\alpha) + \frac{B_A}{\alpha^2} [F(b) - F(\delta/\alpha)] & \text{if } \delta/\alpha \leq b \end{cases}$$

which is non-negative. Also, based on (10),

$$v'(\alpha) = \begin{cases} 0 & \text{if } b < \delta/\alpha \\ (\delta/\alpha) \frac{\max\{B_A, \kappa\}}{\alpha^2} f(\delta/\alpha) - (1-s) \frac{B_A}{\alpha^2} [F(b) - F(\delta/\alpha)] & \text{if } \delta/\alpha \leq b \end{cases}$$

Therefore, if $\delta/\alpha \leq b$ then

$$v'(\alpha) > 0 \Leftrightarrow (\delta/\alpha) \frac{f(\delta/\alpha)}{F(b) - F(\delta/\alpha)} > \frac{(1-s)B_A}{\max\{B_A, \kappa\}} \quad (18)$$

Recall that δ/α is a decreasing function of α and $\delta/\alpha \in [\delta/\bar{\alpha}, b]$, where $\delta/\bar{\alpha} > 0$. Therefore, $v'(\alpha) > 0$ as $\delta/\alpha \rightarrow b$, i.e., when α is sufficiently small. Hereafter, we assume that $v'(\alpha) > 0$ for all $\alpha \in [0, \bar{\alpha}]$. This holds, for example, if s is sufficiently close to 1. ■

Proof of Proposition 4. Note that part (iii) follows directly from Corollary 1 and the text that precedes the proposition. Let $\alpha^*(y)$ be the number of shares the activist buys in equilibrium conditional on signal y . The proof has several steps.

First, we prove $\alpha^*(0) = 0$. Note that $\Pr[\zeta = 0|y = 0] = 1$ and $\Pr[\Delta < 0|y = 0] = 1$. Based on Proposition 2, the probability of a takeover is zero and firm value is q . Since the

share price cannot be smaller than q , regardless of the beliefs of the market maker (on or off the equilibrium path), the activist's expected profit from submitting any order $\alpha > 0$ is non-positive. Therefore, the activist does not invest. Hereafter, we denote $\alpha^*(1)$ as α^* .

Second, we prove $\alpha^* \leq \bar{\alpha}$. Suppose on the contrary $\alpha^* > \bar{\alpha}$. Then, on the equilibrium path the market maker observes that the activist bought α^* shares before the price is set, and hence, the market maker sets the price to be $q + \hat{\mu}h(\alpha^*)$. Indeed, since in any equilibrium $y = 0 \Rightarrow \alpha = 0$ (the first step), the market maker infers that $y = 1$. However, in this case, the activist's profit is non-positive, yielding a contradiction.

Third, we prove that the price function is given by (14). Since the market maker expects the activist to buy no shares if $y = 0$ and $\alpha^* \leq \bar{\alpha}$ shares if $y = 1$, the market maker sets the price at $q + \mu h(\alpha^*)$ if the activist buys $\bar{\alpha}$ shares or less. Indeed, the market maker expects the takeover to take place if and only if $y = 1$ and $\zeta = 1$, which happens with probability μ . If the activist buys more than $\bar{\alpha}$ shares, which is an off-equilibrium event, then the market maker observes α and sets the price to be $q + \mu(\alpha)h(\alpha)$ where $\mu(\alpha)$ is the off-equilibrium beliefs of the market that $\zeta = 1$ given that the activist decided to buy $\alpha > \bar{\alpha}$ shares. We assume $\mu(\alpha) = \hat{\mu}$, which guarantees that such deviation is not profitable (i.e., the market maker assumes $y = 1$). This argument gives (14).

Fourth, we prove (13) has a unique solution. Since $h(\cdot)$ is an increasing function, the left hand side ("LHS") of (13) is a strictly increasing function of α^* . If $\alpha^* = 0$ then $LHS = 0$ and if $\alpha^* \rightarrow \infty$ then $LHS \rightarrow \infty$. Since LHS is a continuous function, (13) has a unique solution.

Fifth, we prove that if an equilibrium exists, then $\alpha^* = \min\{\alpha^{**}, \bar{\alpha}\}$. If an equilibrium exists and the activist submits $\alpha \leq \bar{\alpha}$, then her expected profit conditional on $y = 1$ is

$$\Pi(\alpha, \alpha^*) = \alpha(q + \hat{\mu}h(\alpha) - p(\alpha, \alpha^*)) = \alpha(\hat{\mu}h(\alpha) - \mu h(\alpha^*)),$$

where the second equality follows from (14). There are two cases to consider. First, suppose on the contrary $\alpha^* > \min\{\alpha^{**}, \bar{\alpha}\}$. If $\alpha^{**} \geq \bar{\alpha}$ then $\alpha^* > \bar{\alpha}$ contradicts the second step above. If $\alpha^{**} < \bar{\alpha}$ then $\alpha^* > \alpha^{**}$ implies $\alpha^*(q + \mu h(\alpha^*)) > R$. Notice that $p(\alpha^*, \alpha^*) = q + \mu h(\alpha^*)$, which implies that the activist spends more than R in equilibrium, yielding a contradiction. Second, suppose on the contrary $\alpha^* < \min\{\alpha^{**}, \bar{\alpha}\}$. Then, $\alpha^* < \alpha^{**}$ implies $\alpha^*(q + \mu h(\alpha^*)) < R$. Suppose the activist deviates by increasing her buy order by $0 < \varepsilon < \min\{\alpha^{**}, \bar{\alpha}\} - \alpha^*$. Since $\alpha^* + \varepsilon < \min\{\alpha^{**}, \bar{\alpha}\}$, we have $(\alpha^* + \varepsilon)(q + \mu h(\alpha^*)) < R$ and $p(\alpha^* + \varepsilon, \alpha^*) = p(\alpha^*, \alpha^*) = q + \mu h(\alpha^*)$. So the activist has enough funds to buy additional ε shares at a price of $q + \mu h(\alpha^*)$.

Notice that

$$\begin{aligned}
\Pi(\alpha^* + \varepsilon, \alpha^*) &= (\alpha^* + \varepsilon) (\hat{\mu}h(\alpha^* + \varepsilon) - \mu h(\alpha^*)) \\
&\geq (\alpha^* + \varepsilon) (\hat{\mu}h(\alpha^*) - \mu h(\alpha^*)) \\
&= (\alpha^* + \varepsilon) (\hat{\mu} - \mu) h(\alpha^*) \\
&> \alpha^* (\hat{\mu} - \mu) h(\alpha^*) = \Pi(\alpha^*, \alpha^*)
\end{aligned}$$

where the first inequality follows from $h(\cdot)$ being a non-decreasing function. Therefore, this deviation is profitable, yielding a contradiction.

Sixth, we prove that an equilibrium exists. Based on the fifth step, if an equilibrium exists, then $\alpha^* = \min\{\alpha^{**}, \bar{\alpha}\}$. We show that no profitable deviation exists. Similar to the second step above, it can be shown than any deviation to $\alpha > \bar{\alpha}$ is sub-optimal. Moreover, any deviation to $\alpha^{**} < \alpha \leq \bar{\alpha}$ implies $R < \alpha(q + \mu h(\alpha)) = \alpha p(\alpha, \alpha^*)$, which means that the activist spends more than R , which is not possible. It is left to consider a deviation to $\alpha < \min\{\alpha^{**}, \bar{\alpha}\}$. Note that

$$\begin{aligned}
\Pi(\alpha, \alpha^*) &= \alpha (\hat{\mu}h(\alpha) - \mu h(\alpha^*)) \\
&\leq \alpha (\hat{\mu}h(\alpha^*) - \mu h(\alpha^*)) \\
&= \alpha (\hat{\mu} - \mu) h(\alpha^*) \\
&< \alpha^* (\hat{\mu} - \mu) h(\alpha^*) = \Pi(\alpha^*, \alpha^*),
\end{aligned}$$

where the first inequality follows from $h(\cdot)$ being a non-decreasing function. Therefore, such a deviation is always sub-optimal. ■

Proof of corollary 2. From part (i) of Proposition 4, condition $\delta/\alpha^* < b$ can be rewritten as $\max\{\delta/\alpha^{**}, \delta/\bar{\alpha}\} < b$. Since α^{**} is the unique solution of (13) and $\alpha(q + \mu h(\alpha))$ is strictly increasing in α , $\delta/\alpha^{**} < b \Leftrightarrow (\delta/b)(q + \mu h(\delta/b)) < R$. Noting that $h(\delta/b) = h(0)$ implies that $\delta/\alpha^{**} < b$ is equivalent to $\delta \frac{q + \mu h(0)}{R} < b$, as required. ■